Table 4-3 Suitable connection hardware for use with roundslings in a vertical or choker hitch

Sling Rated Capacity (Vertical) (lbs.)	Minimum hardware size for vertical or choker hitch applications			
	Stock Diameter Or Thickness (in.)		Contact Width (in.)	
2,600	.39	7/16	.97	1
5,300	.59	5/8	1.29	1 3/8
8,400	.72	3/4	1.66	1 3/4
10,600	.85	7/8	1.78	1 7/8
13,200	.95	1	2.00	2
16,800	1.12	1 1/8	2.13	2 1/8
21,200	1.15	1 3/16	2.62	2 5/8
25,000	1.25	1 1/4	2.85	2 7/8
31,000	1.41	1 1/2	3.15	3 1/4
40,000	1.60	1 5/8	3.57	3 5/8
53,000	1.90	2	4.00	4
66,000	2.05	2 1/8	4.60	4 5/8
90,000	2.46	2 1/2	5.22	5 1/4

Table 4-4 Suitable connection hardware for use with roundslings in a basket hitch

Sling Rated Capacity (Basket) (lbs.)	Minimum hardware size for basket hitch applications using a single hook or connection			
	Stock Diameter Or Thickness (in.)		Contact Width (in.)	
5,200	.54	9/16	1.37	1 3/8
10,600	.83	7/8	1.82	1 7/8
16,800	1.02	1 1/16	2.34	2 3/8
21,200	1.20	1 1/4	2.52	2 1/2
26,400	1.35	1 3/8	2.80	2 7/8
33,600	1.59	1 5/8	3.00	3
42,400	1.63	1 5/8	3.71	3 3/4
50,000	1.77	1 7/8	4.00	4
62,000	2.00	2	4.45	4 1/2
80,000	2.26	2 3/8	5.06	5
106,000	2.69	2 3/4	5.62	5 5/8
132,000	2.90	3	6.50	6 1/2
180,000	3.50	3 1/2	7.38	7 3/8

Note: Fraction values have been rounded up from the decimals.

4d. Avoid actions that cause damage to slings, such as:

- Using hooks, shackles or other hardware that have edges or rough surfaces
- Twisting, kinking or knotting the sling
- Using slings to pull on stuck or constrained objects
- Pulling slings from under loads when the load is resting on the sling—place blocks under load if feasible Dropping or dragging slings on the ground, floor or over abrasive surfaces
- Choking on the hardware
- Shortening or connecting slings by knotting, twisting, or other methods not approved by the sling manufacturer or qualified person
- Exposing slings to temperatures above 200°F (90°C), or below -40°F (-40°C)
- "Tip loading" a sling hook instead of centering it in the base or "bowl" of the hook
- Driving over slings with a vehicle or other equipment
- Accelerating or decelerating the load too quickly (i.e., "shock loading")
- Exposing slings to damaging acids or alkalis

5. All Personnel Must Remain Clear of Loads and Alert to Risks

To prevent possible injury when using slings, all personnel must:

- Stand clear of lifted loads and never be under, on or near suspended loads
- Avoid placing any parts of the body between the sling and load, or between the sling and lifting hook or connections
- Be alert to the potential for the sling to become snagged during a lift

6. Maintain and Store Sling Properly

Attempt to keep slings clean and free of dirt, grime and foreign materials. If slings are cleaned, use only mild soap and water, and:

- Do not use bleaching agents
- Do not machine wash or tumble dry slings, as this can significantly reduce their strength

When not in use, slings should be stored in an area free from environmental or mechanical sources of damage, such as: weld spatter, splinters from grinding or machining, or sources of UV, heat, or chemical exposure, etc.

Additional Factors to consider when handling loads;

- Integrity of the attachment points
- Structural stability of the load
- Loose parts that could fall from load
- Power lines in the area
- Secure a clear load path and avoid any contact with objects that would impede load movement
- Tag lines can often be attached to the load and be used to aid in controlling load positioning

For Additional Information;

This bulletin does not contain all of the information that may be necessary to ensure the safe use of roundslings. Some additional sources of training information include:

- WSTDA RS-1 Recommended Standard Specification for Polyester Roundslings
- WSTDA RS-2 Recommended Operating and Inspection Manual for Polyester Roundslings
- ASME B30.9 Sling Standard
- OSHA 29 CFR 1910.184 Regulations
- Lift-All Catalog and website at www.lift-all.com
- Rigging handbooks

Call for information on Sling Inspections & Safety Seminars
Directed Toll Free (800) 909-1964

Lift-All® PRODUCTS FOR BETTER LIFTING 022 R0718

Tuflex® Roundsling Safety Bulletin 022

WARNING

Failure to Read, Understand and **Follow** the information in this bulletin may result in severe **INJURY** or **DEATH** due to sling failure and/or loss of load. This bulletin contains important safety information. It **DOES NOT** contain all of the information you need to know about handling, lifting and manipulating materials and loads safely. It is your responsibility to consider all risk factors prior to using any rigging device or product.

1. **Sling users must be trained** in operating practices, including sling selection, use, inspection, rigging practices, cautions to personnel, and effects of environment.
2. **Inspect sling at least daily** and remove from service if damaged.
3. **Protect sling from being cut or damaged** by corners, protrusions, or from contact with edges that are not well rounded (See Table 3-1), using materials of sufficient strength, thickness and construction to prevent damage.
4. **Use sling properly** - Do not exceed a sling's rated capacities and always consider how the sling angle affects the amount of tension on the sling (See Table 4-1).
5. **Stand clear of load**. Do not stand on, under or near a load, and be alert to dangers from falling and moving loads, and the potential for snagging.
6. **Maintain and store sling properly.** Sling should be protected from mechanical, chemical and environmental damage.

1. Sling Users Must be Trained and Knowledgeable

Sling users must be knowledgeable about the safe and proper use of slings and be aware of their responsibilities as outlined in all applicable standards and regulations. ASME B30.9 states: "*Synthetic roundsling users shall be trained in the selection, inspection, cautions to personnel, effects of the environment and rigging practices.*" OSHA Sling Regulation 29 CFR 1910.184 states that a *qualified person* is one: "*who, by possession of a recognized degree or certificate of professional standing in an applicable field, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.*" If you are unsure whether you are properly trained and knowledgeable, or if you are unsure of what the standards and regulations require of you, ask your employer for information and/or training— **DO NOT** use roundslings if you are unsure of what you are doing. Lack of skill, knowledge or care can result in severe **INJURY** or **DEATH** to you and others.

2. Inspect Sling for Damage

Damage to a roundsling can significantly reduce its capacity to hold or lift loads and increases the chance that the sling will fail during use. If you are not sure if a sling is damaged, **DO NOT USE IT.**

2a. How to inspect slings

Perform a visual inspection of the entire sling and feel along its entire length for any of the types of conditions listed in Tables 2-1 and 2-2.

2b. Removal from service

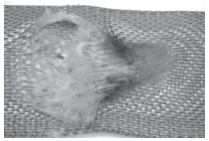
Remove sling from service immediately if ANY of the listed types of damage are detected, even if the damage is not as extensive as the relatively extreme examples illustrated in Table 2-2.

Never ignore sling damage or attempt to perform temporary repairs of damaged slings (e.g., tie knots in the sling, etc.).

Table 2-1. Removal from service criteria:

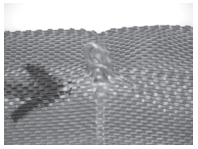
- Any damage to the sling cover that exposes the red striped core yarns of the roundsling, such as excessive abrasive wear, holes, tears, cuts, snags, or embedded materials
- Broken or worn stitches in the cover exposing the core yarns
- Identification tag is missing or not readable
- Slings that have been tied into knots
- Any heat or chemical damage, i.e. acid or alkali burns, melting or weld spatter
- Fittings with any cracks, excessive wear, or other damage, such as deformation, corrosion, or pitting
- Hooks with throat opened more than 15% or twisted more than 10 degrees out of plane
- Any conditions which cause doubt as to the strength of the sling

Table 2-2 Examples of some forms of roundsling damage



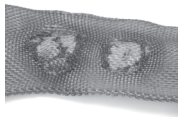
Abrasion

Cutting



Snags and Punctures

Missing / Illegible Tag



Heat or Chemical Burns

Knotting

2c. Inspection Frequency

Initial Inspection - Each new sling must be inspected by a designated person to help ensure that the correct sling has been received, is undamaged, and meets applicable requirements for its intended use.

Frequent Inspection - The entire sling must be inspected by a designated person before each day or shift in **Normal** service conditions, or before each use in **Severe** service conditions, where any rapid rate of wear or other sling degradation may exist.

Periodic Inspection - Every sling must be inspected "periodically". The designated person should be someone other than the person performing the frequent inspection.

The frequency of periodic inspections should be based on the sling's actual or expected use, severity of service, and experience gained during the inspection of other slings used in similar circumstances, but must not exceed a one year interval. General guidelines for the frequency of periodic inspections are:

- Normal service—yearly
- Severe service—monthly to quarterly
- Special service—as recommended

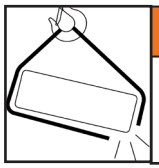
A written record of the most recent periodic inspection must be maintained. (See WSTDA RS-1 for definitions of service conditions.)

3. Protect Sling from Damage

ALWAYS protect roundslings from being cut or damaged by corners, edges and protrusions using protection sufficient for each application.

Do not ignore warning signs of misuse. Cut marks detected during any sling inspection serves as a clear signal that sling protection must be added or improved.

3a. Exposure of slings to edges



⚠ WARNING

Exposure of roundslings to edges with a radius that is too small can cause sling failure and loss of load

Edges do not need to be "sharp" to cause failure of the sling. Table 3-1 shows the minimum allowable edge radii suitable for contact with unprotected roundslings. Chamfering or cutting off edges is not an acceptable substitute for fully rounding the edges to the minimum radius. Slings can also be damaged from contact with edges or burrs at the sling connection.

Figure 3-1. Measure the edge radius. The radius is equal to the distance between points A and B.

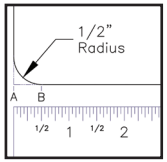


Table 3-1 Minimum Edge Radii suitable for contact with unprotected polyester roundslings

Vertical Rated Capacity (lbs.)	Minimum Edge Radii (in.)	(in.)	Sling Width At Load (in.)
2,600	.14	3/16	.97
5,300	.21	1/4	1.29
8,400	.26	5/16	1.66
10,600	.30	5/16	1.78
13,200	.33	3/8	2.00
16,800	.40	7/16	2.13
21,200	.41	7/16	2.62
25,000	.44	7/16	2.85
31,000	.50	1/2	3.15
40,000	.56	9/16	3.57
53,000	.67	11/16	4.00
66,000	.72	3/4	4.60
90,000	.87	7/8	5.22

For further information on minimum edge radii, contact Lift-All or see WSTDA RS-1.

3b. Sling protection

A qualified person must select materials and methods that adequately protect slings from edges or abrasive surfaces. Sleeves, wear pads, corner protectors or other softeners are examples of materials commonly used as protection devices. However, **No protective device is "cut proof".**

Some protection devices provide abrasion resistance but offer virtally no protection against cuts. Several "test" lifts, done in a non-consequence setting, may be necessary to determine the suitability of each protection device. After each "test" lift, inspect all slings and protection devices for damage.

4. Sling Selection and Use

In order to safely lift a load and not exceed the sling's rated capacity, a qualified person must select slings having suitable characteristics and consider the following:

- *Load information* including size, shape, weight, composition and center of gravity
- *Lifting conditions* including overhead clearance, temperature and chemicals
- *Hoisting equipment and attachment options* including the number and method of connections to the load.

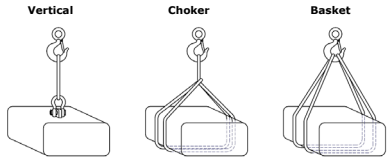
4a. Rigging configuration and load stability

A qualified person must review each lift, create a rigging plan, and select the sling hitches (see Figure 4-1). This process should consider:

Load Control and Stability – A qualified person must choose the quantity of slings, location of attachments, and the hitch types needed to effectively maintain load control. Resistance to tipping must be maintained if the slings are attached below the center of gravity.

Sling Securement – Each sling must be hitched to prevent slippage, yet not restrict the sling from maintaining uniform tensioning.

Figure 4-1. Common types of sling hitches



4b. Sling capacity and the effect of angles

Do not exceed the sling's rated capacity or the capacity of any of the components of the rigging system.

Sling Capacity - Determine the load weight, the tension applied to each sling, and verify that the amount of tension applied to the sling does not exceed it's capacity for the chosen hitch.

Effect of Sling Angle – The sling angle affects the amount of tension applied to the sling (see Figure 4-2). As the sling angle decreases, the tension on each leg increases. This principle applies when one sling is used to lift at an angle or when a basket hitch or multi-legged bridle sling is used. Table 4-1 provides information on increased tension as a function of sling-to-load angle. The use of slings at angles of less than 30 degrees should be avoided.

Figure 4-2
Multiply the amount of load applied to each leg of the sling by the tension factor (See Table 4-1) to determine the increased tension on each leg.

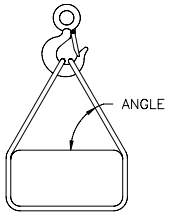


Table 4-1 Sling tension factor as a function of sling angle.

Angles In Degrees *	Tension Factor	Angle in Degrees *	Tension Factor
90	1.000	60	1.155
85	1.004	55	1.221
80	1.015	50	1.305
75	1.035	45	1.414
70	1.064	40	1.555
65	1.104	30	2.000

*angle from the horizontal

Angle of Choke—When a choke hitch is used, and the angle of choke is less than 120 degrees, the sling choker hitch capacity decreases. To determine the actual sling capacity at a given angle of choke, multiply the sling capacity rating (for a choker hitch) by the appropriate reduction factor determined from Table 4-2.

Table 4-3
Adjusted choker hitch capacity = Choker Hitch Capacity x Reduction Factor

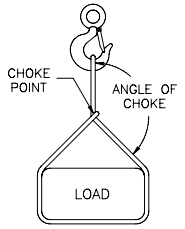


Table 4-2 Reduction in rated capacity as a function of angle of choke

Angle of Choke > or =	Angle of Choke <	Sling Capacity Reduction Factor
120	180	1.00
105	120	0.82
90	105	0.71
60	90	0.58
0	60	0.50

4c. Sling hardware and connections

Connection surfaces must be smooth to avoid abrading or cutting roundslings. Roundslings can also be damaged or weakened by excessive compression between the sling and the connection points if the size of the attachment hardware or connection area is not large enough to avoid this damage. Select and use proper connection hardware that conform to the size requirements listed for choker and vertical hitches (see Table 4-3), or for basket hitches (see Table 4-4).

(Contact Lift-All, or see WSTDA RS-1 for information about how to calculate whether a smaller connection size is allowable when tension on a roundsling is less than its capacity.)