Published: January 13, 2015
Revised: Februrary, 2020

Technical Bulletin 52: Twin-Path® in Long Term Semi-Static Applications

Twin-Path and other roundslings have traditionally been used in dynamic lifting applications. These applications are characterized by intermittent, short-term use with frequent dynamic and/or shock loading. They are most often used in place of steel because of the lower weight and ease of handling. There are also certain advantages that high-performance fibers have over steel in semi-static loading that are leading to increased adoption in applications traditionally reserved for steel wire rope. Nearly every application that is considered static is actually semi-static with fluctuations in load. This is where high-strength fibers have an advantage over steel. Steel wire rope will lose strength relatively quickly due to fatigue when subjected to cyclic tension-tension loading.

Tension-tension Cycling Laboratory Testing

In 2006, three Twin-Path slings were subjected to cyclic tension-tension loading in a laboratory setting. In this test, three slings with a working load limit of 25,000 lb were cycled from 550 – 37,500 lbf for 50,000 cycles. Each cycle was from 2 – 150% of working load limit, this is an extremely wide range compared to real world use and serves to accelerate the damage so that testing could be completed in a reasonable time frame. In this test, all three slings survived the 50,000 cycles, and one was pulled to failure after. Figure 1 shows the loading point with minimal damage after the cycling was complete. The sling pulled to failure still had 84% of its original rated breaking strength. For full details of this test, see Slingmax Technical Bulletin 9a.

Figure 1 - Loading Point after 50,000 Cycles

This can be compared to earlier testing performed on a wire rope sling. The steel wire rope sling was also cycled from 2 – 150% of working load, but in this case the sling only made it to only 26,407 cycles when it failed before the test could be completed.

Texas-Shaker® Field Trial

The Texas-Shaker shown in Figure 2 is a vibrating screen that sorts dry granular material by size by vibrating a feed of material through a series of different size screens. In order to reduce vibration that is transmitted to any surrounding structure, it is suspended from four steel wire rope cables. The steel wire ropes were experiencing failures after less than 11 months in use. A Twin-Path sling was installed along with three of the original steel wire ropes. After 16 months of continuous use in a dusty outdoor environment, the Twin-Path sling was taken out of service for inspection.

Figure 2 - Texas Shaker Vibrating Screen

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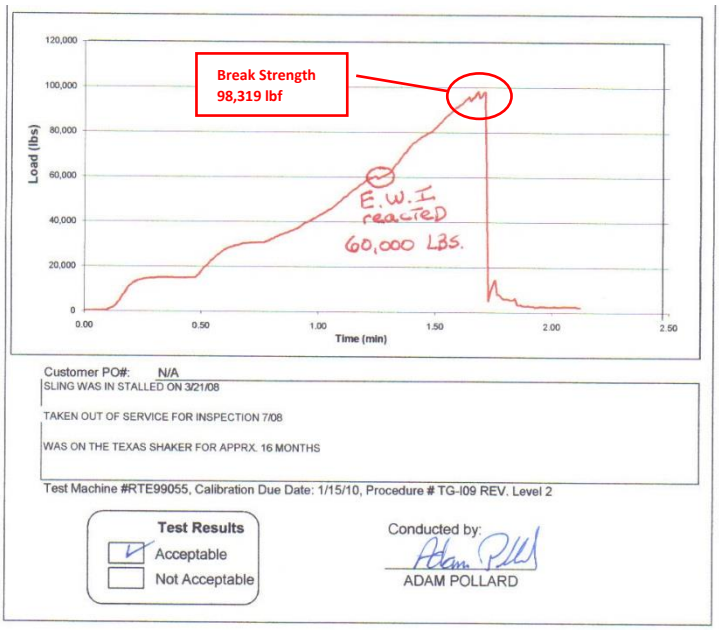
The entire sling was covered in dust except for the bearing point. After the sling was cleaned it was found that there was no visible damage to the jacket or the K-Spec® strength member yarn inside. The sling was then load tested to determine residual breaking strength. The sling had a vertical working load limit of 15,000 lb with a 5:1 design factor, which means a minimum breaking strength of 75,000 lb. When the sling was broken, it achieved 98,319 lbf, or 30% above the minimum required for the wire rope originally used. For a full report and video of the application, see Slingmax Technical Bulletin 42.

Figure 3 - Sling after 16 Months of Use

Figure 4 - Used Sling after Cleaning

Figure 5 - K-Spec® Core Yarn from Used Sling



Vibratory Hammers

Another application where Twin-Path slings have been subjected to an extreme number of loading cycles is when used to suspend vibratory hammers while in use. In this application, it is difficult to measure the exact forces that are put on the sling, since the vibration is so rapid. As an example, one hammer that was used with a Twin-Path sling operated at 1600 vibrations per minute. There have been several hammers used with Twin-Path slings, but an example of the lifetime is a sling that was used 748 hours without the bearing points being rotated. At 1600 vpm x 60 min/hr x 748 hours this means the sling lasted for a total of 71,808,000 cycles before failure. In a normal semi-static application, this would represent many years of use because both the frequency and magnitude of the cycling in this application are far higher than most other applications.