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Subject: Cyclic-Tension Testing and Breaking Strengths of Two Slings
TMT Report FR-2247

Dear Dennis,

The following tests were performed in accordance with your letter dated 19 June 1997. One K-Spec strength member sling designated Type TPX2,000, Twin-Path® Serial number P030797019 and one aramid strength member sling designated Type K-2,000, single path, no serial number were provided to TMT for the purpose of cyclic-straight-tension fatigue testing. Both slings were subjected to identical tests on the same test machine. Each sling was secured in the test machine using a two-inch pin through either end of each loop. Tension was continuously monitored using an in-line strain gauge load cell and was continuously recorded using a strip chart recorder. Tension was controlled by a servo controlled hydraulic cylinder using closed loop feedback from the load cell.

The tests consisted of cycling each sling for 50,000 tension cycles from a slack or zero load condition to a peak tension of 30,000 pounds and back to zero. For Sling Type TPX2,000, a cycling rate of 5.6 seconds per cycle was established. For Sling Type K2,000, the cycling rate was 7.5 seconds per cycle. The difference in cycling period was caused by the greater elongation at 30,000 pounds tension of the Type K2,000 sling. Other than this slight difference, testing conditions were identical for both slings. Neither sling suffered any failures during the fatigue cycling.

Following fatigue cycling, each sling was pulled to failure to determine the residual break strength. The results are summarized below in Table 1, and the test data sheets follow. The virgin break strength of each sling was 100,000 pounds and residual break strength equals 105.5% and 86.5% for tested slings. The Overload Tell-Tails in the Twin-Path® sling disappeared as designed.

TABLE 1. SUMMARY OF RESULTS

Type	Serial No.	Tension Cycles	Residual Break Strength, lbf
TPX2000	P030797019	50,000	105,500
K2000	N/A	50,000	86,500

FATIGUE TEST SUMMARY

OCTOBER 1997

PRODUCT DESCRIPTION	ACTUAL BREAKING STRENGTH	TENSION MEMBER	TEST LOAD	% OF ULTIMATE	# OF CYCLES	RETAINED STRENGTH	PIN SIZE	BREAKING STRENGTH AS A % OF CATALOG STRENGTH
Flemish Eye 6 x 25 IWRC EIP Wire Rope Sling Steel Sleeves	68,000	Wire Rope	20,000	29%	26,407	0	2"	0%
TPXC 1,000 x 11' Twin-Path® Extra	60,300	Kevlar® 3 Strand	20,000	33%	55,148	0	2"	0%
K-2,000 x 6' Single-Path	100,000	Kevlar® Single-Strand Twisted	30,000	30%	50,000	86,500	2"	86.5%
TPXC 2,000 x 6' Twin-Path® Extra	100,000	K-Spec	30,000	30%	50,000	105,500	2"	105%

- NOTE:
1. Clearly the K-Spec gives the best results.
 2. Wire Rope suffers from severe fatigue.
 3. 3 Strand Kevlar® suffers from yarn on yarn abrasion
 4. Single strand twisted Kevlar® shows less abrasion but is rapidly declining in ultimate strength.

The TPXC with K-Spec is the only sling in the world that does not lose strength as a result of use.