

Construction Safety Corner

Synthetic Sling Basics

NAVFAC P-307 Section 14.7.4

ASME B30.9, Slings



USACE EM 385-1-1 Section 15

This presentation only contains basic information and is NOT all inclusive.

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Synthetic Slings are made primarily from 2 types of material.

Nylon and Polyester Pros and Cons:

- **Nylon.** Nylon is the most widely used general purpose synthetic web sling. Nylon is unaffected by grease and oil, and the material has excellent chemical resistance to aldehydes, ethers, and strong alkalis. However, nylon slings are not suitable for use with acids and bleaching agent or at temperatures in excess of 194° F. The stretch of a nylon sling at capacity is approximately 8-10%.
- **Polyester.** Polyester web slings are used primarily in conditions where acid is present and minimum stretch is desired. Polyester is unaffected by common acids and hot bleaching agents, but the material is unsuitable for use in conditions where concentrated sulfuric acid and alkaline is present. Polyester is also unsuitable in locations where temperatures exceed 194°F. Stretch of a polyester web sling at rated capacity is approximately 3-6%.



Synthetic Web Sling Types/Classification

Type 1 Triangle-Choker



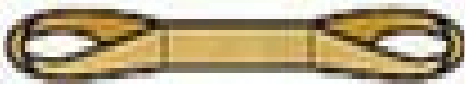
Type 2 Triangle-Triangle



Type 3 Eye & Eye Flat



Type 4 Eye & Eye Twist



Type 5 Endless



Type 6 Reverse Eye



Type 7 Flat Eye



Type 8 Wide Body Heavy
Duty Basket



Type 9 Light Duty
Cargo Basket

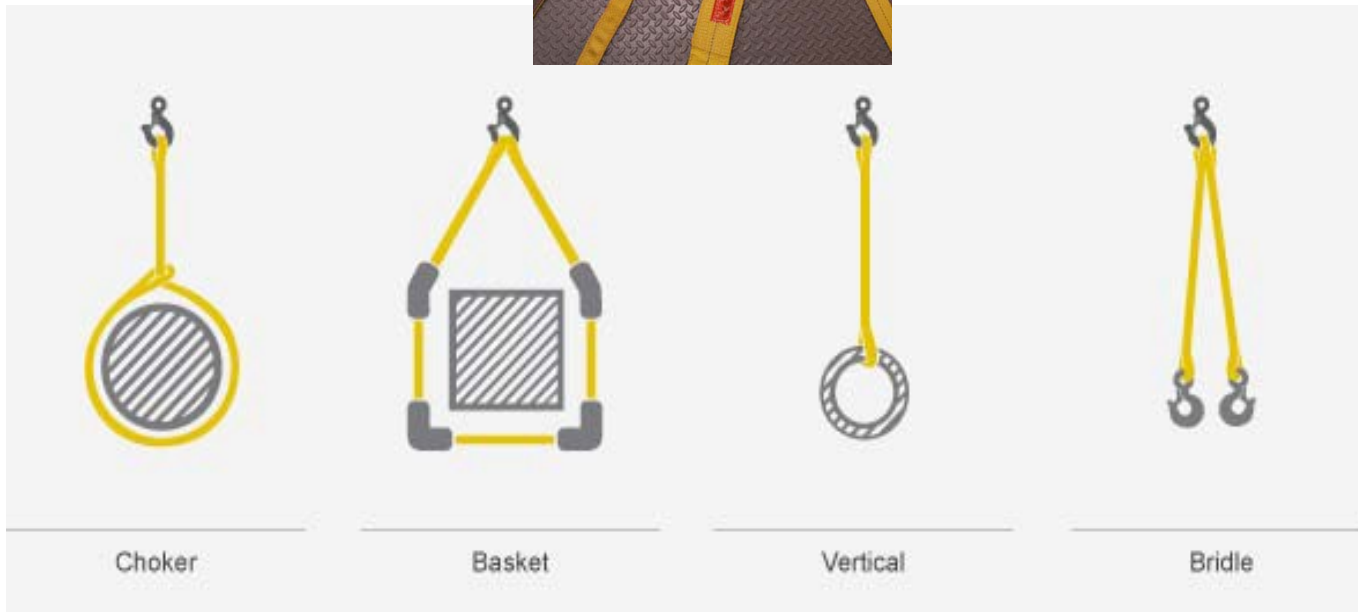
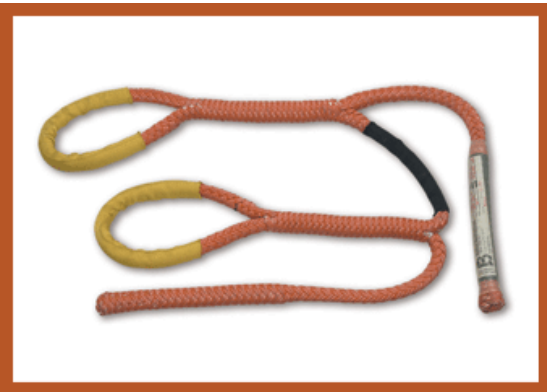


Three Popular Types of Synthetic Slings

Rope

Webbing “Most Popular”

Roundsling



Synthetic Sling Inspection

- **Always Use Manufacturer's Inspection Procedures**
- As a minimum check slings for the following:



Any other conditions that cause doubt as to continued use of a sling.



WEB SLING CHEMICAL CHART FOR SAFE USE

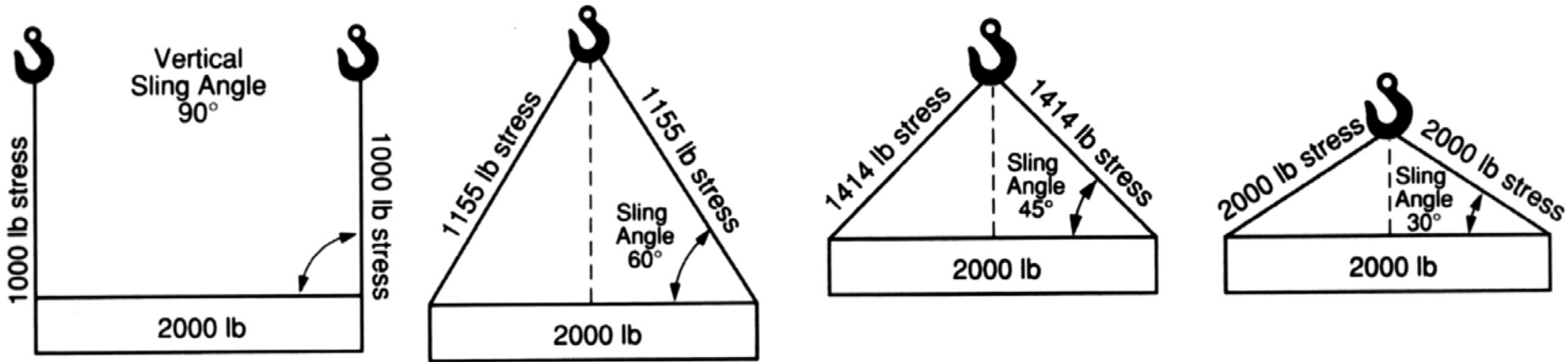
| | Nylon | Polyester |
|--------------------------|-----------|-----------|
| Acid | NO | NO |
| Alcohol | OK | OK |
| Aldehydes | OK | NO |
| Strong Alkalies | OK | - |
| Bleaching Agents | NO | OK |
| Dry Cleaning Solvents | OK | OK |
| Ethers | OK | NO |
| Halogenated Hydrocarbons | OK | OK |
| Hydrocarbons | OK | OK |
| Ketones | OK | OK |
| Oil, Crude | OK | OK |
| Oil, Lubricating | OK | OK |
| Soaps, Detergents | OK | OK |
| Water, Seawater | OK | OK |
| Weak Alkalies | OK | OK |

- * Disintegrated by concentrated sulfuric acid
- ** Degraded by strong alkalies at elevated temperatures



Sling Rated Load

- The Rated Load of a Sling is Based On 5-Factors:
 - Material Strength(s)
 - Design Factor
 - Type of Hitch
 - Angle of Loading
 - Diameter of Curvature over which the sling is used



Rope Slings

- Rope slings must be constructed in accordance with applicable Cordage Institute Specifications (www.ropecord.com).
- Types Include:

- Nylon three-strand laid
- Nylon eight-strand plaited
- Nylon double braid
- Polyester three-strand laid
- Polyester eight-strand plaited
- Polyester double braid
- Polyester single braid

- Must have a legible id tag with rated capacities

- All slings made of nylon or polyester shall have some type of ultraviolet inhibitor.



Synthetic Webbing Slings

- A webbing sling has two eyes at two ends and has a flat construction. It is a very popular design, but has one major disadvantage. The fibers which provide the strength to lift the load are also the ones which come in contact with the load. Therefore, in case of damage to the yarns, the sling has to be taken out of service.

**Synthetic Webbing Slings Must
Have a Legible Tag**



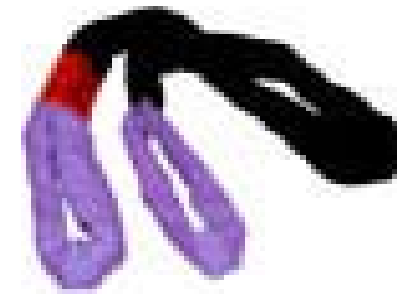
Synthetic Roundslings

- The most flexible style of sling
- Less rigging weight than wire rope slings
- Easy handling
- Wear points can be shifted to extend life
- Color-coded capacity indication
- Red core warning fibers
- Must have a legible id tag with rated capacities

Braided



Eye and Eye



| Part No. | Color | Rated Capacity (lbs.)* | | |
|----------|-------|------------------------|--------|--------|
| | | Vertical | Choker | Basket |
| BS-EN60 | Green | 5,300 | 4,200 | 10,600 |



Synthetic Slings Must

Be protected from sharp corners or edges



Never Store Slings:

- On the ground or floor.
- In direct sunlight, or exposed to (ultra-violet or florescent lighting).
- Near liquid chemicals.
- In areas where damage can occur to them.

Sling Removal from Service Criteria

A synthetic rope sling shall be removed from service if conditions such as the following are present:

1. Missing or illegible sling identification.
2. Cuts, gouges, areas of extensive fiber breakage along the length, and abraded areas on the rope.
3. Damage that is estimated to have reduced the effective diameter of the rope by more than 10%
4. Uniform fiber breakage along the major part of the length of the rope in the sling such that the entire rope appears covered with fuzz or whiskers.
5. Inside the rope, fiber breakage, fused or melted fiber (observed by prying or twisting to open the strands) involving damage estimated at 10% of the fiber in any strand or the rope as a whole
6. Discoloration, brittle fibers, and hard or stiff areas that may indicate chemical damage, ultraviolet damage, or heat damage.
7. Dirt and grit in the interior of the rope structure that is deemed excessive.
8. Foreign matter that has permeated the rope and makes it difficult to handle and may attract and hold grit.
9. Kinks or distortion in the rope structure, particularly if caused by forcibly pulling on loops (known as hockles)
10. Melted, hard, or charred areas that affect more than 10% of the diameter of the rope or affect several adjacent strands along the length that affect more than 10% of strand diameters
11. Poor condition of thimbles or other components manifested by corrosion, cracks, distortion, sharp edges, or localized wear.
12. For hooks, removal criteria as stated in ASME B30.10
13. For rigging hardware, removal criteria as stated in ASME B30.26
14. Other visible damage that causes doubt as to the strength of the sling

A synthetic webbing sling shall be removed from service if conditions such as the following are present:

1. Missing or illegible sling identification.
2. Acid or caustic burns
3. Melting or charring of any part of the sling.
4. Holes, tears, cuts, or snags.
5. Broken or worn stitching in the load bearing splices.
6. Excessive abrasive wear.
7. Knots in any part of the sling.
8. Discoloration, brittle or stiff areas on any part of the sling, which may mean chemical or ultraviolet/sunlight damage.
9. Fittings that are pitted, corroded, cracked, bent, twisted, gouged, or broken.
10. For hooks, removal criteria as stated in ASME B30.10.
11. For rigging hardware, removal criteria as stated in ASME B30.26
12. Other conditions, including visible damage, that may cause doubt as to the continued use of the sling.

A synthetic roundsling shall be removed from service if conditions such as the following are present:

1. Missing or illegible sling identification.
2. Acid or caustic burns
3. Evidence of heat damage
4. Holes, tears, cuts, abrasive wear, or snags that expose the core yarns.
5. Broken or damaged core yarns.
6. Weld splatter that exposes core yarns.
7. Knots in the roundsling, except for core yarns inside the cover.
8. Fittings that are pitted, corroded, cracked, bent, twisted, gouged, or broken.
9. For hooks, removal criteria as stated in ASME B30.10.
10. For rigging hardware, removal criteria as stated in ASME B30.26
11. Other conditions, including visible damage, that may cause doubt as to the continued use of the sling.

Examples of synthetic sling rejection criteria

Acid Damage



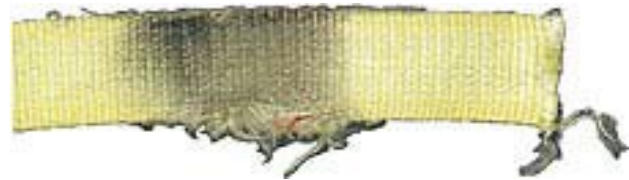
Heat Damage



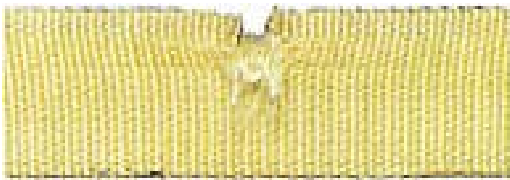
Cut



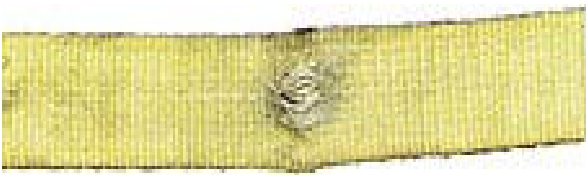
Abrasion Damage



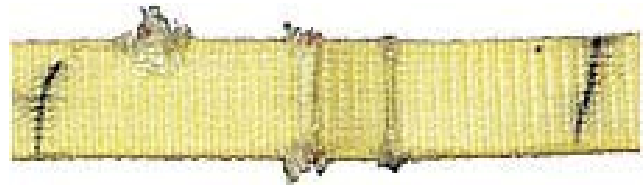
Cut & Tensile Damage



Punctures & Snags



Face Cuts



Tensile Break



Illegible or Missing Tag



September 16, 2008

OSHA Issues Violations in Collapse of Crane

By [WILLIAM K. RASHBAUM](#)

The rigging company that was raising a tower crane in Midtown when it collapsed in March, killing seven people, neglected to inspect the nylon slings it used to hoist a massive steel crane component aloft and was thus unaware that one was damaged, federal regulators said Monday. The findings mean proposed fines of \$220,000 for the company, Rapetti Rigging Services Inc.

The failure of the company to inspect the nylon slings and notice pre-existing cuts and snags was one of three factors that led to the collapse, according to federal regulators, who announced on Monday nearly three dozen citations against Rapetti and two other companies.

The citations, issued by the federal [Occupational Safety and Health Administration](#), also accused Rapetti of failing to follow the crane manufacturer's specifications when raising the crane and failing to use padding to protect the slings from the sharp edges of the crane part.

"This case illustrates in stark terms that failure to follow required procedures can have wide-ranging and catastrophic consequences," Edwin G. Foulke Jr., the assistant secretary of labor for OSHA, said in a statement.

The citations against Rapetti include three willful violations, the most severe issued by the agency, and five serious violations. OSHA defines a willful violation as one committed "with plain indifference to or intentional disregard for employee safety and health." A serious violation is one in which "death or serious physical harm is likely to result from a hazard about which the employer knew or should have known."

A lawyer for Rapetti, Andrew S. Fisher, said William Rapetti, the only full-time employee of the company, which serves as a consultant for contractors that erect cranes, denies wrongdoing.

"We intend to defend against these citations, which we think were issued in error," Mr. Fisher said. "And I think we will be able to establish to OSHA — assuming OSHA has an open mind — that some of the conclusions they reached, which resulted in the citations, are in error."

The collapse sent the 22-story white latticed crane crashing across a two-block swath of the Turtle Bay neighborhood on March 15, piercing one building and tearing a series of terraces off another. Seven people, including a crane operator and three riggers, were killed and two dozen were injured.

It was the first of two fatal crane collapses in less than three months — the second, on East 91st Street in June, left two dead — and came amid a spike of fatal construction accidents, bringing intense scrutiny to the Department of Buildings, which regulates construction work in New York City.

The subsequent revelation that the Buildings Department had mistakenly issued work permits at the site of

the first collapse led to the resignation of the agency's commissioner, Patricia J. Lancaster, in April.

Robert LiMandri, the city's acting buildings commissioner, said on Monday that the agency's preliminary findings are consistent with OSHA's citations.

Mr. Rapetti's crane rigging license, which is issued by the Buildings Department, expired in July, according to city records, which also show that a hold has been placed on it in case he seeks to renew it.

The other two companies cited by the safety agency, Joy Contractors Inc., and the Reliance Construction Group, face possible penalties of \$74,000 and \$19,500, respectively. They were cited for a range of issues unrelated to the March 15 crane collapse that were uncovered in an inspection after the accident.

Efforts to reach those two companies on Monday night were not successful.

Richard Mendelson, the area director for OSHA, said the inquiry had shown that three of the nylon slings were about two months old, and the agency was able to learn where they had been purchased. The fourth sling was believed to be about two years old and investigators were unable to track its provenance.

Mr. Mendelson added that forensic testing had determined that the fourth sling had cuts and tears before the collapse.

OSHA investigators purchased similar slings, he said, and conducted extensive tests that in essence recreated the accident.

Mr. Mendelson said that the agency, which issues about 600 citations a year, usually issues a little more than a dozen willful violations and only one or two that carry fines of more than \$100,000.

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