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Technical Bulletin 23: Abrasion and Cut Protection for Synthetic Slings

Slings are fabricated from a variety of materials, most commonly steel wire rope, chain, and synthetic fibers. Slings made from any material are subject to damage from two distinct modes:

1. Abrasion damage, when the outside surface of the sling is worn away due to contact with rough surfaces such as concrete.
2. Cutting damage from contact with sharp corners under load.

Although steel is generally more resistant to both of these modes of damage than synthetics, it is still necessary to consider the effects of abrasion and cutting and protect any sling if they are present. A wide variety of materials have been used to protect slings, including pads or sleeves made from cow hide, nylon, polyester and aramid as well as steel and aluminum edge protectors. These solutions have achieved limited degrees of success because the difference between abrasion and cutting are often not understood. As a result there have been sling failures due to the use of materials that are effective against abrasion used in situations where cutting was the real issue.

Abrasion

In order to protect against abrasion the sling must be protected with a pad or cover that is large enough to protect the sling area that is in contact with the rough surface or material. The damaging surface can be the load itself or the ground and objects nearby that the sling may come into contact with during or between lifts. In the case of Slingmax® Twin-Path® roundslings, the sling has abrasion resistance from the Covermax® nylon cover that is part of the sling itself. Testing summarized in Figure 1 shows[1] that Covermax® has significantly better abrasion resistance compared to other roundsling covers on the market.

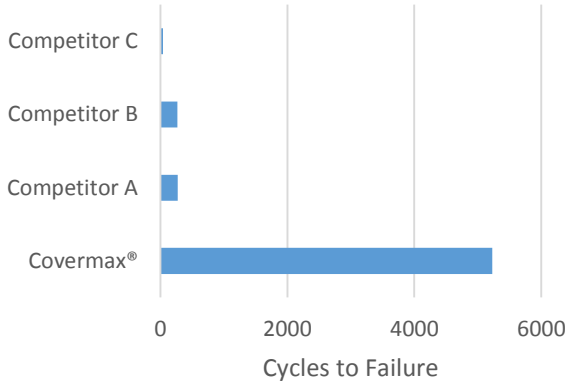

Figure 1 - Roundsling Cover Abrasion Results

Figure 2 - Synthetic Armor™ Pad Abrasion Protection

In the case of applications where the built-in protection is not sufficient, additional abrasion protection can be added. Figure 2 is an example of abrasion protection consisting of the same material as the sling cover in a sliding pad that can be moved to the area of abrasion. Pads can also be constructed to be removable so that the life of the sling can be extended by replacing the abrasion pad periodically.

Cutting

Since abrasion protection is normally constructed from materials similar to or the same as the sling itself, they will offer little to no protection against cutting. In order to protect against cutting due to sharp edges a material that is capable of withstanding the large forces created at the sharp edge is needed, or the contact between the sling and the edge must be eliminated. Slingmax® has developed solutions that use both methods for cut protection.

The CornerMax® pad shown in Figure 3 works by physically separating the sling from making contact with the edge of the load. The pad creates a "tunnel" of cut protection and the edge does not come into contact with the pad or the sling. Note that the sides of the pads must be completely supported in order to create and maintain the "tunnel". This principal has been used for years when riggers would place wooden 2"x4" boards on either side of an edge to separate the sling from making contact. While this method was effective, the boards are only held in place by the loading of the sling. They must be held in place by hand until there is enough load on the sling to keep them stationary, and once the sling is unloaded they can fall, causing injury or damage. The CornerMax® pad can be securely attached to the sling in the position needed, and easily removed when the job is complete.

Figure 3 - CornerMax® Pad

Figure 4 - CornerMax® Sleeve

CornerMax® pads are designed to protect from 90° straight edges. CornerMax® sleeves are used when edges are curved, rough, or irregular. Figure 4 shows an application where pads, blocks or other traditional cut protections would not fit, so a sleeve material must be used to protect the sling from the edges of the hole. In order for a cut protection material to provide sufficient protection for the sling, it must be tested to withstand the cutting forces that could be generated by the sling in use. In the case of the CornerMax® sleeve material, it constructed with Dyneema® high modulus polyethylene (HMPE) fiber that is specially woven to withstand the high cutting forces encountered between a sling and a sharp edge. In order to determine the level of cut protection provided, CornerMax® sleeves and pads were tested in comparison with other materials commonly used for sling cut protection.

Testing

Cut protection materials were tested by installing over a Twin-Path® TPXC 15000 sling and placed over the 90° edges of a sharpened steel edge in a basket configuration as shown in Figure 5. The 8 in wide sling was then pulled to its basket capacity of 300,000 lbs. This exerted 37,500 lbs of force per inch of sling width. When the sample was unloaded and removed from the tensile tester, there was no damage to either the Twin-Path® sling or the CornerMax® sleeve. Figure 6 shows the samples after they have been tested.

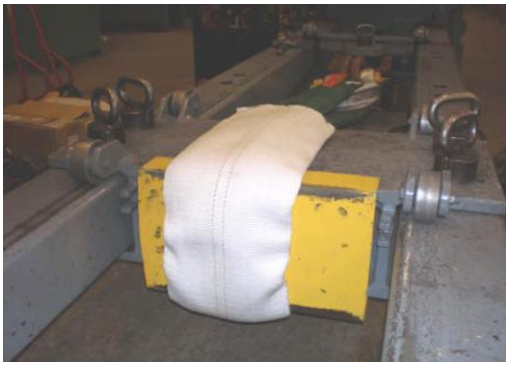

Figure 5 - Cut Testing

Figure 6 - Sling and Sleeve Post-Test

Additional testing was performed in the same arrangment, this time taking the sling to destruction. The slings were tested with the CornerMax® Pads and Sleeves as well as nylon webbing and a light duty HMPE sleeve. The level of protection provided by each type of cut protection is summarized in Figure 7.

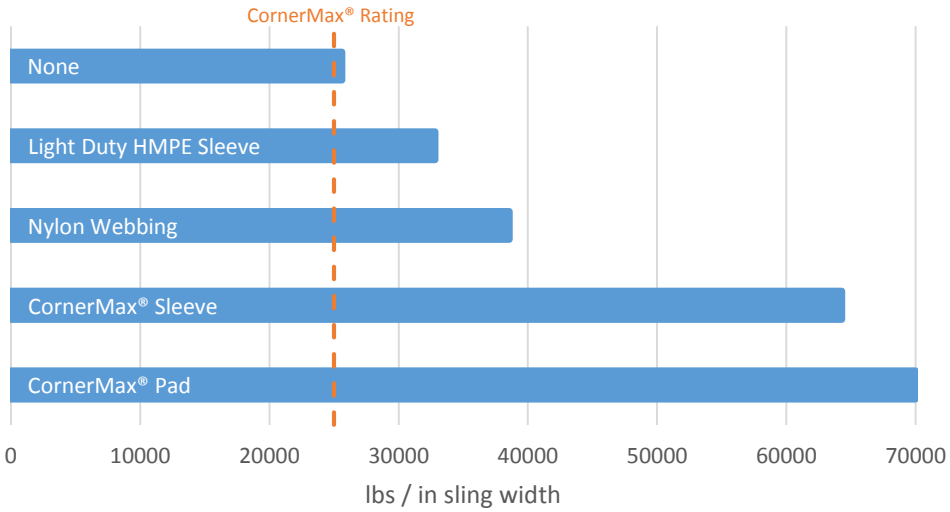

Figure 7 - Cut Protection Results

[1] Slingmax® Technical Bulletin 51: CoverMax® Tubing Abrasion Testing