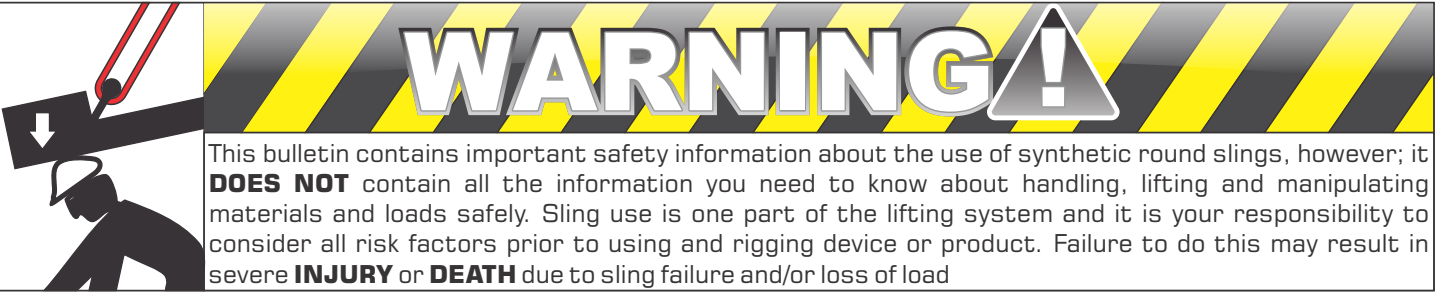



  
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# ROUND SLINGS



Sling Protection
Web Slings
<b>Round Slings</b>
Synthetic Chain Slings
Wire Rope Slings
Chain Slings
Shackles & Turnbuckles
Hooks & Links
Lifting Points
Hoists & Blocks
Lifting Devices
Pipe & Hose Restraints
Tie Down Assemblies
Tie Down Accessories
Towing & Recovery
Rope & Cordage



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 one part of the lifting system and it is your responsibility to consider all risk factors prior to using and 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 slings 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 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.

Albert Occupational Health & Safety Code States; "competent" in relation to a person, means adequately qualified, suitably trained and with sufficient experience to safely perform work without supervision or with only a minimal degree of supervision;

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 NOT** use roundslings until you are absolutely sure of what you are doing. Remember, when it comes to using roundslings, 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 roundsling 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 roundslings 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 roundslings 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 web sling must be **inspected regularly** and it shall be **removed from service** if ANY of the following are detected:

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

## 2a. How often to inspect slings

A three-stage procedure is recommended to help ensure that Round 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 round 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 RS-1 or ASME B30.9 require that a written record of the most recent periodic inspection be maintained. See WSTDA RS-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 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 if feasible.
- Do not shorten/adjust unless authorized by manufacturer
- Twisting, kinking, or knotting the sling.
- Exposing slings to damaging acids or alkalis.
- Exposing slings to sources of heat damage or weld spatter.
- sing 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.). Roundslings 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 roundslings.

**Table 2.** Types Of Damage Your Should Look And Feel For In Round Slings

					
Split Cover, Exposed Yarns	Bunched/Wadded Yarns	Weld Spatter	Melting or Charring	Cuts / Tears	Knots
					
Illegible Tag/Identification	Holes / Punctures	Heat Damage	Damaged Fittings	Acid/Alkali Chemical Damage	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 roundsling, 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 value at the connection does not exceed 7,000 lbs./in<sup>2</sup> during sling loading (see WSTDA RS-1, Section 4.7 for the procedure for calculating bearing stress)

**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 roundslings, 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 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 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 roundsling to pull on objects in a snagged or constrained condition.

**6. Properly Store and Maintain Slings**

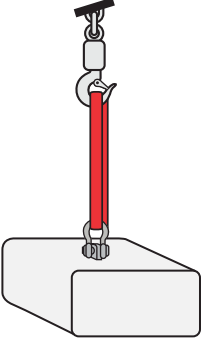
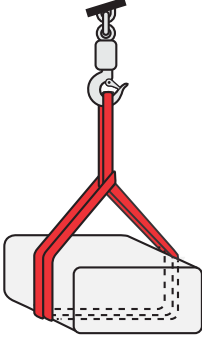
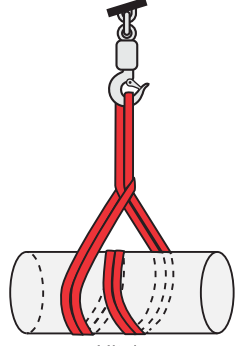
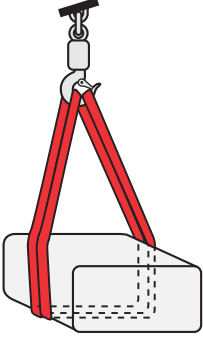
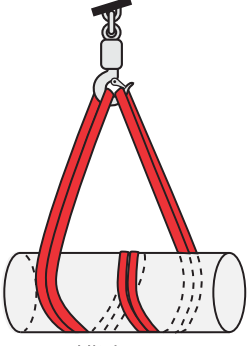
In order to prevent damage to slings when not in use, you should store slings in a cool, dry and dark location. Slings should be stored in an area free from environmental or mechanical sources of damage, such as: weld spatter, splinters from grinding or machining, heat sources, chemical exposure, etc. Also, keep slings clean and free of dirt, grime and foreign materials. If roundslings 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 6.** Issues and Factors to consider when handling, lifting and manipulating materials and loads

Categories			
Environment	Wind Weather Visibility	Environmental Temperature Object temperature Chemical Conditions & 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	Ratio of lift to allowable load Clearance to surrounding facilities Power lines and other hazards Clearance between boom & lift	Emergency/contingency set down area Equipment inspection Ensure a clear path
Rigging	Sling selection Load control Lift point (over CG) Suitable Wear protection	Positive sling-to-load engagement Coefficient of friction: sling to load Appropriate hitch (for CG & load control) Coordination of multiple slings	Load is free to move and is not snagged Sling capacity is adequate for angle and tension
Personnel	Area Clear of unnecessary personnel Pre-Lift plan & meeting	Personnel are trained and qualified Signals: Visual, Audio, electronic, etc. Tag lines/Spotter requirements	Personnel away from load and other dangers

# Lift it up, Tie it down, Pull it around

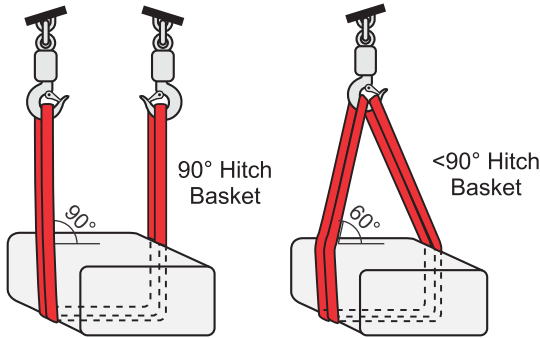
**Table 7.** Common types of sling hitches

				
Vertical	Hitch Choker	Hitch Double Wrapped Choker	Hitch Basket	Hitch Double Wrapped Basket
A vertical hitch, or straight hitch, is the most basic hitch used to directly connect a load to a lifting device.	Uses two slings in a choker hitch to provide more contact area to secure a load.	Similar to standard choker hitch, except that the sling is wrapped around the load twice. This hitch compresses the load and can help prevent it from slipping out of the sling.	Basket hitches distribute a load equally between the two legs of a sling. When using a basket hitch, the load is cradled by running the sling underneath the load.	Similar to a standard basket hitch, except the sling is wrapped around the load twice. This provides excellent load control for loose materials and good grip on smooth surfaces.

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

Effect of Angle - Sling tensions are affected by angle of lift (sling angle), measured from the horizontal, when used with multi-legged web slings or basket hitches. The effect of this angle may be determined by using either of these two methods:

- Sling Tension Method (Recommended Method) **Table 8a**
- Reduced Sling Capacity Method (Alternative Method) **Table 8b**



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

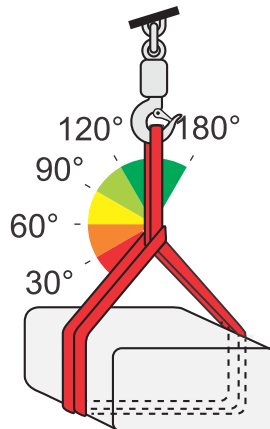
Sling Tension	
Angle/Deg	Loss Factor
Horizontal	1.000
90	1.015
80	1.064
70	1.155
60	1.305
50	1.414
45	1.742
35	2.000

**Table 8b.** Lower sling rating as a function of sling-to-load angle

Capacity Reduction	
Angle/Deg	Loss Factor
Horizontal	1.000
90	0.985
80	0.940
70	0.866
60	0.766
50	0.707
45	0.574
35	0.500

**Table 9.** Reduction in capacity as a function of angle of choke

**Choker Hitches:** For round slings used in a choker hitch, rated capacities are based on a choke angle of 120° or greater. For angles less than 120°, reduce capacity according to table 9



Choker Hitches		Table 9
Angle of Choke (degrees)	Sling rated capacity factor as percentage of single leg choker hitch capacity	
120-180	100%	
105-120	82%	
90-105	71%	
60-90	58%	
0-60	50%	

Sling Protection  
Web Slings  
Round Slings  
Synthetic Chain Slings  
Wire Rope Slings  
Chain Slings  
Shackles & Turnbuckles  
Hooks & Links  
Lifting Points  
Hoists & Blocks  
Lifting Devices  
Pipe & Hose Restraints  
Tie Down Assemblies  
Tie Down Accessories  
Towing & Recovery  
Rope & Carriage

**PROPER USE OF POLYESTER ROUND SLINGS AROUND EDGES**

**WARNING: ALWAYS PROTECT ROUNDSLINGS FROM DIRECT CONTACT WITH EDGES, EXCEPT WHERE THE CONTACTING EDGES MEET THE FOLLOWING MINIMUM, EDGE RADIUS CRITERIA**

**General Statement**

The strength of round slings can be significantly affected when they are allowed to come into direct contact with edges of the load, or connection hardware, if the size and shape of these edges are not suitable. Shearing or cutting of the synthetic sling material is the single most common cause of accidents involving sling failure. This can result when round slings are allowed to come into direct contact with edges that are not adequately rounded to a suitable radius. Round slings shall always be protected from being in direct contact with all edges, unless the contacting edges meet the following criteria.

4.6.2 Determining when round slings need to be protected from contact with edges. Sling protection shall be utilized whenever the edges of the load or connection hardware do not meet the requirements specified in the following:

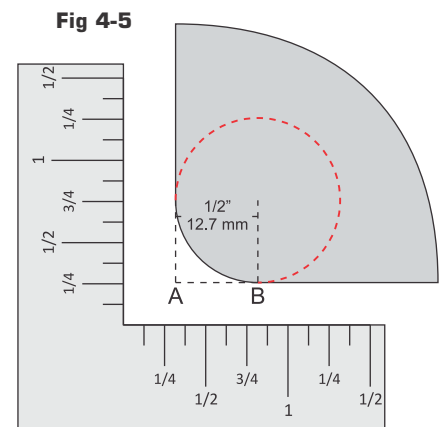
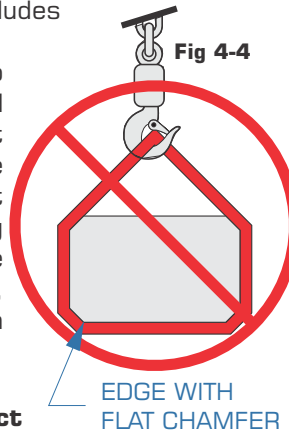
- **Edge Shape** - Round slings shall be properly protected from edges that are not smoothly rounded. This includes chamfered edges.

Round slings shall only be allowed to come into direct contact with edges if they are smooth and are well rounded to a suitable edge radius. Direct contact of round slings with edges that are machined at an angle, such as a 45° angle, can cut into the sling and significantly reduce sling strength. Round slings shall not be allowed to come into direct contact with edges that are chamfered, or flattened at an angle, unless the edges conform to edge radius requirements. (See Figure 4-4)



Required Radius of Rounded Edges – Polyester round slings shall be properly protected from rounded edges if the size of the edge radius is not adequately large. The required size of the edge radius, depends on the sling capacity, and increases with the size of the sling. Please see table 4-5 for a listing, showing the minimum edge radius appropriate for each sling size. These values hold true regardless of the type of hitch being used.

- Measuring the radius of an edge – One method of measuring an edge radius is noted in the following: Place the leading edge of the ruler or tape measure along the leading edge of the radius that is being measured (Point A). Measure the distance from this leading edge, Point A, to the point where the radius initiates from the bottom edge of the surface, Point B (See Figure 4-5). In this figure, a radius of 1/2" is shown.

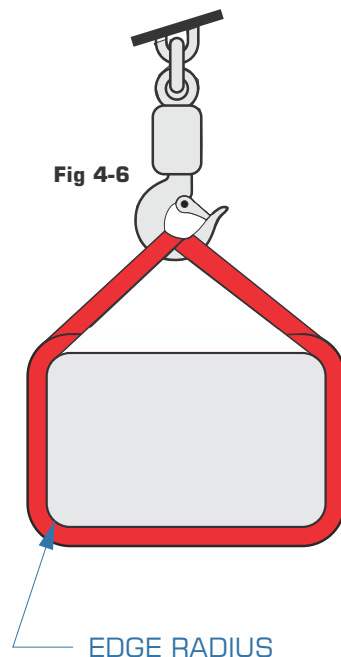


**Table 4-5. Minimum Edge Radii suitable for contact with unprotected Polyester Roundslings\***

WSTDA Round Sling Size	Rated Capacity Vertical	Min Edge Radii	Minimum Edge Radii**	Sling Width at Load
	lbs	[in]	[in]	[in]
1	2,600	0.14	3/16	.97
2	5,300	0.21	1/4	1.29
3	8,400	0.26	5/16	1.66
4	10,600	0.30	5/16	1.78
5	13,200	0.33	3/8	2.00
6	16,800	0.40	7/16	2.13
7	21,200	0.41	7/16	2.62
8	25,000	0.44	7/16	2.85
9	31,000	0.50	1/2	3.15
10	40,000	0.56	9/16	3.57
11	53,000	0.67	11/16	4.00
12	66,000	0.72	3/4	4.60
13	90,000	0.87	7/8	5.22

\*The radii values apply to the round slings that are fully tensioned to their rated capacity. When round slings are tensioned to lower force values, the minimum radius values will reduce accordingly. (See Appendix 1 for further information)

\*\*Fractional equivalent, rounded up to the nearest 1/16".



## SELECTION OF PROPER CONNECTION HARDWARE

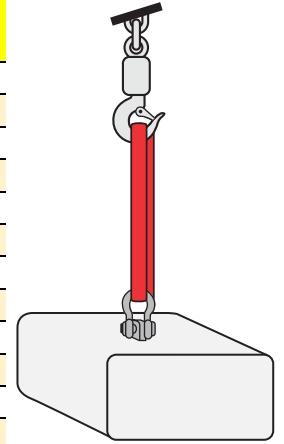
### **WARNING: ALWAYS CONNECT ROUND SLINGS TO PROPERLY SIZED AND RATED FITTINGS AND / OR MATERIALS**

For polyester round slings, connection hardware should be selected such that it either:

- Conforms to the size requirements listed in Tables 4-6 and 4-7, OR
- Sized such that the bearing stress value at the connection does not exceed 7,000 Lbs./in<sup>2</sup> during sling loading. (See calculations below).

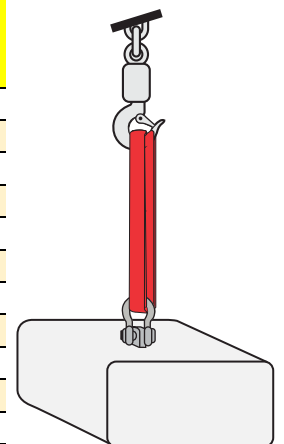
**Table 4-6 Suitable Connection Hardware Sizes for Polyester Round Slings, When Used in a Vertical or Choker Hitch**

WSTDA Round Sling Size	Rated Capacity Vertical Hitch (Lbs.)	Minimum Stock Diameter or Thickness (Inches)	Minimum Stock Diameter or Thickness (Inches)*2	Minimum Effective Contact Width*3 (Inches)	Minimum Effective Contact Width*3 (Inches) *2
1	2,600	0.39	7/16	.97	1
2	5,300	0.59	5/8	1.29	1-3/8
3	8,400	0.72	3/4	1.66	1-3/4
4	10,600	0.85	7/8	1.78	1-7/8
5	13,200	0.95	1	2.00	2
6	16,800	1.12	1-1/8	2.13	2-1/8
7	21,200	1.15	1-3/16	2.62	2-5/8
8	25,000	1.25	1-1/4	2.85	2-7/8
9	31,000	1.41	1-1/2	3.15	3-1/4
10	40,000	1.60	1-5/8	3.57	3-5/8
11	53,000	1.90	2	4.00	4
12	66,000	2.05	2-1/8	4.60	4-5/8
13	90,000	2.46	2-1/2	5.22	5-1/4



**Table 4-7 Suitable Connection Hardware Sizes for Polyester Round Slings, When Used in a Basket Hitch**

WSTDA Round Sling Size	Rated Capacity Basket Hitch (Lbs.)	Minimum Stock Diameter or Thickness (Inches)	Minimum Stock Diameter or Thickness (Inches)*2	Minimum Effective Contact Width*3 (Inches)	Minimum Effective Contact Width*3 (Inches) *2
1	1	5,200	0.54	9/16	1.37
2	2	10,600	0.83	7/8	1.82
3	3	16,800	1.02	1-1/16	2.34
4	4	21,200	1.20	1-1/4	2.52
5	5	26,400	1.35	1-3/8	2.80
6	6	33,600	1.59	1-5/8	3.00
7	7	42,400	1.63	1-5/8	3.71
8	8	50,000	1.77	1-7/8	4.00
9	9	62,000	2.00	2	4.45
10	10	80,000	2.26	2-3/8	5.06
11	11	106,000	2.69	2-3/4	5.62
12	12	132,000	2.90	3	6.50
13	13	180,000	3.50	3-1/2	7.38



\*The values in Table 4.7 apply to the use of round slings in a basket hitch when the two ends of the sling are attached to a single connection point. Use table 4.6 when round slings are used in a basket hitch when the two ends of the sling are attached to separate connection points.

\*2 This is the value when rounded up to the closest fractional equivalent.

3 These values also equal the approximate natural flattening width of the round sling.

**Effective Contact Width between the Sling and Connection Hardware**

a. Connection to Flat-Bottom Surfaced Hardware – Such hardware connections include pins, bolts and trunnions. The value of the effective contact width is equal to the opening width or spread of the sling at the connection area (See Figure 4-7). Please note, however, that the effective contact width will never exceed the natural flattening width of the sling as listed in Tables 4-6 and 4-7. b. Connection to Round-Bottom (or Curved) Surfaced Hardware – Such hardware connections include links, hooks, or the bow ends of shackles. To determine the value of the effective contact width, multiply the inside opening width of the hardware by a factor of 0.75 (See Figure 4-8). For connections to the base of hooks, multiply the value of the radius at the hook base by a factor of 1.5 to determine the effective contact width. Please note, however, that the effective contact width will never exceed the natural flattening width of the sling as listed in Tables 4-6 and 4-7.

**STRAIGHT BEARING SURFACE**

EFFECTIVE INSIDE WIDTH  
EQUALS 100% OF THE  
ACTUAL INSIDE WIDTH

**CURVED BEARING SURFACE**

EFFECTIVE INSIDE WIDTH  
EQUALS 75% OF THE  
ACTUAL INSIDE WIDTH

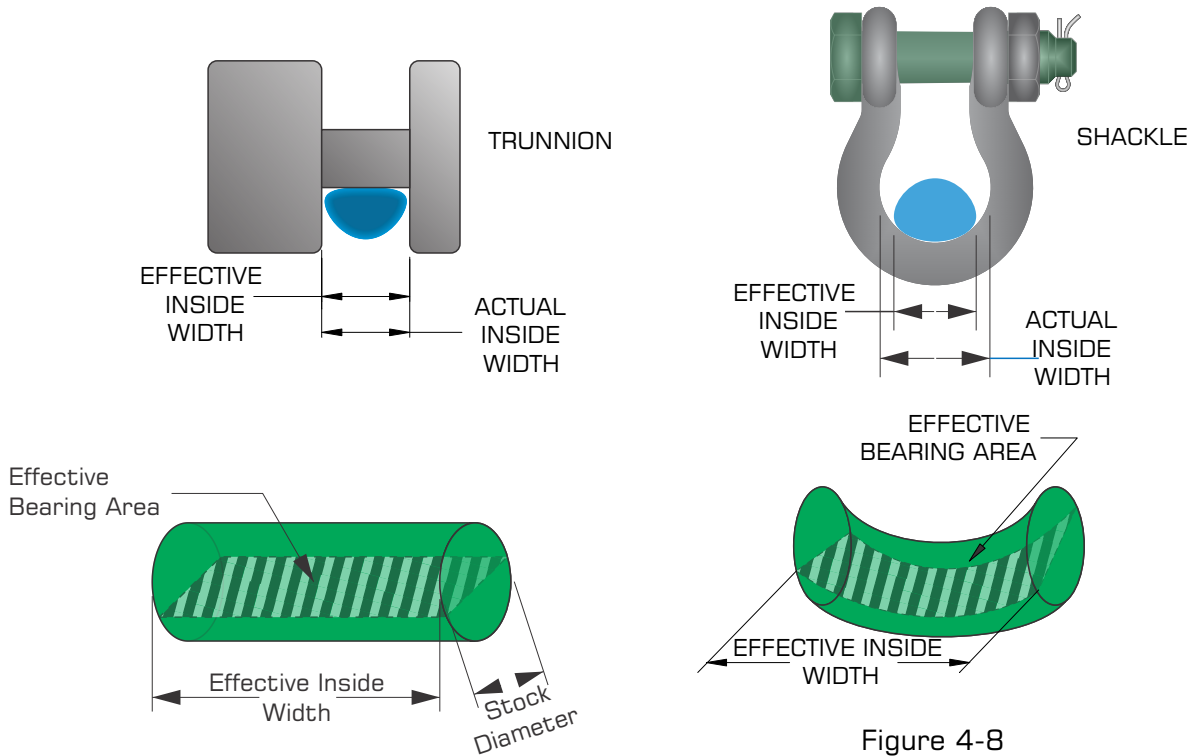


Figure 4-8

**Note:**

Round sling strength is affected by the size of the connection hardware. For special applications wherein a retained design factor of 5 is required to be maintained, contact the sling manufacturer, as a capacity reduction of 20% may be appropriate in order to satisfy this criteria.

Load Bearing Area at the Hardware Connection – The load bearing area at the hardware connection is determined by multiplying the thickness or stock diameter of the hardware by the effective contact width at the connection.

$$\text{Load Bearing Area} = (\text{Hardware Thickness or Stock Diameter}) \times (\text{Effective Contact Width})$$

Calculating Bearing Stress Values at the Hardware Connection – The bearing stress value is determined by dividing the amount of loading on the sling by the load bearing area at the hardware connection.

$$\text{Bearing Stress} = \frac{\text{Sling Load Value (in Pounds)}}{\text{Load Bearing Area}}$$



# Lift it up, Tie it down, Pull it around

**Example:** A size 3 polyester round sling, rated at 8,400 lbs. in a vertical hitch, is connected in a vertical hitch using the rounded bow end of a shackle that is smaller in size to that listed in Table 4-6. The shackle has a stock diameter of only .62 inch, and an inside opening width of 2 inches. However, a force of only 6,000 lbs. is applied, noticeably less than the rated capacity of the sling (See Figure 4-9). Is this use of the selected shackle acceptable?

6,000 Lbs. of Force <-

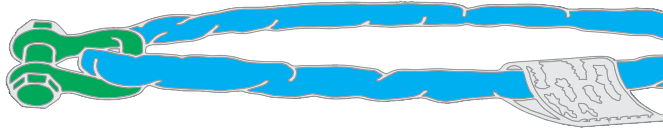


Figure 4-9

Answer: Since the shackle size is smaller than recommended for a size 3 round sling per Table 4-6, we need to establish that the bearing stress value does not exceed 7,000 Lbs./in<sup>2</sup> during use. Since the bearing surface of the shackle is rounded;

$$\begin{aligned} \text{Effective Contact Width} &= (.75) \times (\text{The shackle inside width}) \\ &= (.75) \times (2 \text{ inches}) \\ &= 1.50 \text{ inches} \end{aligned}$$

And;

$$\begin{aligned} \text{Load Bearing Area} &= (\text{The shackle stock diameter}) \times (\text{The Effective Contact Width}) \\ &= (.62 \text{ inches}) \times (1.50 \text{ inches}) = .93 \text{ in}^2 \end{aligned}$$

$$\begin{aligned} \text{Bearing Stress Value} &= (\text{The Applied Force}) / (\text{Load Bearing Area}) \\ &= (6,000 \text{ Lbs.}) / (.93 \text{ in.}^2) \\ &= 6,451 \text{ Lbs./in.}^2 \end{aligned}$$

Therefore, since the bearing stress value is less than 7,000 Lbs./in<sup>2</sup> during use, **the selected shackle size is suitable for use.**

Therefore, since the bearing stress value is less than 7,000 Lbs./in<sup>2</sup> during use, the selected shackle size is suitable for use.

## OTHER MECHANICAL CONSIDERATIONS

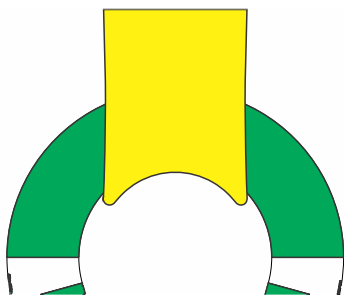
- round slings in contact with edges, corners, or protrusions **MUST ALWAYS** be protected with materials of sufficient strength, thickness, and construction to prevent sling damage.
- round slings should be protected from abrasive surfaces.
- Determine the weight of the load. Round slings shall not be loaded in excess of the rated capacity. Consideration shall be given to the sling angle, which affects rated capacity. (See Effect of Sling Angle, Section 4.5. 1).
- Select round slings having suitable characteristics for the type of load, hitch and environment.
- Round slings with fittings that are used in a choker hitch shall be of sufficient length to ensure that the choking action is on the round sling, and never on the fitting, or sling tag.
- Round slings used in a basket hitch shall have the load balanced to prevent slippage.
- The openings in fittings shall be the proper shape and size to ensure that the fittings will seat properly on the round sling, crane hook, or other attachments.
- Round slings should not be dragged on the floor or over an abrasive surface.
- Round slings shall not be twisted, shortened, lengthened, tied into knots, or joined by knotting.
- Round slings should not be pulled from under loads when the load is resting on the round sling.
- Do not drop round slings equipped with metal fittings.
- Round slings that appear to be damaged shall not be used unless inspected and accepted as usable under Section 4.4.
- Round slings shall be hitched in a manner providing control of the load.
- Personnel shall not stand under, and should stand clear of, the suspended load.
- All portions of the human body shall be kept from being placed between the round slings and the load, and from between the round sling and the hook of the crane or hoist.
- Personnel shall not ride round slings, or loads suspended by the round slings, and round slings shall not be used as bridles on suspended personnel platforms.
- Shock loading shall be avoided.
- Twisting the legs (branches) shall be avoided.
- Load applied to a hook shall be centred in the bowl of the hook to prevent point loading.
- During use, personnel shall be alert for possible snagging of the round sling.
- The round sling legs (branches) shall contain or support the load from the sides above the centre of gravity when using a basket hitch. 4.8.22 Tags and labels should be kept away from the load, hook and point of choke.
- Round slings should not be constricted or bunched between the ears of a clevis or shackle, or in a hook. When a round sling is used with a shackle, it is recommended that it be used (rigged) in the bow of the shackle. When this is not possible, protect the sling from damage.
- Place blocks under load prior to setting down the load, to allow removal of the round sling, if applicable.
- For multiple-leg slings used with non-symmetrical loads, an analysis by a qualified person should be performed to prevent overloading of any leg.

Recommended Shackles Sizes for Vertical, Choker & Basket Hitches

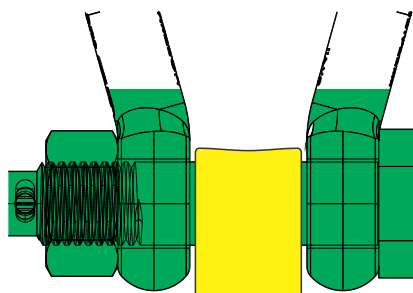


Code	Color	Vertical 90° lbs	Recc Shackle Size Vertical & Choker		Recc Shackle Size Basket	
			Bow Contact	Pin Contact	Bow Contact	Pin Contact
			Item Code	Item Code	Item Code	Item Code
SL-30	PURPLE	3,000	1/2	3/8	3/4	5/8
SL-40	BLACK	4,000	5/8	1/2	7/8	3/4
SL-60	GREEN	6,000	3/4	5/8	1	7/8
SL-90	YELLOW	9,000	7/8	3/4	1 1/4	1
SL-120	TAN	12,000	1	7/8	1 3/8	1 1/4
SL-140	RED	14,000	1	7/8	1 1/2	1 3/8
SL-170	ORANGE	17,000	1 1/8	1	1 3/4	1 1/2
SL-230	BLUE	23,000	1 3/8	1 1/4	2	1 3/4
SL-260	ORANGE	26,000	1 3/8	1 1/4	2	1 3/4
SL-320	GREY	32,000	1 3/4	1 1/2	2 1/4	2
SL-400	ORANGE	40,000	2	1 3/4	2 1/2	2 1/4
SL-540	BROWN	54,000	2	1 3/4	3	2 1/2
SL-680	OLIVE	68,000	2 1/4	2	N/A	3
SL-900	BLACK	90,000	2 1/2	2 1/4	N/A	N/A

**BOW CONTACT**



**PIN CONTACT**



**OTHER WEB SLING & TIE DOWN ASSOCIATION PUBLICATIONS**

**Recommended Standard Specifications for:**

- Synthetic Web Slings (WSTDA-WS-1)
- Synthetic Polyester Roundslings (WSTDA-RS-1)
- High Performance Yarn (HPY) Roundslings (RS-1HP)
- Synthetic Webbing for Slings (WSTDA-WB-1)
- Sewing Threads for Slings & Tie Downs (WSTDA-TH-1)
- Synthetic Web Tie Downs (WSTDA-T-1)
- Winches Used With Web Tie Downs (WSTDA-T-3)
- Synthetic Webbing Used for Tie Downs (WSTDA-T-4)
- Load Binders Used with Chain Tie Downs (WSTDA-T-6)

**Operating, Care & Inspection Manuals for:**

- Synthetic Polyester Roundslings (WSTDA-RS-2)
- Synthetic Web Tie Downs (WSTDA-T-2)

Download free, sing-use copies of the above Standards & Manuals at [www.wstda.com](http://www.wstda.com)

Available for Purchase from Web Sling & Tie Down Association:

**Warning Products: Available in English, Spanish and French**

- Fabric Warning Labels for Web Slings, Roundslings and Tie Downs
- Paper Safety Bulletins for Web Slings, Roundslings and Tie Downs

**Illustrated Wall Chart**

- Inspection of Web Slings & Roundslings (WSTDA-WSWC-1)

**UV Degradation Reports**

- UV Degradation Testing Program for Web Slings: Summary Report (2003) (WSTDA-UV-Sling-2003)
- UV Degradation Testing Program for Web Slings: Graphs (Mini Manual) (WSTDA-UV-MM-2005)
- UV Degradation Testing Program for Web Slings: Report (1981, revised 2005) (WSTDA-UVDR-1981)

For ordering information and prices, contact the association office or visit our website:

**Web Sling & Tie Down Association, Inc.**

9 Newport Drive, Suite 200, Forest Hill, Maryland 21050  
 Phone (443) 640-1070 Fax (443) 640-1031  
 Email: [wstda@stringfellowgroup.net](mailto:wstda@stringfellowgroup.net)  
 Web Site: [www.wstda.com](http://www.wstda.com)

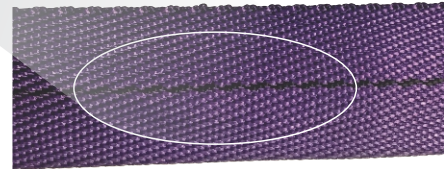
Sling Protection  
 Web Slings  
 Round Slings  
 Synthetic Chain Slings  
 Wire Rope Slings  
 Chain Slings  
 Shackles & Turnbuckles  
 Hooks & Links  
 Lifting Points  
 Hoists & Blocks  
 Lifting Devices  
 Pipe & Hose Restraints  
 Tie Down Assemblies  
 Tie Down Accessories  
 Towing & Recovery  
 Rope & Cordage

## POLYESTER ROUND SLINGS

A Round Sling is an endless loop of yarns, covered by a woven tubular jacket. Super Slings round slings are manufactured by using high tenacity polyester yarn's and extra durable covers. Color coded, conforming to international and WSTDA standard which validate sling capacity. Our specialized **"HEAVY DUTY TWILL JACKET"** performs better than plain double jackets. It provides **30% better abrasion resistance** compared to conventional 2 plied polyester jacket in the field. Heavy Clear Plastic Covered Rating Tag Extends the life of the sling and also includes WSTDA guidelines.

### Features

- The most flexible sling available. Round slings conform to the load extremely well and provide a superior choker hold.
- Hook and load contact points can be continually rotated to extend the service life of the sling.
- Longer sling life means overall cost reduction throughout the life of the sling.
- The load bearing fibres never come in to contact with the load, there is no wear to the inner fibres, the protective cover remains intact.
- Protection to the load from sling damage.
- Seamless covers mean no edges to wear out.
- Wide variety of slings lengths and load capacities.
- Adapts to all types, sizes and load configurations.
- Lightweight, easy to rig, store and clean.
- No loss of strength in water.
- Only 3% elongation at working load limit.
- Reduces the need for wear pads.
- No metal parts to rust.
- Good for temperatures up to 90° C) or down to -40° C.



Code	Color	Vertical 90°	Choke 120°	Basket				Appr Dia	Appr Weight	Min Pin Dia	Min Pin Dia	Min Length
				90°	60°	45°	30°					
		lbs	lbs	lbs	lbs	lbs	lbs	(in)	lbs/ft	Vertical	Basket	(in)
SL-30	PURPLE	3,000	2,400	6,000	5,200	4,200	3,000	0.75	0.25	0.50	0.63	18
SL-40	BLACK	4,000	3,200	8,000	6,900	5,700	4,000	0.80	0.35	0.50	0.63	18
SL-60	GREEN	6,000	4,800	12,000	10,400	8,500	6,000	0.90	0.40	0.63	0.88	18
SL-90	YELLOW	9,000	7,200	18,000	15,600	12,700	9,000	1.00	0.50	0.75	1.00	24
SL-120	TAN	12,000	9,600	24,000	20,800	17,000	12,000	1.25	0.75	0.88	1.25	24
SL-140	RED	14,000	11,200	28,000	24,200	19,800	14,000	1.30	0.85	1.00	1.38	30
SL-170	ORANGE	17,000	13,600	34,000	29,400	24,000	17,000	1.60	0.95	1.13	1.63	36
SL-230	BLUE	23,000	18,400	46,000	39,800	32,500	23,000	1.65	1.25	1.25	1.75	48
SL-260	ORANGE	26,000	20,800	52,000	45,000	36,800	26,000	1.75	1.45	1.38	1.88	48
SL-320	GREY	32,000	25,600	64,000	55,400	45,200	32,000	2.15	1.75	1.50	2.00	48
SL-400	ORANGE	40,000	32,000	80,000	69,300	56,600	40,000	2.45	2.25	1.63	2.38	48
SL-540	BROWN	54,000	43,200	108,000	93,500	76,400	54,000	3.00	2.75	1.88	2.75	48
SL-680	OLIVE	68,000	54,400	136,000	117,800	96,200	68,000	3.25	3.60	2.13	3.00	60
SL-900	BLACK	90,000	72,000	180,000	155,900	127,300	90,000	3.75	4.10	2.50	3.50	60



**NEVER EXCEED THE WORKING LOAD LIMIT.**  
ALWAYS CHECK THE IDENTIFICATION TAG TO DETERMINE IF THE SLINGS RATED CAPACITY IS APPROPRIATE FOR THE LIFT. RATINGS LISTED ARE VALID FOR NEW SLINGS ONLY. ALWAYS INSPECT THE SLING BEFORE USE.

# ARMOUR SUPER SLINGERS High Capacity Round Slings

## Rely on full inspection

**Prevent delays!  
Save money!**

Pre-failure warnings on slings often present a false alarm, when in fact the sling is ok to use. Prevent delays with your lift, and save money with inspection costs by using Super Slings.

Hey Boss, we just received this sling back from inspection, I put it up on crane, and pre-failure warnings have failed again. What should I do?

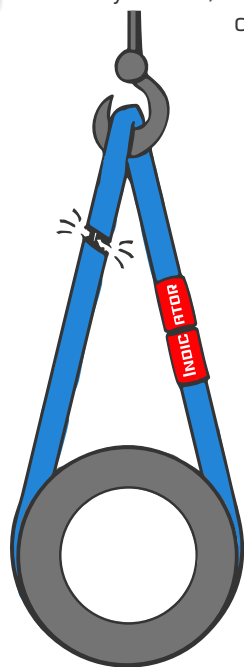
You can't use it, put the sling in the barrel with the others.



**Meets ASME B30.9 standard!**

## NEVER rely only on overload indicators

Even with overload indicators you must inspect the entire length of the sling.



No, the sling is damaged!  
The indicator is okay, we can proceed.



ASME B30.9 states inspection MUST be done on the entire length of the sling!

Elongation at WLL	1%
Melting Range	144-152°C
Density	Floats
Moisture Retention	1%
Yarn Abrasion Resistance	Excellent (yarn on yarn)
Cover Abrasion Resistance	Excellent
UV Resistance	Very Good
Loss Strength when wet	0%

Code	Color	Vertical 90° lbs	Choke 120° lbs	Basket				Appr Dia in	Appr Weight Lbs/ft
				90° lbs	60° lbs	45° lbs	30° lbs		
SSA200	Blue	20,000	16,000	40,000	34,600	28,000	20,000	1 1/4	0.55
SSA250	Blue	25,000	20,000	50,000	432,000	35,000	25,000	1 1/4	0.65
SSA300	Blue	30,000	24,000	60,000	51,900	42,000	30,000	1 3/8	0.8
SSA400	Blue	40,000	32,000	80,000	69,200	56,000	40,000	1 3/4	1.1
SSA500	Blue	50,000	40,000	100,000	86,500	70,000	50,000	1 7/8	1.5
SSA600	Blue	60,000	48,000	120,000	103,800	84,000	60,000	2	1.6
SSA700	Blue	70,000	56,000	140,000	121,100	98,000	70,000	2 1/8	1.65
SSA850	Blue	85,000	58,000	170,000	147,000	119,000	85,000	2 1/2	1.85
SSA1000	Blue	100,000	80,000	200,000	173,000	140,000	100,000	2 3/4	2.2
SSA1250	Blue	125,000	100,000	250,000	216,200	175,000	125,000	3	3
SSA1500	Blue	150,000	120,000	300,000	259,500	210,000	150,000	3 1/4	3.35
SSA1750	Blue	175,000	140,000	350,000	302,700	245,000	175,000	3 1/2	4
SSA2000	Blue	200,000	160,000	400,000	346,000	280,000	200,000	3 3/4	4.35
SSA2250	Blue	225,000	180,000	450,000	389,700	318,000	225,000	5	5
SSA2500	Blue	250,000	200,000	500,000	433,000	353,000	250,000	5 1/2	5.85
SSA2750	Blue	275,000	220,000	550,000	476,300	388,000	275,000	6	6.5
SSA3000	Blue	300,000	240,000	600,000	519,600	424,000	300,000	6 1/2	7.15
SSA4000	Blue	400,000	320,000	800,000	692,800	565,600	400,000	7	7
SSA5000	Blue	500,000	400,000	1,000,000	866,000	707,000	500,000	8	8.5
SSA6000	Blue	600,000	480,000	1,200,000	1,039,200	848,400	600,000	9	10

**WARNING!**

**NEVER EXCEED THE WORKING LOAD LIMIT.**  
ALWAYS CHECK THE IDENTIFICATION TAG TO DETERMINE IF THE SLINGS RATED CAPACITY IS APPROPRIATE FOR THE LIFT. RATINGS LISTED ARE VALID FOR NEW SLINGS ONLY. ALWAYS INSPECT THE SLING BEFORE USE.

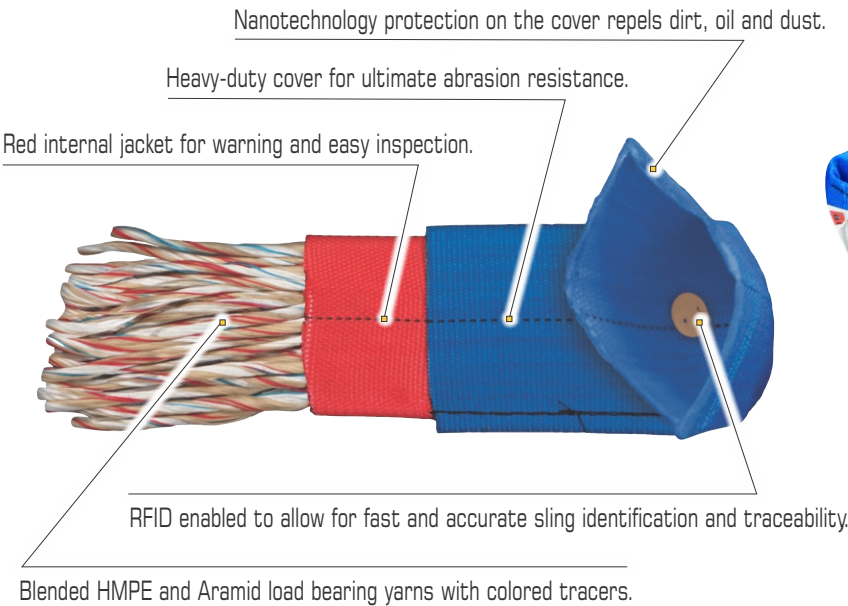


## ARMOUR SUPER SLINGERS

ARMOUR Super Slingers are a **HIGH PERFORMANCE** Round Slings and can be up to **15 times lighter** than steel slings of the same capacity.

Armour Super Slingers are made with a heavy duty nylon cordura® cover for maximum protection, and a red internal jacket for easy inspection. Armour Super Slingers are RFID enabled to allow for fast and accurate sling identification.

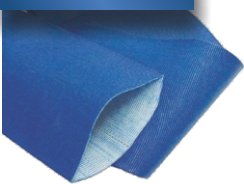
Using Super Slingers can reduce the amount of manpower needed for the job, as well as the hours it takes to do the lift. A SS-3000 sling has a Vertical capacity of 300,000 lbs, and at a 60 foot length the sling would weigh 320 lbs. To reach the same capacity in wire rope the slings would have to be 4-1/8" diameter would weigh 2000 lbs. That means the Super Slingers weigh only 16% of what the wire rope sling would weigh!



## HEAVY LIFTING LIGHT SLINGS!

### FIRST EVER ROUND SLING WITH NANOTECHNOLOGY APPLIED ON THE COVER

#### STAYS CLEAN



#### Durable protective function

Due to the extremely high level of abrasion resistance, the Nano covers protective function is retained even with heavy-duty use, frequent washing or cleaning.

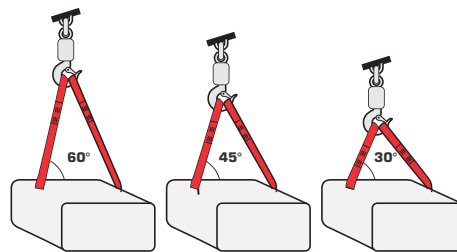
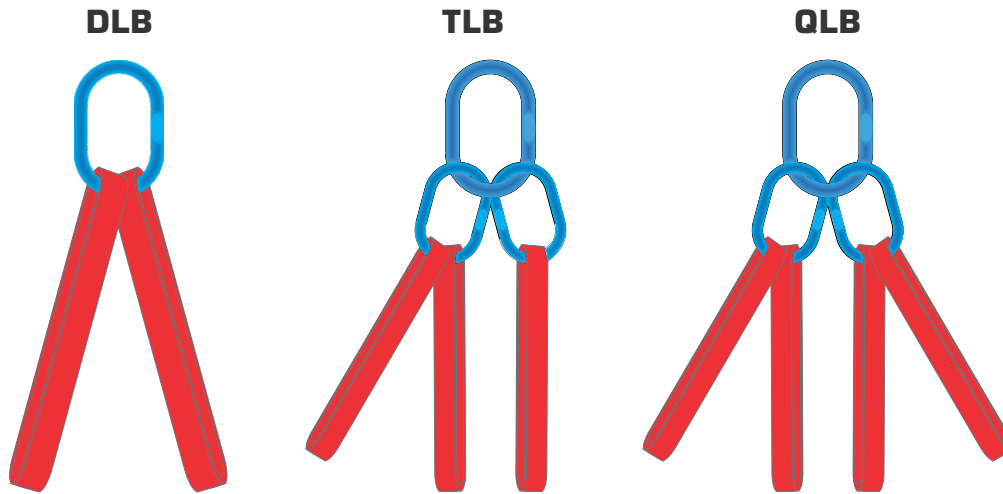
#### Naturally Self-cleaning

Oil, dirt and dust do not adhere to the Nano surface and can be rinsed off with water.



## Bridle Web Sling Ratings

Multi-leg bridle assemblies are ideal for loads equipped with multiple lifting points. They're lightweight, easy to use and economical. Available in Single, Double, Triple or Quadruple leg configurations. A large variety of hooks and other bottom attachments are available at the time of order.



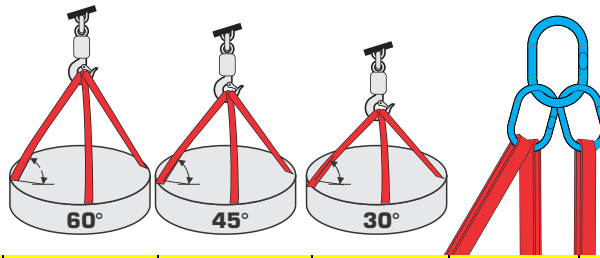
### Double-Leg Bridles

Sling Code	Item Code	Width	60°	45°	30°	Min Length	Eye Hook	Masterlink
SL-30	DO-SL-30	PURPLE	5,200	4,200	3,000	18	1-1/2T	5/8
SL-40	DO-SL-40	BLACK	6,900	5,700	4,000	18	2T	3/4
SL-60	DO-SL-60	GREEN	10,400	8,500	6,000	18	3T	3/4
SL-90	DO-SL-90	YELLOW	15,600	12,700	9,000	24	4-1/2T	1
SL-120	DO-SL-120	TAN	20,800	17,000	12,000	24	7T	1-1/4
SL-140	DO-SL-140	RED	24,200	19,800	14,000	30	7T	1-1/4
SL-170	DO-SL-170	ORANGE	29,400	24,000	17,000	36	11T	1-1/2
SL-230	DO-SL-230	BLUE	39,800	32,500	23,000	48	15T	1-1/2
SL-260	DO-SL-260	ORANGE	45,000	36,800	26,000	48	15T	1-3/4
SL-320	DO-SL-320	GREY	55,400	45,200	32,000	48	22T	1-3/4
SL-400	DO-SL-400	ORANGE	69,300	56,600	40,000	48	22T	2
SL-540	DO-SL-540	BROWN	93,500	76,400	54,000	48	30T	2-1/8
SL-680	DO-SL-680	OLIVE	117,800	96,200	68,000	60	-	2-1/8
SL-900	DO-SL-900	BLACK	155,900	127,300	90,000	60	-	2-3/8

**WARNING!**

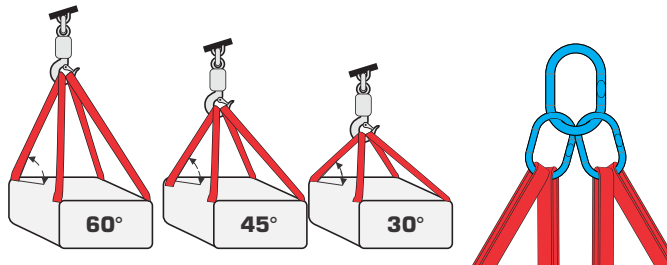
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Sling Protection  
 Web Slings  
**Round Slings**  
 Synthetic Chain Slings  
 Wire Rope Slings  
 Chain Slings  
 Shackles & Turnbuckles  
 Hooks & Links  
 Lifting Points  
 Hoists & Blocks  
 Lifting Devices  
 Pipe & Hose Restraints  
 Tie Down Assemblies  
 Tie Down Accessories  
 Towing & Recovery  
 Rope & Cordage



## Triple-Leg Bridles

Sling Code	Item Code	Width	60°	45°	30°	Min Length	Eye Hook	Masterlink
SL-30	TO-SL-30	PURPLE	7,800	6,400	4,500	18	1-1/2T	3/4
SL-40	TO-SL-40	BLACK	10,400	8,500	6,000	18	2T	3/4
SL-60	TO-SL-60	GREEN	15,600	12,700	9,000	18	3T	1
SL-90	TO-SL-90	YELLOW	23,400	19,100	13,500	24	4-1/2T	1-1/4
SL-120	TO-SL-120	TAN	31,200	25,500	18,000	24	7T	1-1/2
SL-140	TO-SL-140	RED	36,400	29,700	21,000	30	7T	1-1/2
SL-170	TO-SL-170	ORANGE	44,200	36,100	25,500	36	11T	1-3/4
SL-230	TO-SL-230	BLUE	59,800	48,800	34,500	48	15T	1-3/4
SL-260	TO-SL-260	ORANGE	67,500	55,100	39,000	48	15T	2
SL-320	TO-SL-320	GREY	83,100	67,900	48,000	48	22T	2-1/8
SL-400	TO-SL-400	ORANGE	103,900	84,800	60,000	48	22T	2-1/8
SL-540	TO-SL-540	BROWN	140,300	114,500	81,000	48	30T	2-3/4
SL-680	TO-SL-680	OLIVE	176,700	144,200	102,000	60	-	2-3/4
SL-900	TO-SL-900	BLACK	233,800	190,900	135,000	60	-	3-1/8



## Quadruple-Leg Bridles

Sling Code	Item Code	Width	60°	45°	30°	Min Length	Eye Hook	Masterlink
SL-30	QO-SL-30	PURPLE	10,400	8,500	6,000	18	1-1/2T	3/4
SL-40	QO-SL-40	BLACK	13,900	11,300	8,000	18	2T	1
SL-60	QO-SL-60	GREEN	20,800	17,000	12,000	18	3T	1-1/4
SL-90	QO-SL-90	YELLOW	31,200	25,500	18,000	24	4-1/2T	1-1/2
SL-120	QO-SL-120	TAN	41,600	33,900	24,000	24	7T	1-1/2
SL-140	QO-SL-140	RED	48,500	39,600	28,000	30	7T	1-3/4
SL-170	QO-SL-170	ORANGE	58,900	48,100	34,000	36	11T	1-3/4
SL-230	QO-SL-230	BLUE	79,700	65,000	46,000	48	15T	2-1/8
SL-260	QO-SL-260	ORANGE	90,100	73,500	52,000	48	15T	2-1/8
SL-320	QO-SL-320	GREY	110,800	90,500	64,000	48	22T	2-3/4
SL-400	QO-SL-400	ORANGE	138,600	113,100	80,000	48	22T	2-3/4
SL-540	QO-SL-540	BROWN	187,100	152,700	108,000	48	30T	2-3/4
SL-680	QO-SL-680	OLIVE	235,600	192,300	136,000	60	-	3-1/8
SL-900	QO-SL-900	BLACK	311,800	254,500	180,000	60	-	3-1/8



**WARNING!** NEVER EXCEED THE WORKING LOAD LIMIT. ALWAYS CHECK THE IDENTIFICATION TAG TO DETERMINE IF THE SLINGS RATED CAPACITY IS APPROPRIATE FOR THE LIFT. RATINGS LISTED ARE VALID FOR NEW SLINGS ONLY. ALWAYS INSPECT THE SLING BEFORE USE.

Sling Protection  
Web Slings  
Round Slings  
Synthetic Chain Slings  
Wire Rope Slings  
Chain Slings  
Shackles & Turnbuckles  
Hooks & Links  
Lifting Points  
Hoists & Blocks  
Lifting Devices  
Pipe & Hose Restraints  
Tie Down Assemblies  
Tie Down Accessories  
Towing & Recovery  
Rope & Carriage

Sling Protection

Web Slings

**Round Slings**

Synthetic Chain Slings

Wire Rope Slings

Chain Slings

Shackles & Turnbuckles

Hooks & Links

Lifting Points

Hoists & Blocks

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Towing & Recovery

Rope & Cordage