Mr. Jones,

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ADD: Stanley Gardocki, Mary Neely
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I am writing to you on the topic of the draft regulatory guideline DG-1381. I have attached a letter going into greater detail on my concerns with this document, but to summarize, we believe that the distinction between synthetic and steel rigging should be reconsidered. We have performed cut testing where wire rope with no cut protection performed very similarly to unprotected synthetics on sharp edges. I have also attached those test results, which we had also presented at an ASME NML-1 meeting a few years ago.

Best regards,

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In April 2021, the Nuclear Regulatory Commission issued draft regulatory guideline DG-1381, titled “Control of Heavy Loads at Nuclear Facilities”. This document intends to endorse the use of ASME standards NML-1, NOG-1, and BTH-1 by applicants and licensees for both nuclear power plant operations as well as independent storage of spent nuclear fuel. Of particular concern with this change is the following section of NML-1:

> *(b)* Synthetic slings may be used only if one of the following applies:
> *(1)* The tensioned slings remain in a straight line between their end bearing points.
> *(2)* The tensioned legs wrap around a curved surface with a minimum D/d ratio of 25:1, where D is the diameter of the curved surface and d is the nominal body diameter of the sling.

Synthetic slings have been safely and successfully used in critical lifts in the nuclear industry for decades. In fact, the nuclear industry has been the catalyst for many of the safety related innovations that Slingmax has introduced over the years, including:

- The independent load-bearing paths of a Twin-Path® Sling
- Check-Fast® inspection system
- Smart Sling® Electronic monitoring system

This change will severely restrict operations by requiring operators to revert back to heavy, inefficient steel rigging. We believe this is detrimental to the industry for several reasons:

First, all slings are susceptible to cutting on edges and should be protected from cutting regardless of the sling material used. All riggers should be in the practice of protecting slings from cutting on edges at all times. In fact, we have performed testing where both synthetic and steel slings were rigged over an edge, and the steel wire slings failed at a similar load to the synthetic sling. Prohibiting synthetic slings from these types of lifts will not enhance safety and may in fact decrease safety because of the false sense of security when using steel rigging on edges. If there is an intention to reduce the possibility of slings cutting on edges, any prohibition should be universal, and engineered cut protection should be included in the consideration

Additionally, if there is an intention to avoid rigging around edges, a 25:1 D/d is far beyond what is needed to accomplish that goal. According to ASME B30.9, a basic single-part wire rope sling requires a 25:1 D/d in the body, and a multipart wire rope sling requires 15:1:

> *(h)* When D/d ratios (see Figure 9-2.10.1-1) smaller than 15/1 for hand-tucked splice type slings and 25/1 for mechanical splice and swaged or poured socket-type slings are used in the body of the sling, the rated load of the sling shall be decreased according to the recommendations of the manufacturer, a qualified person, or the Wire Rope Sling Users Manual. For other sling types, consult the sling manufacturer for specific data or refer to the Wire Rope Sling Users Manual.

Industry guidance also exists for synthetic slings:

WSTDA-RS-1 Section 4.7 and RS-1HP Section 4.6 give tables for minimum edge radii for unprotected polyester and high performance roundslings, respectively.

ASME B30.9 Chapter 4 gives a minimum of 8:1 D/d for synthetic rope slings in a basket hitch.

If a multipart wire rope sling is used on a 15:1 D/d, this implies that sling is 1.67x more cut resistant than any synthetic sling. However, our testing showed that wire rope slings only had approximately 6% more cut resistance than a high performance synthetic roundsling.

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Technical Bulletin 57: Cut Testing for Wire Rope

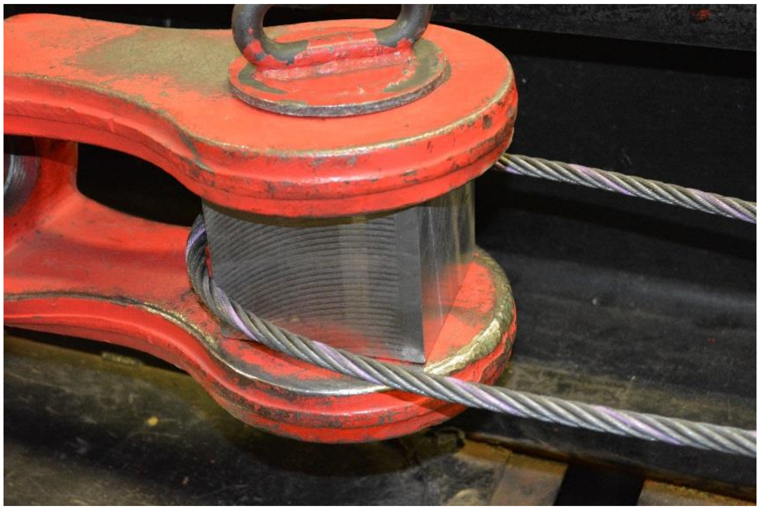
The common conception of wire rope or other steel slings is that it is safer to rig over an edge compared to a synthetic sling. This has never been proven. Slingmax completed testing on wire rope slings over a steel edge to determine when steel slings would cut and how they compare to synthetic roundslings.

Test Set-up

All cut tests were performed on a 5" steel block constructed of 4140 steel. See figure 2. Between each test the edges were ground to maintain a consistent 90° edge. Control tests were performed on a 3-1/2" round pin. See Figure 1. Tests were performed using a 150,000lb capacity test machine and load cell calibrated to ASTM E4-15 standards on 4/21/16.

Figure 1 – Steel Block and Pin

Figure 2– Steel Block Test Set-up



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Testing

Wire Rope

Four ½" x 10 ft Flemish Eye Slings were constructed. All slings were tested in a basket. The working load limit (WLL) for each sling in a basket configuration was 5.1 tons or 10,200 lb. One sling was tested as a control on a 3.5 in diameter pin to determine the efficiency of the wire rope. The other three wire rope slings were tested around the steel block. See Figure 3.

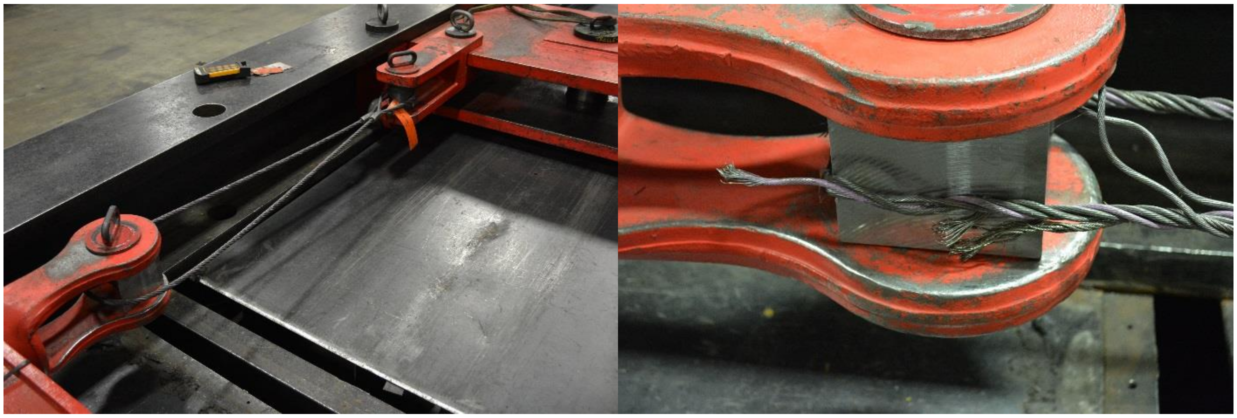
The control sling ultimately failed at 49,620 lb – 4.86:1 Design Factor. The lower than 5:1 Design Factor break test result is attributed to a D/d ratio lower than the recommended 25:1 in the body of a basket hitch.

The first wire rope sling tested around the steel block cut at 32,380 lb – 3.17:1 Design Factor. The second wire rope sling cut at 34,410 lb – 3.37:1 Design Factor. The third wire rope sling cut at 30,750 lb – 3.01:1 Design Factor. The average Design Factor achieved was 3.19:1. The slings maintained an average efficiency over the control sling of 65%.

Table 1 – Wire Rope Test Results

Type of Test	Sling	Length	WLL (lb)	Break (lbf)	Design Factor
Control	½" FE	10ft	10,200	49,620	4.86
Cut Test	½" FE	10ft	10,200	32,380	3.17
Cut Test	½" FE	10ft	10,200	34,410	3.37
Cut Test	½" FE	10ft	10,200	30,750	3.01
Average for FE cut tests				32,513	3.19

Figure 3 – Wire Rope Cut Test



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Testing

Synthetic Roundslings

Two synthetic roundslings were tested in a basket configuration around the same steel block. The first sling tested was a Twin-Path® sling rated for 20,000 lb and is shown in Figure 4 below. This sling ultimately failed at 60,070 lb – 3:1 Design Factor. The second roundsling tested was a standard single path polyester roundsling with a working load limit of 18,000 lb. The single path sling cut at 35,590 lb – 1.98:1 Design Factor. This test is shown in Figure 5.

Table 2 – Synthetic Sling Test Results

Type of Test	Sling	Length	WLL (lb)	Break (lbf)	Design Factor
Cut Test – no protection	TPXCF1000	15ft	20,000	60,070	3.00
Cut Test – no protection	SP900	12ft	18,000	35,590	1.98

Figure 4 – Twin-Path Cut Test

Figure 5 – Polyester Roundsling Cut Test

Testing

Cornermax® Sleeve Cut Protection

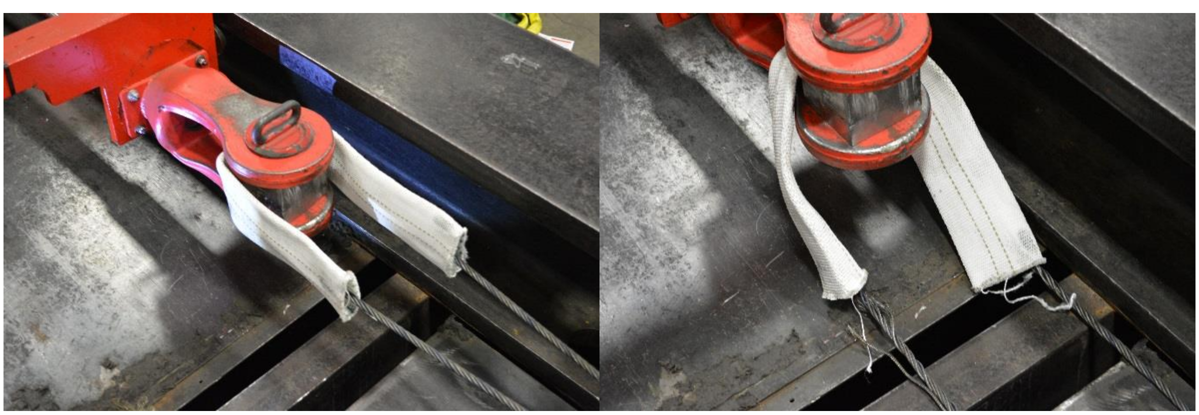
A Twin-Path sling and a ½” wire rope sling were tested with the Cornermax Sleeve in a basket configuration around the steel block. The Twin-Path sling with a working load limit of 20,000 lb, achieved a breaking strength of 92,800 lb - 4.64:1 Design Factor. See figure 6. The wire rope sling cut at 41,170 lb – 4.04:1 Design Factor. See Figure 7.

Table 3 – Cornermax Sleeve Test Results

Type of Test	Sling	Length	WLL (lb)	Break (lbf)	Design Factor
Cut Test – Cornermax Sleeve	TPXCF1000	15ft	20,000	92,800	4.64
Cut Test – Cornermax Sleeve	½” FE	10ft	10,200	41,170	4.04

Figure 6 – Twin-Path® Sling with Cornermax Sleeve Cut Test

Figure 7 – Wire Rope Sling with Cornermax Sleeve Cut Test



Summary

The test results prove that a wire rope sling can cut over a steel edge. Furthermore, a wire rope sling will cut and catastrophically fail at the same Design Factor as an unprotected Twin-Path sling.

Cornermax Sleeves can increase a Twin-Path sling's cut resistance by 65%. This does not prove the same for a wire rope sling. Synthetic cut protection is not an effective way of increasing wire rope's cut resistance. The Twin-Path sling with a Cornermax Sleeve used for protection outperformed all other cut tests.

Table 4 – Cut Test Results