

Synthetic Web Slings

Synthetic web slings offer a number of advantages for rigging purposes. The most commonly used synthetic web slings are made of nylon, Dacron, and polyester. They have the following properties in common:





- Strength - can handle load of up to 300,000 lbs.
- Convenience - can conform to any shape.
- Safety - will adjust to the load contour and hold it with a tight, non-slip grip.
- Load protection - will not mar, deface, or scratch highly polished or delicate surfaces.
- Long life - are unaffected by mildew, rot, or bacteria; resist some chemical action; and have excellent abrasion resistance.
- Economy - have low initial cost plus long service life.
- Shock absorbency - can absorb heavy shocks without damage.
- Temperature resistance - are unaffected by temperatures up to 180°F.

Each synthetic material has its own unique properties. Nylon must be used wherever alkaline or greasy conditions exist. It is also preferable when neutral conditions prevail and when resistance to chemicals and solvents is important. Dacron must be used where high concentrations of acid solutions - such as sulfuric, hydrochloric, nitric, and formic acids - and where high-temperature bleach solutions are prevalent. (Nylon will deteriorate under these conditions.) Do not use Dacron in alkaline conditions because it will deteriorate; use nylon or polypropylene instead. Polyester must be used where acids or bleaching agents are present and is also ideal for applications where a minimum of stretching is important.

Possible Defects. Synthetic web slings must be removed from service if any of the following defects exist:

- Acid or caustic burns,
- Melting or charring of any part of the surface,
- Snags, punctures, tears, or cuts,
- Broken or worn stitches,
- Wear or elongation exceeding the amount recommended by the manufacturer, or
- Distortion of fittings.

Types of Synthetic (Soft) Slings

<p>Type 1: Triangle & Choker (TC) - Hardware on each end produces the most effective choker hitch. Can also be used in vertical and basket hitches.</p>	
<p>Type 2: Triangle & Triangle (TT) - Hardware on each end for use in basket or vertical hitch.</p>	
<p>Type 3: Flat Eye & Eye (EE) - Popular, versatile sling used in vertical, choker & basket hitches. Easy to remove from underneath loads.</p>	
<p>Type 4: Twisted Eye & Eye (EE) - Eyes turned at a right angle to sling body. Forms superior choker hitch & allows better fit on crane hook in basket hitch.</p>	

Type 5: Endless (EN) - Economical & adaptable sling with no fixed wear points. Used in all hitches.



Type 6: Reversed Eye (RE) - Extremely strong & durable for continuous &/or abusive applications. Wear pads on both sides of body.



Every lift utilizes one of three basic hitches



Vertical Hitch

This hitch is made directly from the crane hook to the load, usually attached by means of a hook.



Choker Hitch

The sling passes entirely around the load with one loop passing through the other to form a slip noose or "choker".



Basket Hitch

This hitch is made by passing the sling under the load and having both eyes going to the crane hook.

Mechanical Considerations

1. Determine weight of the load.
2. Select sling having suitable characteristics for the type of load, hitch and environment.
3. Slings shall not be loaded in excess of the rated capacity. Consideration should be given to sling angles, which are discussed below.
4. Slings with fittings used in a choker hitch shall be of sufficient length to assure that the choking action is on the webbing.
5. Slings used in a basket hitch shall have the load balanced to prevent slippage.
6. Slings shall not be dragged on the floor or over an abrasive surface.
7. Slings shall not be twisted or tied into knots, or joined by knotting.
8. Slings shall not be pulled from under loads when the load is resting on the sling.
9. Slings shall always be protected from being cut by sharp corners, sharp edges, protrusions or abrasive surfaces.
10. Do not drop slings equipped with metal fittings.

The opening in fittings shall be the proper shape and size to insure that the fitting will seat properly in the hook or other attachment.

Environmental Considerations

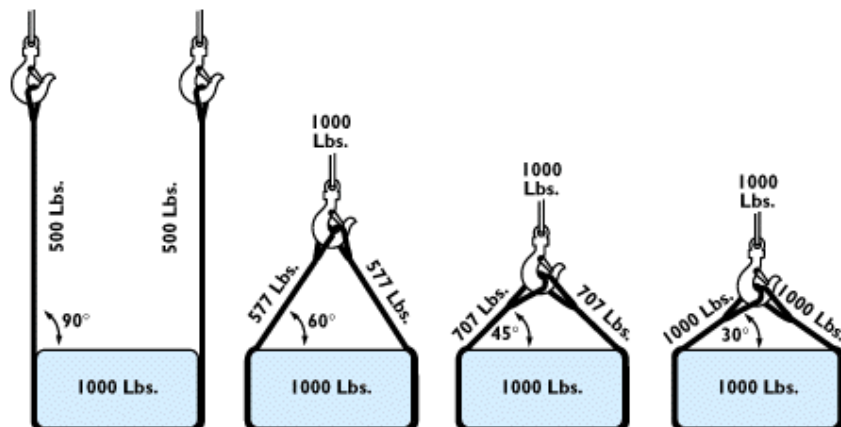
- Slings should be stored in a cool, dry, and dark place, and should not be exposed to ultra-violet light (sunlight).
- Chemically active environments can affect the strength of synthetic web slings in varying degrees ranging from none to total degradation. The sling manufacturer should be consulted before using slings in chemically active environments.
- Acids**
 - Nylon is subject to degradation in acids, ranging from none to total degradation.
 - Polyester is resistant to many acids**, but is subject to degradation ranging from none to moderate in some acids.
- Alkalis**
 - Polyester is subject to degradation in alkalis, ranging from none to total degradation.
 - Nylon is resistant to many alkalis**, but is subject to degradation ranging from none to moderate in some alkalis.
- See chart below for effects of other chemicals on web slings.

	Acids	Alcohols	Aldehydes	Strong Alkalis	Bleaching Agents	Dry Cleaning Solvents	Ethers	Halogenated Hydrocarbons	Hydrocarbons	Keytones	Oils Crude	Oils Lubricating	Soap & Detergents	Water & Sea-Water	Weak Alkalis
Nylon	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Polyester	*	Yes	No	**	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
* Disintergrated by concentrated sulfuric acid															
**Degraded by strong alkalis at elevated temperatures															

- Nylon and polyester slings shall not be used at temperatures in excess of 194 degree F (90 degree C)**, however, they may be used in temperatures as low as -40 degree F (-40 degree C).
- Slings incorporating aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of alkalis and/or acids are present.

Environments in which synthetic web slings are continuously exposed to ultra-violet light (sunlight) can affect the strength of synthetic webbing in varying degrees, ranging from slight to total degradation. The degradation is also cumulative.

Sling angles have a direct and oftentimes dramatic affect on the rated capacity of a sling. This angle, which is measured between a horizontal line and the sling leg or body, may apply to a single leg sling in an angled vertical or basket hitch, or to a multi-legged bridle sling. Anytime pull is exerted at an angle on a leg, the tension or stress on each leg is increased. To illustrate, each sling leg in a vertical basket hitch absorbs 500 lbs. of stress from a 1,000 lb. load. The same load, when lifted in a 60 degree basket hitch, exerts 577 lbs. of tension on each leg.



It is critical therefore, that rated capacities be reduced to account for sling angles. Angles less than 45 degrees are not recommended and those below 30 degrees should be avoided whenever possible. Use the formula and chart shown below to calculate the reduction in rated capacities caused by various sling angles.

$$\text{Actual Sling Capacity} = \text{Factor} \times \text{Rated Capacity}$$

Sling Angles in Degrees	Factor	Sling Angles in Degrees	Factor
15	.259	55	.819
20	.342	60	.866
25	.423	65	.906
30	.500	70	.940
35	.574	75	.966
40	.643	80	.985
45	.707	85	.996
50	.766	90	1.000

SAFE LIFTING PRACTICES

Now that the sling has been selected (based upon the characteristics of the load and the environmental conditions surrounding the lift) and inspected prior to use, the next step is learning how to use it *safely*. There are four primary factors to take into consideration when safely lifting a load. They are (1) the size, weight, and center of gravity of the load; (2) the number of legs and the angle the sling makes with the horizontal line; (3) the rated capacity of the sling; and (4) the history of the care and usage of the sling.

Size, Weight, and Center of Gravity of the Load

The center of gravity of an object is that point at which the entire weight may be considered as concentrated. In order to make a level lift, the crane hook must be directly above this point. While slight variations are usually permissible, if the crane hook is too far to one side of the center of gravity, dangerous tilting will result causing unequal stresses in the different sling legs. This imbalance must be compensated for at once.

Number of Legs and Angle with the Horizontal

As the angle formed by the sling leg and the horizontal line decreases, the rated capacity of the sling also decreases. In other words, the smaller the angle between the sling leg and the horizontal, the greater the stress on the sling leg and the smaller (lighter) the load the sling can safely support. Larger (heavier) loads can be safely moved if the weight of the load is distributed among more sling legs.

Rated Capacity of the Sling

The rated capacity of a sling varies depending upon the type of sling, the size of the sling, and the type of hitch. Operators must know the capacity of the sling. Charts or tables that contain this information generally are available from sling manufacturers. The values given are for *new* slings. Older slings must be used with additional caution. Under no circumstances shall a sling's rated capacity be exceeded.

History of Care and Usage

The mishandling and misuse of slings are the leading causes of accidents involving their use. The majority of injuries and accidents, however, can be avoided by becoming familiar with the essentials of proper sling care and usage.

Proper care and usage are essential for maximum service and safety. Slings must be protected from sharp bends and cutting edges by means of cover saddles, burlap padding, or wood blocking, as well as from unsafe lifting procedures such as overloading.

Before making a lift, check to be certain that the sling is properly secured around the load and that the

weight and balance of the load have been accurately determined. If the load is on the ground, do *not* allow the load to drag along the ground. This could damage the sling. If the load is already resting on the sling, ensure that there is no sling damage prior to making the lift.

Next, position the hook directly over the load and seat the sling squarely within the hook bowl. This gives the operator maximum lifting efficiency without bending the hook or overstressing the sling.

Wire rope slings are also subject to damage resulting from contact with sharp edges of the loads being lifted. These edges can be blocked or padded to minimize damage to the sling.

After the sling is properly attached to the load, there are a number of good lifting techniques that are common to all slings:

- Make sure that the load is not lagged, clamped, or bolted to the floor.
- Guard against shock loading by taking up the slack in the sling slowly. Apply power cautiously so as to prevent jerking at the beginning of the lift, and accelerate or decelerate slowly.
- Check the tension on the sling. Raise the load a few inches, stop, and check for proper balance and that all items are clear of the path of travel. Never allow anyone to ride on the hood or load.
- Keep all personnel clear while the load is being raised, moved, or lowered. Crane or hoist operators should watch the load at all times when it is in motion.

- Finally, obey the following critical rigging & hoisting safety guidelines:
 - Never allow more than one person to control a lift or give signals to a crane or hoist operator except to warn of a hazardous situation.
 - Never raise the load more than necessary.
 - Never leave the load suspended in the air.
 - Never work under a suspended load or allow anyone else to.

Once the lift has been completed, clean the sling, check it for damage, and store it in a clean, dry airy place. It is best to hang it on a rack or wall.

Remember, damaged slings cannot lift as much as new or well-cared for older slings. Safe and proper use and storage of slings will increase their service life.

MAINTENANCE

Fiber Ropes and Synthetic Webs

Fiber ropes and synthetic webs are generally discarded rather than serviced or repaired. Operators must always follow manufacturer's recommendations.

SUMMARY

There are good practices to follow to protect your self while using slings to move materials. First, learn as much as you can about the materials with which you will be working. Slings come in many different types, one of which is right for your purpose. Second, analyze the load to be moved - in terms of size, weight, shape, temperature, and sensitivity - then choose the sling which best meets those needs. Third, always inspect all the equipment before and after a move. Always be sure to give equipment whatever "in service" maintenance it may need. Fourth, use safe lifting practices. Use the proper lifting technique for the type of sling and the type of load.