ELEPHANT

LIFTING PRODUCTS™

SYNTHETIC SLINGS

ELEPHANT
LIFTING PRODUCTS™

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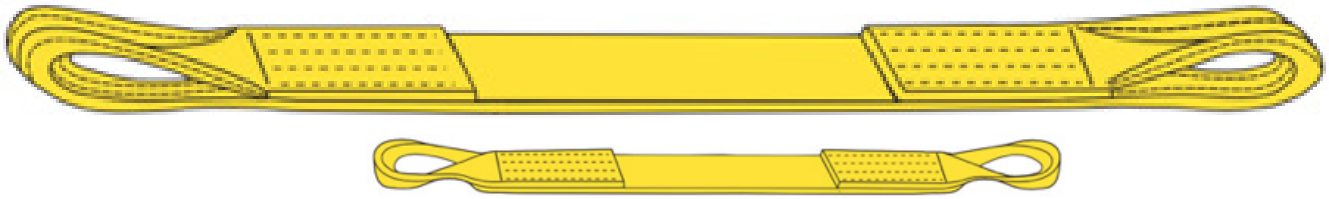
WEB SLINGS

FLAT AND TWISTED WEB SLINGS



	Type 3 EEF	Type 4 EET	RATED CAPACITY IN POUNDS Vertical	Choker	Basket
ONE PLY	1-901		1600	1280	3200
	1-901.5		2300	1840	4600
	1-902		3100	2480	6200
	1-903		4700	3760	9400
	1-904		6200	4960	12400
	1-905		7800	6240	15800
	1-906		9300	7440	18600
	1-908		11800	9440	23800
	1-910		14700	11760	29400
	1-912		17600	14080	35200
TWO PLY	2-901		3100	2480	6200
	2-901.5		4700	3760	9400
	2-902		6200	4960	12400
	2-903		8800	7040	17600
	2-904		11000	8800	22000
	2-905		13700	10960	27400
	2-906		16500	13200	33000
	2-908		22700	18160	45400
	2-910		28400	22720	56800
	2-912		34100	27280	68200

	Type 3 EEF	Type 4 EET	RATED CAPACITY IN POUNDS Vertical	Choker	Basket
THREE PLY	3-901		4700	3760	9400
	3-901.5		7000	5600	14000
	3-902		9300	7440	18800
	3-903		13500	10800	27000
	3-904		17200	13760	34400
	3-905		20600	16480	41200
	3-906		24400	19520	48800
	3-908		30700	24580	61400
	3-910		36000	28800	72000
	3-912		40300	32260	80600
FOUR PLY	4-901		5500	4400	11000
	4-901.5		9400	7520	18800
	4-902		11000	8800	22000
	4-903		16400	13120	32800
	4-904		20400	16320	40800
	4-905		25500	20400	51000
	4-906		30800	24480	61200
	4-908		41000	32800	82000
	4-910		48000	38400	96000
	4-912		60000	48000	120000

MAKING SLING BUYING EASY: HOW TO ORDER

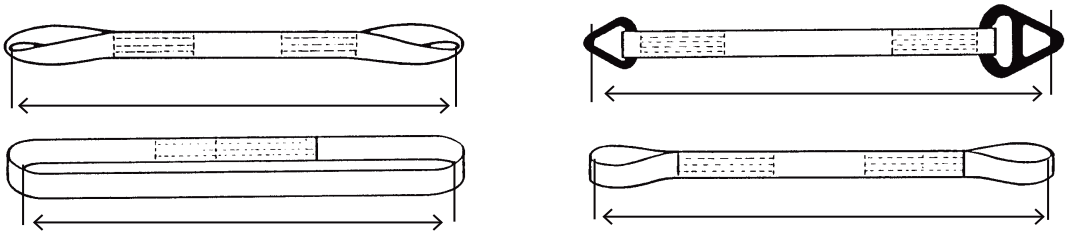
UNDERSTANDING PART NUMBERS

EEF-2-9 03 x 8′ Type 4 - Polyester

Type of Sling	No. of Body Plies	Grade of Webbing	Width	Length	Sling Type	Sling Material

MEASURING LENGTH OF SLING

To calculate the correct length of the sling, measure pull to pull when flat.



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Eye and Eye slings can be used in choker, vertical and basket hitches. Slings with Flat (Type 3) eyes are furnished unless Half Twist (Type 4) eyes are specified. Heavy duty polyester and nylon rigging slings featuring Eye and Eye design are made in widths ranging from as narrow as 1 inch and as wide as 12 inches.

Sling eyes are automatically tapered to a narrower width on Eye and Eye lifting slings that are over 3 inches in width. Tapered eyes on 2 in wide slings are available upon request. Also available with extra protection wrapped around the sling eye, which provides additional service life as this is a critical wear area for all polyester and nylon rigging slings.

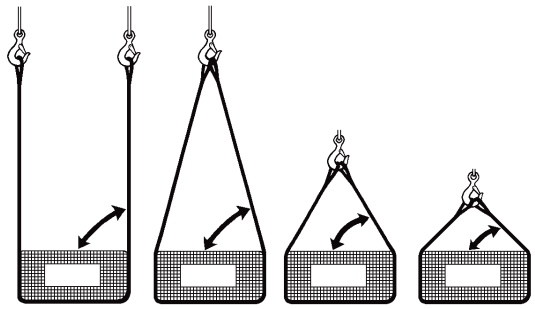
For 3 and 4 ply slings wider than 4 in, Round Slings should be considered. Round Slings offer increased flexibility, ease of use and lower costs.

Manufacturing Tolerance
All web slings are manufactured to the following tolerances. For Web Slings wider than 6 inches, add 1/2" to the following values. For exact tolerances or matched slings, please contact us.

Sling Thickness	Tolerance
1 PLY	1.5" + 1.5% of Sling Length
2 PLY	2" + 2% of Sling Length
3 & 4 PLY	3" + 3% of Sling Length

CALCULATING SLING'S RATED CAPACITY

We use the following guidelines for calculating a sling's rated capacity:



1. Web tensile strength: This factor is the foundation for the calculation. Every webbing material is made with a specified nominal strength, measured in pounds per inch of width, in two basic grades. The webbing manufacturer is required to meet or exceed these nominal strengths with written proof. Any variation must exceed these ratings. This nominal strength of the webbing is used to calculate the sling's rated capacity.
2. Fabrication factor: This compensates for the reduction in webbing strength that occurs due to stitching and tapering. The greater the stitching, the more the reduction in webbing strength. Two-ply slings, for example, require more stitching than one-ply slings, thereby increasing the fabrication factor for the two-ply sling. Another factor is applied when webbing must be tapered such as in slings' eyes.
3. Hardware strength: This becomes a factor only when the nominal strength of the hardware is lower than the nominal strength of the sling. If so, the nominal strength of the hardware is used in calculating a sling's rated capacity.
4. Design factor: After web nominal strength has been adjusted by applying the fabrication factor, the sling's rated capacity is then determined by using a design factor of 5 to 1, as specified by American Society of Mechanical Enginneers (ASME) standard ASME B30.9, Section 9 - 4.4. ANSI and OSHA both require sling manufacturers to document published sling ratings with records of test data.
5. Random testing: In addition to using the above factors for calculating each sling's rated capacity, we test randomly selected slings from production runs to make sure every new sling meets or exceeds specifications and the rated capacity.

WARNING: Do not exceed rated capacities. Sling capacity decreases as the angle from horizontal decreases. Slings should never be used at angles less than 30 degrees.

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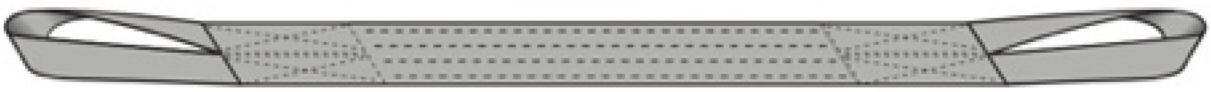
REVERSED EYE WEB SLINGS

Reversed Eye slings feature sling eyes and bodies that are covered by Bulked Nylon wear pads. Bulked Nylon wear pad material is more abrasion resistant than webbing, but provides no protection against cutting.

The bearing points of Reversed Eye-Standard (Type 6) eyes are 90° to the sling body. The perpendicular relationship between the eye and sling body in a Reversed Eye-Standard (Type 6) results in a comparatively advantageous choke hitch, when compared to the Reversed Eye-Flat (Type 7).

The Reversed Eye-Flat (Type 7) body is turned 180°, forming an eye, in the same plane as the sling body. Type 6 and Type 7 Reversed Eye Slings can be used in choker, vertical or basket hitches. Larger widths and plies are available upon request



		RATED CAPACITY IN POUNDS		
	Type 6 RE / Type 7 FE	Vertical	Choker	Basket
ONE PLY	1-902	3200	2560	6400
	1-903	4600	3680	9200
	1-904	6200	4960	12400
	1-906	9400	7520	18800
TWO PLY	2-902	6200	4960	12400
	2-903	9200	7360	18400
	2-904	12400	9920	24800
	2-906	17600	14080	35200

WARNING: Do not exceed rated capacities. Sling capacity decreases as the angle from horizontal decreases. Slings should never be used at angles less than 30 degrees.

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ROUND SLINGS

WHAT IS A ROUND SLING?

A Round Sling is an endless synthetic sling made from a continuous loop of polyester yarns covered with a double wall tubular jacket.

FEATURES, ADVANTAGES, AND BENEFITS

- Light weight, which reduces fatigue and strain on riggers
- Consistently matched lengths for better multiple sling load control
- No loss of strength from abrasion to cover
- Low stretch (about 3% at rated capacity) reduces sling and load abrasion
- Good design for low headroom lifts
- Conforms to shape of load for a more secure grip
- Load bearing yarns protected from UV degradation
- Double wall cover for greater sling life
- Soft cover will not scratch load surface
- Seamless, no sewn edges to rupture prematurely, requiring removal from service
- Color coded capacities for quick identification up to the maximum straight line capacity offered
- Pliable for easy rigging and storage
- Independent core yarns choke tightly, but release easily after use
- High strength to weight ratio for easy transportation
- All round slings are made to a tolerance of 1' +/- 2% of specified length.
- All slings meet or exceed OSHA and ASME B30.9 standards and regulations.
- Wear points can be shifted to extend life.
- Our most flexible sling

WARNING: Always protect Slings from corners, edges or protrusions. Never exceed the rated capacity listed on the tag

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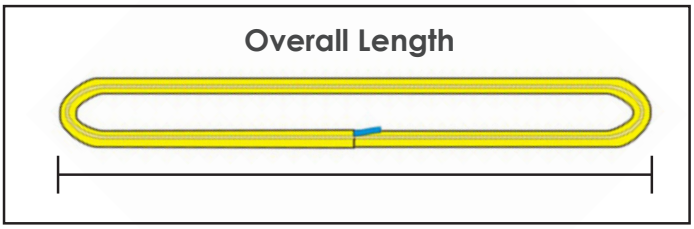
ENDLESS POLYESTER ROUND SLING



Part #	Color Code	Vertical	Choker	Basket At 90°	Basket At 45°	Length in Feet	Weight Per Foot	Body DIA Relaxed
A30	PURPLE	2,600	2,100	5,200	3,600	1.5′	0.2	5/8″
A60	GREEN	5,300	4,240	10,600	7,400	1.5′	0.3	7/8″
A90	YELLOW	8,400	6,700	16,800	11,800	2′	0.5	1 1/8″
A120	TAN	10,600	8,500	21,200	14,000	2′	0.6	1 1/8″
A150	RED	13,200	10,600	26,400	18,000	3′	0.8	1 3/8″
A180	WHITE	16,800	13,400	33,600	23,000	3′	0.9	1 3/8″
A240	BLUE	21,200	17,000	42,400	29,000	3′	1.3	1 3/4″
A300	ORANGE	25,000	20,000	50,000	35,000	4′	1.5	2″
A360	GREY	31,000	24,800	62,000	43,300	4′	1.7	2 1/4″
A400	ORANGE	40,000	32,000	80,000	56,500	6′	2.2	2 1/2″
A600	BROWN	53,000	42,400	106,000	74,000	6′	2.8	2 3/4″
A800	OLIVE	66,000	52,800	132,000	93,000	6′	3.4	3 1/8″
A1000	BLACK	90,000	72,000	180,000	127,000	6′	4.3	3 5/8″
A1100	BLACK	100,000	80,000	200,000	141,000	6′	5	4 1/4″

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SYNTHETIC WEB SLING SAFETY BULLETIN

⚠ WARNING

This bulletin contains important safety information about the use of synthetic web slings. However, it DOES NOT contain all the information you need to know about handling, lifting and manipulating materials and loads safely. Sling use is only one part of a lifting system and it is your responsibility to consider all risk factors prior to using any rigging device or product. Failure to do this may result in severe INJURY or DEATH due to sling failure and/or loss of load.

The following six points briefly summarize some important safety issues:

1. All users must be trained in sling selection, use and inspection, cautions to personnel, environmental effects and rigging practices.
2. Inspect sling for damage regularly, if the sling is damaged, remove it from service.
3. Protect sling from damage. ALWAYS protect slings in contact with edges, corners, protrusions, or abrasive surfaces with materials of sufficient strength, thickness and construction to prevent damage.
4. Do not exceed a sling's rated capacity. Always consider the effect of sling angle and tension on the sling's rated capacity.
5. Do not stand on, under or near a load with the sling under tension. All personnel should be alert to dangers of falling and/or uncontrolled loads, sling tension and the potential for snagging.
6. Maintain and store slings properly. Slings should be protected from mechanical, chemical and environmental damage.

1. All Sling Users Must be Trained and Knowledgeable

All web sling users must be trained on the proper use of web slings. The American Society of Mechanical Engineers, Safety Standard for Slings (ASME B30.9) states:

> "Synthetic webbing sling users shall be trained in the selection, inspection, cautions to personnel, effects of the environment and rigging practices as covered" by Chapter 9-5.

OSHA Guidance on Safe Sling Use (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."

It is important that all sling users be knowledgeable about the safe and proper use and application of slings and be thoroughly familiar with the manufacturer's recommendations and safety materials provided with each product. In addition, all sling users need to be aware of their responsibilities as outlined in all applicable standards and regulations.

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 NOTuse web slings until you are absolutely sure of what you are doing. Remember, when it comes to using web slings, lack of skill, knowledge and care can result in severe INJURY or DEATH to you and others.

2. Slings Must Be Regularly and Properly Inspected

Even seemingly "minor" damage to a web sling can significantly reduce its capacity to hold or lift objects and increases the chance that the sling will fail during use. For example, one sling manufacturer has shown that a 3/8" (9.5mm) cut (much smaller than the cut shown in Table 2) caused a sling to break under load at almost half its non-damaged capacity. Therefore, it is very important that web slings are regularly and properly inspected. If you are not sure whether a sling is damaged, DO NOT USE IT.

2a. How to inspect slings

To detect possible damage, you should perform a visual inspection of the entire sling and also feel along its entire length, as some damage may be felt more than seen. You should look and feel for any of the types of conditions listed in Table 1. Table 2 shows examples of some of these types of damage, but note that they are relatively extreme examples provided for illustration purposes only.

2b. What to do if you identify damage in a sling

If you identify ANY of these types of damage in a sling, remove it from service immediately even if the damage you feel or see is not as extensive as shown in the pictures in Table 2. Slings that are removed from service must be destroyed and rendered completely unusable unless they can be repaired and proof-tested by the sling's manufacturer or other qualified person. You should never ignore sling damage or attempt to perform temporary field repairs of damaged slings (e.g., tie knots in the webbing, etc.).

Table 1.Web sling removal from service criteria

The entire web sling must be inspected regularly and it shall be removed from service if ANY of the following are detected:

- If sling identification tag is missing or not readable.
- Holes, tears, cuts, snags or embedded materials.
- Broken or worn stitches in the load bearing splices.
- Knots in any part of the sling webbing.
- Acid or alkali burns.
- Melting, charring or weld spatter on any part of the web sling.
- Excessive abrasive wear or crushed webbing.
- Signs of Ultraviolet (UV) light degradation.
- Distortion, excessive pitting, corrosion or other damage to fitting(s).
- If provided, exposed red core yarn. However if damage is present and red yarns are not exposed DO NOT USE the sling.
- Any conditions which cause doubt as to the strength of the web sling.

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2c. How often to inspect slings

A three-stage procedure is recommended to help ensure that web slings are inspected with appropriate frequency:

Initial Inspection —Whenever a sling is initially received, it must be inspected by a designated person to help ensure that the correct web sling has been received and is undamaged and that the web sling meets applicable requirements for its intended use.

Frequent Inspection—The entire sling must be inspected before each shift or day in Normal service and before each use in Severe service applications.

Periodic Inspection —Every sling must be inspected "periodically" by a qualified and designated person. In order to validate the frequent level of inspection, the periodic inspection should be performed by someone other than the individual(s) who most commonly performs the frequent inspection. The frequency of periodic inspections is based on the sling's actual or expected frequency of use, severity of service conditions, the nature of the work performed with the sling and experience gained during the inspection of other slings used in similar circumstances. General guidelines for the frequency of periodic inspections are:

- Normal service—yearly
- Severe service—monthly to quarterly
- Special service—as recommended by a qualified person

Periodic inspections intervals must not exceed one year.

Written records are not required for frequent inspections, but WSTDA WS-1 or ASME B30.9 require that a written record of the most recent periodic inspection be maintained. See WSTDA WS-1 or ASME B30.9 for more information about definitions of Normal, Severe and Special service conditions.

3. Slings Must be Adequately Protected from Damage

3a. Avoid environmental degradation

Environmental factors such as an exposure to sunlight, dirt or gritty-type matter and cyclical changes in temperature and humidity, can result in an accelerated deterioration of web slings. The rate of this deterioration will vary with the level of exposure to these conditions and with the thickness of the sling material. For example, single ply slings will generally degrade more rapidly with this exposure than multiple ply slings. Web slings that are used outdoors regularly should generally be permanently removed from service within a period of 2 to 4 years. All web slings that are exposed to these conditions should be highly scrutinized during their inspections.

Visible indications of such deterioration can include the following:

- Fading of webbing color.
- Uneven or disoriented surface yarn of the webbing.
- Shortening of the sling length.
- Reduction in elasticity and strength of the sling material due to an exposure to sunlight, often evident by an accelerated abrasive damage to the surface yarn of the sling.
- Breakage or damage to yarn fibers, often evident by a fuzzy appearance of the web.
- Stiffening of the web, which can become particularly evident when web slings are exposed to outdoor conditions without being used or cyclically tensioned.

3b. Avoid actions that cause damage to slings

You should always avoid any action that causes the types of damage identified in the previous section of this Safety Bulletin, including (but not limited to):

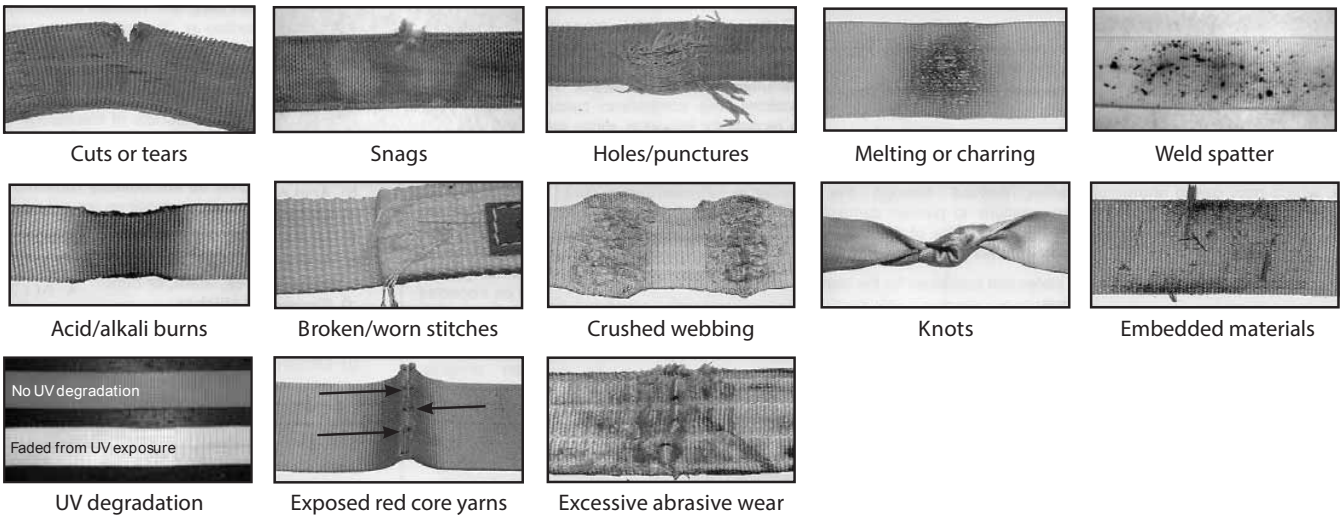
- Dropping or dragging slings on the ground, floor or over abrasive surfaces.
- Pulling slings from under loads when the load is resting on the sling—place blocks under load if feasible.
- Shortening or adjusting sling using methods not approved by the sling manufacturer or qualified person.
- Twisting, kinking or knotting the sling.
- Exposing slings to damaging acids or alkalis.
- Exposing slings to sources of heat damage or weld spatter.
- Using slings or allowing exposure to temperatures above 194°F (90°C) or below -40°F (-40°C).
- "Tip loading" a sling on a hook instead of centering it in the base or "bowl" of the hook.
- Using hooks, shackles or other hardware that have edges or surfaces that could damage sling.
- Running/driving over slings with a vehicle or other equipment.

Synthetic slings are affected by some chemicals ranging from little to total degradation. Time, temperature and concentration factors affect the degradation. For specific applications, consult the manufacturer. In addition, water absorption can decrease the strength of nylon web slings by as much as 10–15% (its strength returns when the sling dries completely). For specific applications, consult the manufacturer.

3c. Safeguard slings with sufficient protection

Synthetic web slings can be damaged, abraded or cut as tension and compression between the sling, the connection points and the load develops. Surfaces in contact with the sling do not have to be very

Table 2. Types of damage you should look and feel for in web slings



Cuts or tears | Snags | Holes/punctures | Melting or charring | Weld spatter

Acid/alkali burns | Broken/worn stitches | Crushed webbing | Knots | Embedded materials

UV degradation | Exposed red core yarns | Excessive abrasive wear

abrasive or have "razor" sharp edges in order to create the conditions for sling failure. Therefore, web slings must ALWAYS be protected from being cut or damaged by corners, edges, protrusions or abrasive surfaces with protection sufficient for the intended purpose.

There are a variety of types of ways to protect slings from such damage. A qualified person might select and use appropriate engineered protectors/softeners—commercially available products (e.g., sleeves, wear pads, edge wraps, body wraps, corner protectors, etc.) specifically designed to protect slings from damage. A qualified person might also design and construct their own methods of protection so long as the sling is adequately protected from and/or kept off of the damaging edge surface.

Regardless of the particular method chosen, the goal is to ensure that the sling, under tension, maintains its ability to securely lift the load while avoiding contact with damaging or abrasive surfaces under tension. A qualified person must carefully consider the most appropriate means to accomplish this goal. The protection used should not be makeshift (i.e., selecting and using cardboard, work gloves or other such items based solely on convenience or availability).

Regardless of the approach taken, a qualified person must ensure that the protection method chosen is appropriate for the types of damage to which the slings will be exposed. For instance, some protection provides abrasion resistance, but offers virtually no protection against cuts. Several "test" lifts, done in a non-consequence setting, may be necessary to determine the suitability of the protection device(s). After each "test" lift, the protection device(s) and sling(s) need to be inspected for damage and suitability. You should keep in mind that no protection is "cut proof" and you should always operate within the specified limits of the sling and its accessories (e.g., fixtures, hardware, protection, etc.).

4. Always Use Slings Properly

When lifting loads, a trained, qualified and knowledgeable user must take into account the factors and issues addressed in this bulletin, as well as considering any other relevant factors not addressed herein (see Table 4). Among the factors related specifically to web slings, users must perform several activities, including (but not limited to) those discussed in the following subsections.

4a. Assess the load

Determine the weight of the load and make sure it does not exceed the sling's rated capacity or the capacity of any of the components of the rigging system. Users must also determine the load's center of gravity (CG) to make sure the rigging system used will be able to retain and control the load once lifted.

4b. Select an appropriate sling/configuration

Select a sling having suitable characteristics for the type, size and weight of the load, the type of hitch (see Table 3) and the environment. The sling must be securely attached to the load and rigged in a manner to provide for load control to prevent slipping, sliding and/or loss of the load. A trained, qualified and knowledgeable user must determine the most appropriate method of rigging to help ensure a safe lift and control of the load.

Table 3. Common types of sling hitches

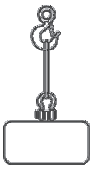
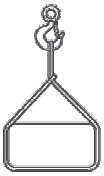
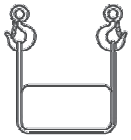
Hitch		Comments
Vertical Hitch		One end is placed on the hook, while the other end is attached directly to the load. A tagline should be used to prevent load rotation.
Choker Hitch		Sling passes through one end around the load and the other end is placed on the hook. Rated capacity is normally 80% of that for a vertical hitch. Load control is limited with only one sling rigged in a choker hitch. Also, the choke point should always be on the sling body–not on the sling eye, fitting, base of the eye or fitting, splice or tag.
Basket Hitch		The sling cradles the load while both ends are attached overhead. The rated capacity for a basket hitch is twice that for a vertical hitch. As with the choker hitch, more than one sling rigged in a basket hitch (or some other means) may be necessary to help ensure load control.

Table 4. Issues and Factors to consider when handling, lifting and manipulating materials and loads

Safe handling, lifting and manipulation of materials and loads requires consideration of a number offactors and issues, including (but not limited to):

Categories	Issues/ Factors to Consider		
Environment	Wind Weather Visibility	Environmental temperature Object temperature Chemical conditions and exposure	Ground stability Underground installations
Load	Weight Dimensions Center of Gravity (CG)	Attachment point integrity Susceptibility to crushing/compression Loose parts that could fall from load	Combination loads Damaging surfaces/edges Structural stability (bend/flex)
Equipment/Lift	Single/multiple cranes/hoists Maximum/planned operating radius Allowable load Ratio of lift to allowable load	Clearance to surrounding facilities Power lines and other environmental hazards Clearance between boom and lift Emergency/contingency set down area	Equipment inspection Ensure a clear load path
Rigging	Sling selection Load control Lift point (over the CG) Positive sling-to-load engagement	Coefficient of friction: Sling-to-load Appropriate hitch (for CG and load control) Load is free to move and is not snagged Coordination of multiple slings	Suitable wear protection Sling capacity is adequate for angle and tension
Personnel	Area clear of unnecessary personnel Personnel are trained and qualified	Signals: Visual, audible, electronic, etc. Personnel away from load and other dangers	Pre-lift plan and meeting Tag lines/spotter requirements

Another important consideration is the sling-to-load angle—the angle formed between a horizontal line and the sling leg or body. This angle is very important and can have a dramatic effect on the rated capacity of the sling. When the sling-to-load angle decreases, the load on each leg increases. This principle applies in a number of conditions, including when one sling is used to lift at an angle and when a basket hitch or multi-legged bridle sling is used. Table 5 provides information about increased tension as a function of sling-to-load angle (assuming equally-loaded sling legs). Sling angles of less than 30 degrees are not recommended.

Similarly, when 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 6.

4c. Do not misuse the sling

Avoid accelerating or decelerating the load too quickly (i.e., "shock loading"). Do not use slings to pull on stuck or snagged objects and do not use slings for towing purposes. A web sling should only be used for lifting loads.

5. Make Sure All Personnel are Clear of Loads and Alert to Risks

Even if you account for all of the factors/issues discussed in this Safety Bulletin, things can still go wrong. Therefore, all personnel must stand clear of lifted loads and never be under, on or near suspended loads.

When using slings, no part of the body should be placed between the sling and load or between the sling and lifting hook. In addition, personnel must be alert to the potential for the sling to become snagged during a lift. Never use a web sling to pull on objects in a snagged or constrained condition.

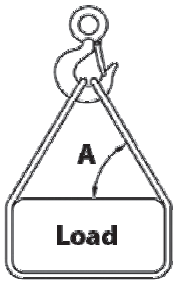
6. Properly Store and Maintain Slings

In order to prevent damage to slings when not in use, you should store slings in a cool, dry and dark location. Slings should be stored in an area free from environmental or mechanical sources of damage, such as: weld spatter, splinters from grinding or machining, heat sources, chemical exposure, etc. Also, keep slings clean and free of dirt, grime and foreign materials.

If slings are cleaned, use only mild soap and water. Rinse sling thoroughly and let it dry completely before placing the sling back into storage or use. Do not machine wash slings. Machine washing results in significant loss of sling strength.

Table 5. Increased sling tension as a function of sling-to-load angle

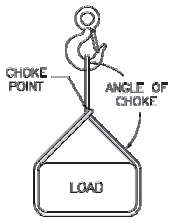
Angle "A" in degrees from horizontal	Tension Multiplier
90	1.000
85	1.004
80	1.015
75	1.035
70	1.064
65	1.104
60	1.155
55	1.221
50	1.305
45	1.414
40	1.555
35	1.742
30	2.000



Multiply the load weight (per leg) by the tension factor to determine the increased tension on the sling leg(s)

Table 6. Reduction in rated capacity as a function of angle of choke

Angle of Choke (degrees)		Angle of Choke Reduction Factor
= or >	<	
120	180	1.000
105	120	0.82
90	105	0.71
60	90	0.58
0	60	0.50



Actual Sling Capacity = Rated Capacity x Reduction Factor

Where to Find Additional Information

This bulletin does not provide you with all the information you need to know in order to be considered trained and knowledgeable about rigging and lifting loads, but it does provide important information about the use of web slings within a rigging system. If you need more information about web slings and rigging practices or your responsibilities according to regulations and standards, talk to your employer. You and your employer can consult a number of sources of information to help ensure that you are properly trained and knowledgeable when using web slings, including (but not limited to):

- WSTDA-WS-1—Recommended Standard Specification for Synthetic Web Slings.
- ASME B30.9—Synthetic Webbing Slings: Selection, Use and Maintenance.
- OSHA 29 CFR 1910.184—Slings.
- Rigging handbooks.
- OSHA Guidance on Safe Sling Use. (http://www.osha.gov/dsg/guidance/slings/synth-web.html)
- Manufacturer's catalog, manual, website, bulletins, etc.
- Formal training provided by manufacturers or other outside entities.

WSTDA-WSSB-1 2010

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SYNTHETIC ROUND SLING SAFETY BULLETIN

⚠ WARNING

This bulletin contains important safety information about the use of synthetic round slings. However, it DOES NOT contain all the information you need to know about handling, lifting and manipulating materials and loads safely. Sling use is only one part of a lifting system and it is your responsibility to consider all risk factors prior to using any rigging device or product. Failure to do this may result in severe INJURY or DEATH due to sling failure and/or loss of load.

The following six points briefly summarize some important safety issues:

1. All users must be trained in sling selection, use and inspection, cautions to personnel, environmental effects and rigging practices.
2. Inspect sling for damage regularly, if the sling is damaged, remove it from service.
3. Protect sling from damage. ALWAYS protect slings in contact with edges, corners, protrusions, or abrasive surfaces with materials of sufficient strength, thickness and construction to prevent damage.
4. Do not exceed a sling's rated capacity. Always consider the effect of sling angle and tension on the sling's rated capacity.
5. Do not stand on, under or near a load with the sling under tension. All personnel should be alert to danger of falling and/or uncontrolled load, sling tension and the potential for snagging.
6. Maintain and store round slings properly. Slings should be protected from mechanical, chemical and environmental damage.

1. All Sling Users Must be Trained and Knowledgeable

All round sling users must be trained on the proper use of round-slings. The American Society of Mechanical Engineers, Safety Standard for Slings (ASME B30.9) states:

> "Synthetic round sling users shall be trained in the selection, inspection, cautions to personnel, effects of the environment and rigging practices as covered" by Chapter 9-6.

OSHA Guidance on Safe Sling Use (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."

It is important that all sling users be trained and knowledgeable about the safe and proper use and application of slings and be thoroughly familiar with the manufacturer's recommendations and safety materials provided with each product. In addition, all sling users need to be aware of their responsibilities as outlined in all applicable standards and regulations.

If you are unsure whether you are properly knowledgeable or trained, 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 round slings until you are absolutely sure of what you are doing. Remember, when it comes to using round slings, lack of skill, knowledge and care can result in severe INJURY or DEATH to you and others.

2. Slings Must Be Regularly and Properly Inspected

Even seemingly "minor" damage to a round sling can significantly reduce its capacity to hold or lift objects and increases the chance that the sling will fail during use. Therefore, it is very important that round slings are regularly and properly inspected. In reality, there simply is no such thing as "minor" damage. If you are not sure whether a sling is damaged, DO NOT USE IT.

2a. How to inspect slings

Generally, damage to round slings can be detected visually. In some instances, internal load yarn damage can occur and not be visible. To detect possible damage, you should perform a visual inspection of the entire sling and also feel along its entire length, as some damage may be felt more than seen. You should look and feel for any of the types of conditions listed in Table 1. Table 2 shows examples of some of these types of damage, but note that they are relatively extreme examples provided for illustration purposes only.

2b. What to do if you identify damage in a sling

If you identify ANY of these types of damage in a sling,remove it from service immediately even if the damage you feel or see is not as extensive as shown in the pictures in Table 2. Slings that are removed from service must be destroyed and rendered completely unusable unless they can be repaired and proof-tested by the sling's manufacturer or other qualified person. You should never ignore sling damage or attempt to perform temporary field repairs of damaged slings (e.g., tie knots in the sling, etc.).

Table 1. Round sling removal from service criteria

The entire round sling must be inspected regularly and it shall be removed from service if ANY of the following are detected:

- If round sling identification tag is missing or not readable.
- Holes, tears, cuts, embedded materials, excessive abrasive wear, or snags that expose the core yarn of the round sling.
- Broken or damaged core yarn.
- If round sling has been tied into one or more knots.
- Acid or caustic burns of the round sling.
- Melting, charring or weld spatter of any part of the round sling.
- Distortion, excessive pitting, corrosion or other damage to fitting(s).
- Broken or worn stitching in the cover which exposes the core yarn.
- Any conditions which cause doubt as to the strength of the round sling.

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2c. How often to inspect slings

A three-stage procedure is recommended to help ensure that slings are inspected with appropriate frequency.

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

Frequent Inspection—The entire sling must be inspected before each shift or day in Normal service and before each use in Severe service applications.

Periodic Inspection —Every sling must be inspected "periodically" by a qualified and designated person. In order to validate the frequent level ofinspection, the periodic inspection should be performed by someone other than the individual(s) who most commonly performs the frequent inspection. The frequency of periodic inspections is based on the sling's actual or expected frequency of use, severity of service conditions, the nature of the work performed with the sling and experience gained during the inspection of other slings used in similar circumstances. General guidelines for the frequency of periodic inspections are:

Normal service—yearly

Severe service—monthly to quarterly

Special service—as recommended by a qualified person

Periodic inspections intervals must not exceed one year.

Written records are not required for frequent inspections, but WSTDA RS-1 and ASME B30.9 require that a written record of the most recent periodic inspection be maintained. See WSTDA RS-1 for more information about definitions of Normal, Severe and Special service conditions.

3. Slings Must be Adequately Protected From Damage

3a. Avoid actions that cause damage to slings

You should always avoid any action that causes the types of damage identified in the previous section of the Safety Bulletin, including (but not limited to):

- Dropping or dragging slings on the ground, floor or over abrasive surfaces.
- Pulling slings from under loads when the load is resting on the sling—place blocks under the load iffeasible.
- Shortening or adjusting sling using methods not approved by the sling manufacturer or qualified person.
- Twisting, kinking, or knotting the sling.
- Exposing slings to damaging acids or alkalis.
- Exposing slings to sources of heat damage or weld spatter.
- Using slings or allowing exposure to temperatures above 194°F (90°C) or below -40°F (-40°C).
- "Tip loading" a sling on a hook instead of centering it in the base or "bowl" of the hook.
- Using hooks, shackles or other hardware that have edges or surfaces that could damage sling.
- Running/driving over slings with a vehicle or other equipment.

Synthetic slings are affected by some chemicals ranging from little to total degradation. Time, temperature and concentration factors affect the degradation. For specific applications, consult the manufacturer.

3b. Safeguard slings with sufficient protection

Synthetic slings can be damaged, abraded or cut as tension and compression between the sling, the connection points and the cargo develops. Surfaces in contact with the sling do not have to be very abrasive or have "razor" sharp edges in order to create the conditions for sling failure. Therefore, round slings must ALWAYS be protected from being cut or damaged by corners, protrusions, or from contact with edges that are not smooth or well rounded with materials sufficient for the intended purpose.

Round slings should be protected from abrasive surfaces.

There are a variety of types of ways to protect slings from such damage. A qualified person might select and use appropriately engineered protectors/softeners—commercially available products (e.g., sleeves, wear pads, corner protectors, etc.) specifically designed to protect slings from damage. A qualified person might also design and construct their own methods of protection so long as the sling is adequately protected from and/or kept off of the damaging edge surface.

Regardless of the particular method chosen, the goal is to ensure that the sling, under tension, maintains its ability to securely lift the load while avoiding contact with damaging or abrasive surfaces under tension. A qualified person must carefully consider the most appropriate means to accomplish this goal. The protection used should not be makeshift (i.e. , selecting and using cardboard, work gloves or other such items based solely on convenience or availability).

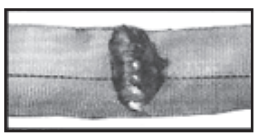
Regardless of the approach taken, a qualified person must ensure that the protection method chosen is appropriate for the types of damage to which the slings will be exposed. For instance, some protection provides abrasion resistance, but offers virtually no protection against cuts. Several "test" lifts, done in a non-consequence setting, may be necessary to determine the suitability of the protection device(s). After each "test" lift, the protection device(s) and sling(s) need to be inspected for damage and suitability. You should keep in mind that no protection is "cut proof" and you should always operate within the specified limits of the sling and its accessories (e.g., fixtures, hardware, protection, etc.).

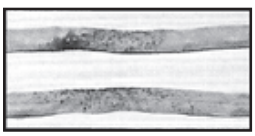
Round slings must always be protected from coming into direct contact with any edges unless the contacting edges meet both of the following criteria:

- The edges must be smooth and well-rounded. Edges that are chamfered or flattened at an angle do not meet this criteria.
- The size of the edge radii must be adequately large. Table 3 shows the minimum edge radii suitable for contact with unprotected polyester round slings.

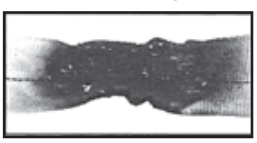
Table 2. Types of damage you should look and feel for in round slings


Holes/tears/cuts in cover; exposed/damaged yarns

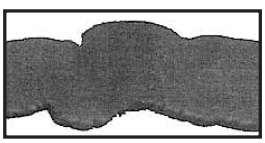

Melting or charring


Weld spatter


Knots


Acid/alkali burns


Snags/punctures


Bunched/wadded yarns

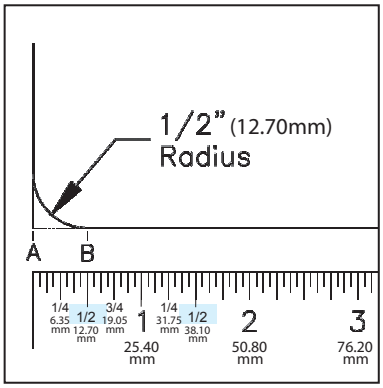

Embedded materials

One way to measure an edge radius is to measure the distance between the leading edge of the radius that is being measured (Point A) and the point where the radius initiates from the bottom edge of the surface (Point B) (see Figure 1).

In order to protect the round sling, it is also necessary to select and use proper connection hardware. Connection hardware should be selected so that either:

- it conforms to the size requirements listed in Table 4 (choker and vertical hitches) or Table 5 (basket hitch)
- the bearing stress value at the connection does not exceed 7,000 lbs./in^2 during sling loading (see WSTDA RS-1, Section 4.7 for the procedure for calculating bearing stress)

Figure 1



(*) The radii values apply to round slings that are fully tensioned to their rated capacity regardless of the hitch.

When round slings are tensioned to lower force values, the minimum radius values will reduce accordingly. (See WSTDA - RS-1 Appendix 1)

Fractional inches are rounded up to the nearest 1/16 " (1.58mm).

Table 3. Minimum edge radii suitable for contact with unprotected polyester round slings

Sling Size	Vertical Rated Capacity lbs.	kgs.	Minimum Edge Radii inch	mm	Minimum Edge Radii inch	mm	Sling Width at Load inch	mm
1	2,600	1,200	0.14	3.55	3/16	4.76	.97	24.63
2	5,300	2,400	0.21	5.33	1/4	6.35	1.29	32.76
3	8,400	3,800	0.26	6.60	5/16	7.93	1.66	42.16
4	10,600	4,800	0.30	7.62	5/16	7.93	1.78	45.21
5	13,200	6,000	0.33	8.38	3/8	9.52	2.00	50.80
6	16,800	7,600	0.40	10.16	7/16	11.11	2.13	54.10
7	21,200	9,600	0.41	10.41	7/16	11.11	2.62	66.54
8	25,000	11,400	0.44	11.17	7/16	11.11	2.85	72.39
9	31,000	14,100	0.50	12.70	1/2	12.70	3.15	80.01
10	40,000	18,200	0.56	14.22	9/16	14.28	3.57	90.67
11	53,000	24,100	0.67	17.01	11/16	17.46	4.00	101.60
12	66,000	30,000	0.72	18.28	3/4	19.05	4.60	116.84
13	90,000	40,900	0.87	22.09	7/8	22.22	5.22	132.58

Roundsling			Minimum Hardware Size							
Sling Size	Rated Cap. Vert. Hitch		Stock Diameter or Thickness				Effective Contact Width			
	lbs.	kgs.	inch	mm	inch	mm	inch	mm	inch	mm
1	2,600	1,200	.39	9.90	7/16	11.11	.97	24.63	1	25.40
2	5,300	2,400	.59	14.98	5/8	15.87	1.29	32.76	1 3/8	34.92
3	8,400	3,800	.72	18.28	3/4	19.05	1.66	42.16	1 3/4	44.45
4	10,600	4,800	.85	21.59	7/8	22.22	1.78	45.21	1 7/8	47.62
5	13,200	6,000	.95	24.13	1	25.40	2.00	50.80	2	50.80
6	16,800	7,600	1.12	28.44	1 1/8	28.57	2.13	54.10	2 1/8	53.97
7	21,200	9,600	1.15	29.21	1 3/16	30.16	2.62	66.54	2 5/8	66.67
8	25,000	11,400	1.25	31.75	1 1/4	31.75	2.85	72.39	2 7/8	73.02
9	31,000	14,100	1.41	35.81	1 1/2	38.10	3.15	80.01	3 1/4	82.55
10	40,000	18,200	1.60	40.64	1 5/8	41.27	3.57	90.67	3 5/8	92.07
11	53,000	24,100	1.90	48.26	2	50.80	4.00	101.60	4	101.60
12	66,000	30,000	2.05	52.07	2 1/8	53.97	4.60	116.84	4 5/8	117.47
13	90,000	40,900	2.46	62.48	2 1/2	63.50	5.22	132.58	5 1/4	133.35

Table 4.
Suitable connection hardware for polyester round slings when used in choker and vertical hitches

4. Always Use Slings Properly

When lifting loads, a trained, qualified and knowledgeable user must take into account the factors and issues addressed in this bulletin, as well as considering any other relevant factors not addressed herein (see Table 6). Among the factors related specifically to round slings, users must perform several activities, including (but not limited to) those discussed in the following subsections.

4a. Assess the load

Determine the weight of the load and make sure it does not exceed the sling's rated capacity or the capacity of any of the components of the rigging system. Users must also determine the load's center of gravity (CG) to make sure the rigging system used will be able to retain and control the load once lifted.

4b. Select an appropriate sling/configuration

Select a sling having suitable characteristics for the type, size and weight of the load, the type of hitch (see Table 7) and the environment. The sling must be securely attached to the load and rigged in a manner to provide for load control to prevent slipping, sliding and/or loss of the load. A trained, qualified and knowledgeable user must determine the most appropriate method of rigging to help ensure a safe lift and control of the load.

Another important consideration is the sling-to-load angle—the angle between a horizontal line and the sling leg or body. This angle is very important and can have a dramatic effect on the rated capacity of the sling. When the sling-to-load angle decreases, the load on each leg increases. This principle applies in a number of conditions, including when one sling is used to lift at an angle and when a basket hitch or multi-legged bridle sling is used. Table 8 provides information about increased tension as a function of sling-to-load angle (assuming equally loaded sling legs. Sling angles ofless than 30 degrees are not recommended.

Similarly, when 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 9.

4c. Do not misuse the sling

Avoid accelerating or decelerating the load too quickly (i.e. "shock loading"). Do not use slings to pull on stuck or snagged objects and do not use slings for towing purposes. A round sling should only be used for lifting loads.

5. Make Sure All Personnel are Clear of Loads and Alert to Risks

Even if you account for all of the factors/issues discussed in this Safety Bulletin, things can still go wrong. Therefore, all personnel must stand clear of the lifted loads and never be under, on or near suspended loads.

When using slings, no part of the body should be placed between the sling and load, or between the sling and lifting hook. In addition, personnel must be alert to the potential for the sling to become snagged during a lift. Never use a round sling to pull on objects in a snagged or constrained condition.

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6. Properly Store and Maintain Slings

In order to prevent damage to slings when not in use, you should store slings in a cool, dry and dark location. Slings should be stored in an area free from environmental or mechanical sources of damage, such as: weld spatter, splinters from grinding or machining, heat sources, chemical exposure, etc. Also, keep slings clean and free of dirt, grime and foreign materials.

If round slings are cleaned, use only mild soap and water. Rinse sling thoroughly and allow to dry completely before placing the sling back into storage or use. Do not machine wash slings. Machine washing results in significant loss of sling strength.

Table 5. Suitable connection hardware sizes for polyester roundslings when used in a basket hitch

Roundsling			Hardware Size - Single Hook or Connection Point							
Sling Size	Rated Cap. Basket Hitch		Minimum Stock Diameter or Thickness				Minimum Effective Contact Width			
	lbs.	kgs.	inch	mm	inch	mm	inch	mm	inch	mm
1	5,200	2,400	.54	13.71	9/16	14.28	1.37	34.79	1 3/8	34.92
2	10,600	4,800	.83	21.08	7/8	22.22	1.82	46.22	1 7/8	47.62
3	16,800	7,600	1.02	25.90	1 1/16	26.98	2.34	59.43	2 3/8	60.32
4	21,200	9,600	1.20	30.48	1 1/4	31.75	2.52	64.00	2 1/2	63.50
5	26,400	12,000	1.35	34.29	1 3/8	34.92	2.80	71.12	2 7/8	73.02
6	33,600	15,200	1.59	40.38	1 5/8	41.27	3.00	76.20	3	76.20
7	42,400	19,200	1.63	41.40	1 5/8	41.27	3.71	94.23	3 3/4	95.25
8	50,000	22,800	1.77	44.95	1 7/8	47.62	4.00	101.60	4	101.60
9	62,000	28,200	2.00	50.80	2	50.80	4.45	113.03	4 1/2	114.30
10	80,000	36,400	2.26	57.40	2 3/8	60.32	5.06	128.52	5	127.00
11	106,000	48,200	2.69	68.32	2 3/4	69.85	5.62	142.74	5 5/8	142.87
12	132,000	60,000	2.90	73.66	3	76.20	6.50	165.10	6 1/2	165.10
13	180,000	81,800	3.50	88.90	3 1/2	88.90	7.38	187.45	7 3/8	187.32

Table 7. Common types of sling hitches

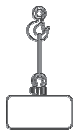
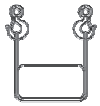
Hitch	Comments
Vertical Hitch 	One end is placed on the hook, while the other end is attached directly to the load. A tagline should be used to prevent load rotation.
Choker Hitch 	Sling passes through one end around the load and the other end is placed on the hook. Rated capacity is normally 80% of that for a vertical hitch. Load control is a potential problem with only one sling rigged in a choker hitch. Also, the choke point should always be on the sling body—not on the fittings, base of the fitting or tag.
Basket Hitch 	The sling cradles the load while both ends are attached overhead. The rated capacity for a basket hitch is twice that for a vertical hitch. As with the choker hitch, more than one sling rigged in a basket hitch (or some other means) may be necessary to help ensure load control.

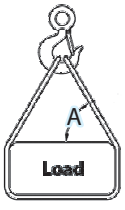
Table 6. Issues and Factors to consider when handling, lifting and manipulating materials and loads

Safe handling, lifting and manipulation of materials and loads requires consideration of a number of factors and issues, including (but not limited to):

Categories	A Number of Issues/Factors to Consider		
Environment	Wind Weather Visibility	Environmental temperature Object temperature Chemical conditions and exposure	Ground stability Underground installations
Load	Weight Dimensions Center of Gravity (CG)	Attachment point integrity Susceptibility to crushing/compression Loose parts that could fall from load	Combination loads Damaging surfaces/edges Structural stability (bend/flex)
Equipment/Lift	Single/multiple cranes/hoists Maximum/planned operating radius Allowable load Ratio of lift to allowable load	Clearance to surrounding facilities Power lines and other environmental hazards Clearance between boom and lift Emergency/contingency set down area	Equipment inspection Ensure a clear load path
Rigging	Sling selection Load control Lift point (over the CG) Positive sling-to-load engagement	Coefficient of friction: Sling-to-load Appropriate hitch (for CG and load control) Load is free to move and is not snagged Coordination of multiple slings	Suitable wear protection Sling capacity is adequate for angle and tension
Personnel	Area clear of unnecessary personnel Personnel are trained and qualified	Signals: Visual, audible, electronic, etc. Personnel away from load and other dangers	Pre-lift plan and meeting Tag lines/spotter requirements

Table 8. Increased sling tension as a function of sling-to-load angle

Angle "A" in degrees from horizontal	Tension Multiplier
90	1.000
85	1.004
80	1.015
75	1.035
70	1.064
65	1.104
60	1.155
55	1.221
50	1.305
45	1.414
40	1.555
35	1.742
30	2.000

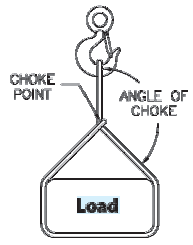


Multiply the load weight (per leg) by the tension factor to determine the increased tension on the sling leg(s)

Table 9. Reductions in rated capacity as a function of angle of choke

Angle of Choke (degrees)		Angle of Choke Reduction Factor
= or >	<	
120	180	1.000
105	120	0.82
90	105	0.71
60	90	0.58
0	60	0.50

Actual Sling Capacity = Rated Capacity x Reduction Factor



Where to Find Additional Information

This bulletin does not provide you with all the information you need to know in order to be considered trained and knowledgeable about rigging and lifting loads, but it does provide important information about the use of round slings within a rigging system. If you need more information about round slings and rigging practices or your responsibilities according to regulations and standards, talk to your employer. You and your employer can consult a number of sources of information to help ensure that you are properly trained and knowledgeable when using round slings, including (but not limited to):

- WSTDA-RS-1—Recommended Standard Specification for Synthetic Polyester Roundslings
- WSTDA–RS-2—Recommended Operating and Inspection Manual for Synthetic Roundslings
- ASME B30.9—Synthetic Roundslings: Selection, Use, and Maintenance
- OSHA Guidance on Safe Sling Use [http://www.osha.gov/dsg/guidance/slings/synth-round.html]
- OSHA 29 CFR 1910.184-Slings
- Rigging handbooks
- Manufacturer's catalog, manual, website, bulletins, etc.
- Formal training provided by manufacturers or other entities

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WARRANTY

Any warranty that is expressed or implied in regards to quality, performance of the sling, or suitability for an application is always based upon the suggested safe usage and sling ratings found within this catalog. This is only applicable to brand new product where the accessory items or applied machinery for the slings are properly engineered and maintained. These slings must be correctly stored, serviced, and inspected on a regular basis during periods of use. All of these sling products must be used within accordance of the manufacturer's recommendations. It is important that these products not be altered, abused, misused, neglected of proper maintenance, or have any unauthorized repairs done to them. Elephant Lifting Products, L.L.C. will not be liable for loss, damage, expense, injury to property, injury to people, death, any consequential damages and disclaims any other expressed / implied product warranty, including warranties of merchant ability and fitness for a particular application.

WARNING: It is the user's responsibility to determine what equipment is suitable for the application, and to comply with regulation. Always read and understand the operations manual, review warnings, and take precaution. It is strongly recommended that you understand suggested maintenance of the product, and have a maintenance plan in place.

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