RECOMMENDED OPERATING,
CARE AND INSPECTION MANUAL
FOR

SYNTHETIC POLYESTER ROUNDSLINGS

WSTDA-RS-2

$6.00

MANDATORY AND ADVISORY RULES

Mandatory rules are characterized by the use of the word "shall". If a rule is of an advisory nature, it is indicated by the use of the word "should", or it is stated as a recommendation.

The Web Sling & Tie Down Association has also formulated a Recommended Standard Specification for Synthetic Polyester Roundslings WSTDA-RS-1 as a guide for users, industry and government to ensure the proper use, maintenance and inspection of synthetic polyester roundslings.

The Association suggests the purchase and use of the Recommended Standard Specification for Synthetic Roundslings WSTDA-RS-1 by all synthetic polyester roundsling users.

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WEB SLING & TIE DOWN ASSOCIATION ™

INTRODUCTION

The Web Sling & Tie Down Association (WSTDA) is a tax-exempt, non-profit, technical association dedicated to the development and promotion of voluntary recommended standards and associated reference materials. Originally established in 1973 as the Web Sling Association (WSA), the WSA serviced the synthetic web sling industry. In 1988, the WSA further defined its purpose to include synthetic web tie downs and became the Web Sling & Tie Down Association. Today, members of the WSTDA include manufacturers and suppliers of synthetic web slings and tie downs, polyester roundslings, synthetic webbing, fibers, thread and related components. The WSTDA's mission is to foster and further, in every lawful manner, the common interests of its members and industry.

It is an industry organization of manufacturers of synthetic yarns, synthetic webbing, synthetic slings, synthetic web tiedowns and related components. These products are used in the manufacturing, transportation, recreation, and forestry industries; also by the military and governmental agencies, for lifting, lowering, moving, and securing loads.

In pursuance of this mission, the association has prepared this manual. It is intended to serve as a general outline of recommended procedures and suggested operating practices and is not intended to be an all-inclusive list of procedures for specific products or applications.

Accordingly, the Web Sling & Tie Down Association, Inc. disclaims any responsibility for the actual use of any synthetic polyester roundsling products. The user should consult the manufacturer of such products for further information concerning the proper care and use of their products.

POLYESTER ROUNDSLINGS

A polyester roundsling, also referred to as a tubular sling, is composed of a continuous load bearing core(s) made from synthetic polyester yarns, not woven, fully enclosed in a protective cover(s), with or without fitting(s) or coupling component(s) used for general lifting purposes.

Safety is the paramount consideration involved in the use of any polyester roundsling. The proper polyester roundsling must be chosen for the job. Riggers must know the proper hitch to use, where and how to attach polyester roundslings to the load. Therefore, riggers shall acquire the knowledge, not only of the different type hitches, but the way loads can be expected to react when the lift is made.

POLYESTER ROUNDSLING IDENTIFICATION

EACH POLYESTER ROUNDSLING SHALL BE DURABLY MARKED OR LABELED SHOWING:

A. Name or trademark of manufacturer.
B. Manufacturer's code or stock number.
C. Rated capacities for the three basic hitches (vertical, choker, vertical basket).
D. Polyester core - if cover(s) is of a different fiber type, both fiber types shall be identified.
E. Length (reach) - bearing point to bearing point.
F. Sling identification should be maintained by the user so as to be legible during the life of the sling.

RECOMMENDED OPERATING PRACTICES

Mechanical Considerations

Polyester roundslings shall always be protected from being cut by corners, edges, and protrusions.

Determine weight of the load. Polyester roundslings shall not be loaded in excess of their rated capacity. Consideration shall be given to the angle from the horizontal (roundsling to load angle) which affects rated capacities. See Table 4 - Sling Angle Chart.

Select a proper polyester roundsling having suitable characteristics for the type of load, hitch and environment.

Polyester roundslings with fittings that are used in a choker hitch shall be of sufficient length to assure that the choking action is on the polyester roundsling and never on the fitting.

Polyester roundslings used in a basket hitch shall have the load balanced to prevent slippage.

Polyester roundslings should not be dragged on the floor or over an abrasive surface.

Polyester roundslings shall not be twisted or tied into knots, or joined by knotting.

Polyester roundslings should not be pulled from under loads when the load is resting on the sling.

Polyester roundslings shall be used with lifting devices that are compatible with roundslings.

Do not drop polyester roundslings equipped with metal fittings.

The opening in fittings shall be the proper shape and size to ensure that the fitting will seat properly on the polyester roundsling, crane hook or other attachments.

Polyester roundslings protective covers that are cut, exposing the load bearing yarn, shall be removed from service.

Consideration shall be given to the fitting's radius in that it shall be compatible to that of the crane hook on which it is to be used.

Consideration shall be given to the distribution of load weight on a multi-legged lift.

Environmental Considerations

When not in use, polyester roundslings should be stored in a cool, dry and dark place to prevent loss of strength from exposure to ultra-violet rays.

Polyester roundslings shall not be stored in chemically active areas.

Chemically active environments can affect the strength of polyester roundslings in varying degrees ranging from little to total degradation. The polyester roundsling manufacturer, or qualified person, should be consulted before roundslings are used in a chemically active environment.

Acid

1. Polyester is resistant to some acids, but is subject to degradation, ranging from little to moderate in some acids.
2. Each application shall be evaluated, taking into consideration the following:
    a. Type of acid
    b. Exposure conditions
    c. Concentration
    d. Temperature

Alkalis

1. Polyester is subject to degradation in alkalis, ranging from little to total degradation.
2. Each application shall be evaluated, taking into consideration the following:
    a. Type of alkali
    b. Exposure conditions
    c. Concentration
    d. Temperature

Polyester roundslings shall not be used at temperatures in excess of 194 degrees F (90 C), or at temperatures below minus 40 degrees F (-40 C).

Polyester roundslings incorporating aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of alkalis and/or acids are present, unless the compatibility of these materials is verified by the manufacturer or a qualified person.

POLYESTER ROUNDSLING HITCHES

Loads vary in physical dimension, shape and weight. Where and how to attach the roundsling is important to a rigger.

Hitch: Choker - A method of rigging in which the polyester roundsling is passed around the load, then through itself, then attached to the lifting device.

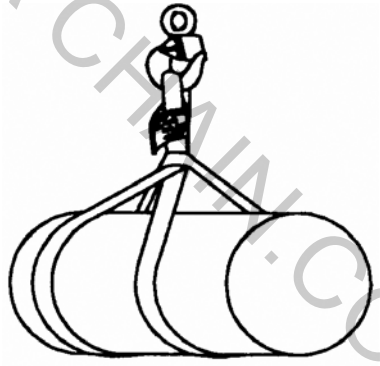


Figure 1

Hitch: Double Wrapped Choker - A method of rigging in which the polyester roundsling is passed around the load twice, then through itself, then attached to the lifting device.

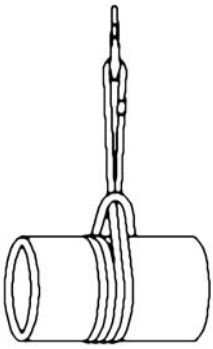


Figure 2

Hitch: Basket - A method of rigging in which the polyester roundsling is passed around the load and both ends are attached to the lifting device.

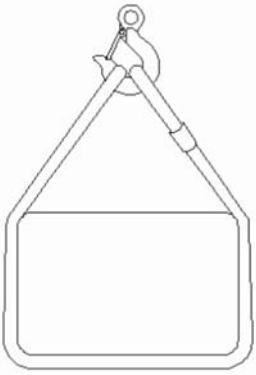


Figure 3

WARNING

Rated capacities are affected by the Angle of Lift (roundsling to load angle) when polyester roundslings are used in multi-legged or basket hitches. To determine the actual polyester roundsling capacity at a given Angle of Lift, multiply the original polyester roundsling rating by the appropriate loss factor determined from Table 4.

Hitch: Vertical - A method of rigging in which the load is attached to one end of the polyester roundsling and the other end of the polyester roundsling is attached to the lifting device.

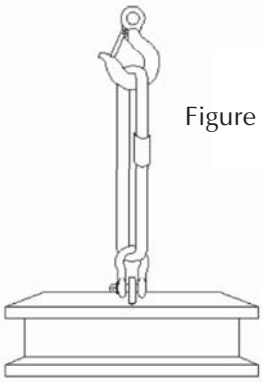


Figure 4

Multi-Leg Polyester Roundsling Bridle - A method of rigging in which the load is attached to two or more legs of a bridle assembly. The assembly can consist of 2, 3, 4, or more legs. (a four leg bridle shown in figure 5)

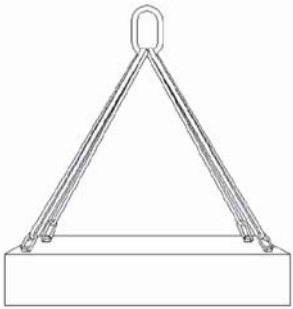


Figure 5

⚠ WARNING

Rated Capacities for Multi-leg Bridle assemblies are based on an assumed set of ideal conditions as follows:

1. **The load is evenly distributed on all legs.**
2. **All legs are the same length.**
3. **All legs are used at the same horizontal angle.**

If the conditions of the lift vary from those above, the rated capacity must be recalculated.

BASIC RULES OF HITCHING

RATED CAPACITY: Be sure the polyester roundsling you intend to use is strong enough for the job (refer to identification tag on the polyester roundsling).

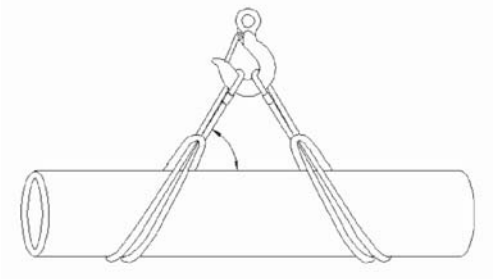


Figure 6

⚠ WARNING

Rated capacities are affected by the Angle of Lift (roundsling to load angle) when used in multi-legged polyester roundslings or basket hitches. To determine the actual polyester roundsling capacity at a given Angle of Lift, multiply the original polyester roundsling rating by the appropriate loss factor determined from Table 4.

CONTROL AND BALANCE: Use a hitch that will keep the load under control at all times and be sure the lifting device is directly over center of gravity (CG).

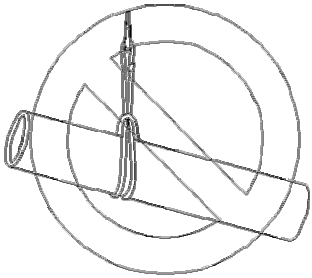


Figure 7

PREVENT DAMAGE: ROUNDSLINGS SHALL ALWAYS BE PROTECTED FROM BEING CUT OR DAMAGED BY CORNERS, EDGES, OR PROTRUSIONS.

LIFTING LOAD: Lift load carefully, accelerating smoothly. Avoid shock loading.

CONDITIONS OF POLYESTER ROUNDSLINGS: Inspect roundslings and their parts carefully before each lift and at regular intervals.

REGULATIONS: Polyester roundslings shall be used in accordance with industry, local, state federal, and provincial regulations applicable to the lift.

USE OF LIFTING LUGS/EYE BOLTS: Lifting lugs/eye bolts shall be used in accordance with the lug / eye bolt manufacturer's recommendations. Many loads are equipped with lifting lugs for each attachment of the polyester roundsling. Make sure pull is transmitted to them straight along the axis of the shank unless prescribed otherwise by the manufacturer. However, if "hoist rings" are utilized, the pull does not have to be along the axis.

PROPER HITCHING METHODS

SINGLE LEG HITCHES - Single leg hitches such as the single leg vertical and the single choker hitch may not provide optimum control over the load. In these hitches only one polyester roundsling supports the load.

In a single choker hitch, there is always a part of the polyester roundsling at the choke point not in contact with the bundle being lifted.

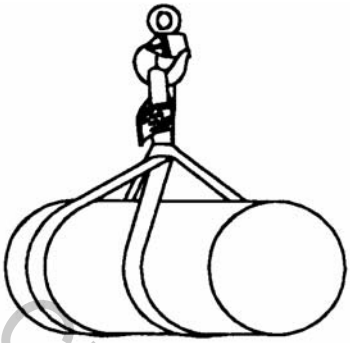


Figure 8

DOUBLE WRAP CHOKER HITCH - The double wrap hitch or the double wrap choker hitch provides full contact with the load.

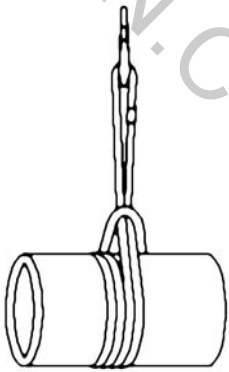


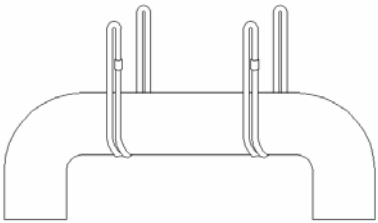
Figure 9

⚠ WARNING

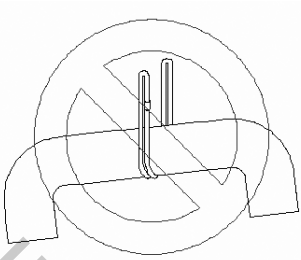
No single polyester roundsling hitch shall ever be used to lift and transport a load that is not balanced. See example, figure 11.

BASKET HITCHES - Basket hitches, whether single or double, may be used successfully in a variety of applications. However, they have inherent limitations which the following sketches will indicate.

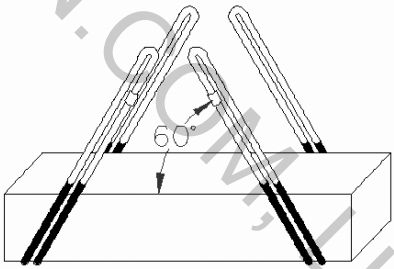
RIGHT WAY
Figure 10



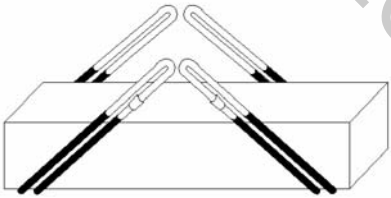
WRONG WAY
Figure 11



RIGHT WAY
Figure 12



WRONG WAY
Figure 13

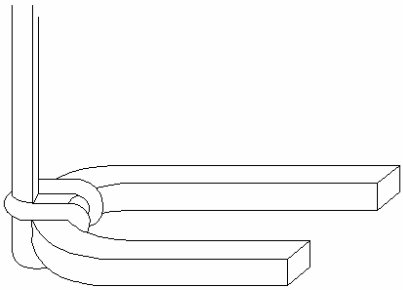


⚠ WARNING

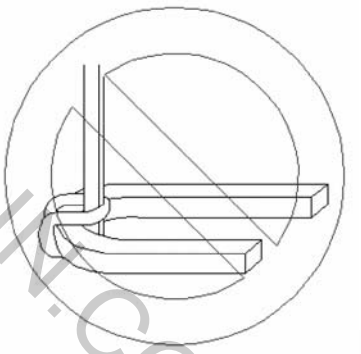
Angles of less than 60 degrees can cause polyester roundsling to slip under the load, creating an imbalance condition. See examples, figures 12 and 13.

T**URNING HITCH** - When turning a load, use a choker hitch. If the turning hitch is made wrong, the turning action of the load will loosen the hitch, causing it to slip.

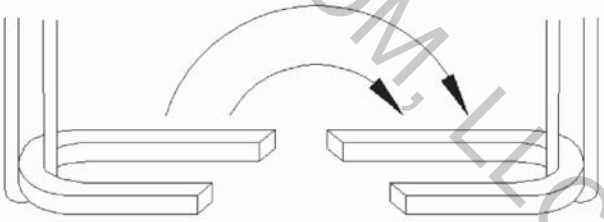
RIGHT WAY
Figure 14



WRONG WAY
Figure 15



WRONG WAY
Figure 16



WARNING

A polyester roundsling shall not be used in basket hitch for turning a load.

SELECTION OF PROPER CONNECTION HARDWARE

Connection hardware should be selected such that it either:

- Conforms to the size requirements listed in Tables 1 and 2.

OR

- Sized such that the bearing stress value at the connection does not exceed 7,000 Lbs./in^2 during sling loading. (see calculations below)

Table 1. Suitable Connection Hardware Sizes for Vertical / Choker Hitches

TABLE 1

Roundsling		Hardware Size	
WSTDA Sling Size	Rated Capacity - Vertical Hitch (Lbs.)	Minimum Stock Diameter or Thickness (Inches)	Minimum Effective Contact Width* (Inches)
1	2,600	.50	1.00
2	5,300	.62	1.25
3	8,400	.75	1.62
4	10,600	.88	1.75
5	13,200	1.00	2.00
6	16,800	1.12	2.12
7	21,200	1.25	2.62
8	25,000	1.25	2.88
9	31,000	1.50	3.12
10	40,000	1.62	3.50
11	53,000	1.88	4.00
12	66,000	2.12	4.50
13	90,000	2.50	5.12

Table 2. Suitable Connection Hardware Sizes for Basket Hitches

TABLE 2

Roundsling		Hardware Size *2	
WSTDA Sling Size	Rated Capacity - Basket Hitch (Lbs.)	Minimum Stock Diameter or Thickness (Inches)	Minimum Effective Contact Width* (Inches)
1	5,200	.62	1.25
2	10,600	.88	1.75
3	16,800	1.00	2.25
4	21,200	1.25	2.50
5	26,400	1.38	2.75
6	33,600	1.62	3.00
7	42,400	1.75	3.62
8	50,000	1.88	4.00
9	62,000	2.00	4.38
10	80,000	2.38	5.00
11	106,000	2.75	5.50
12	132,000	3.00	6.50
13	180,000	3.50	7.38

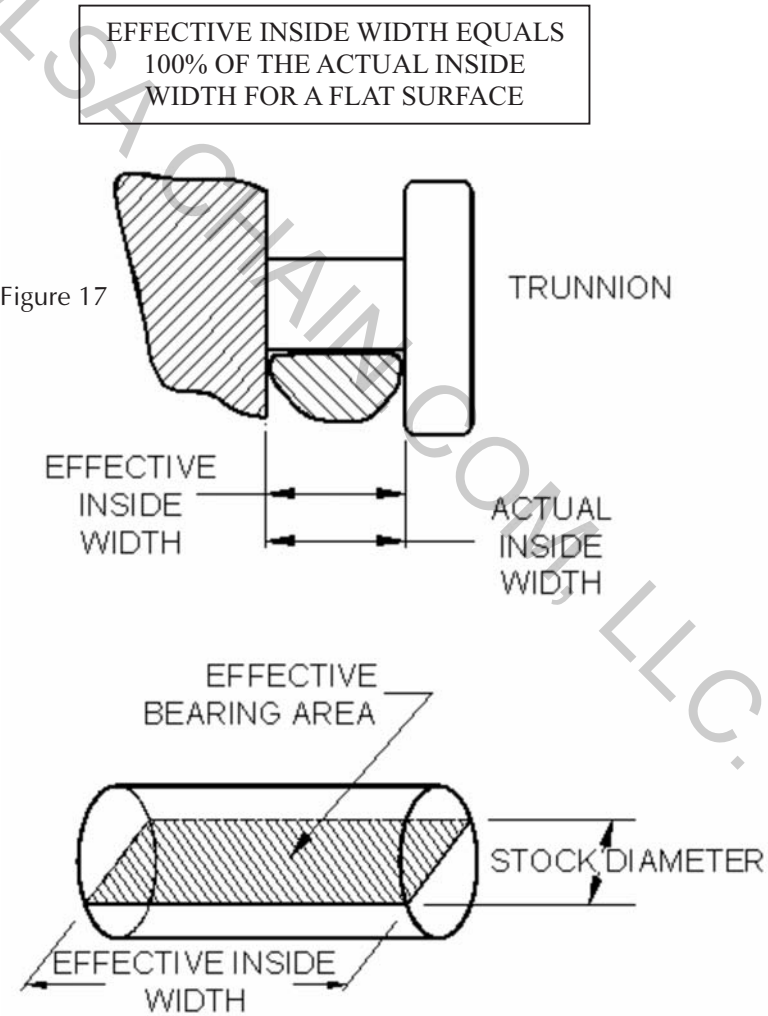
* This value is also the approximate natural flattening width of the roundsling.

*2 These tabled values apply to all hardware from which a roundsling is attached using a basket hitch configuration.

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 connection (See Figure 17). Please note, however, that the effective contact width will never exceed the natural flattening width of the sling as listed in Tables 1 and 2, per Table 2 footnote.

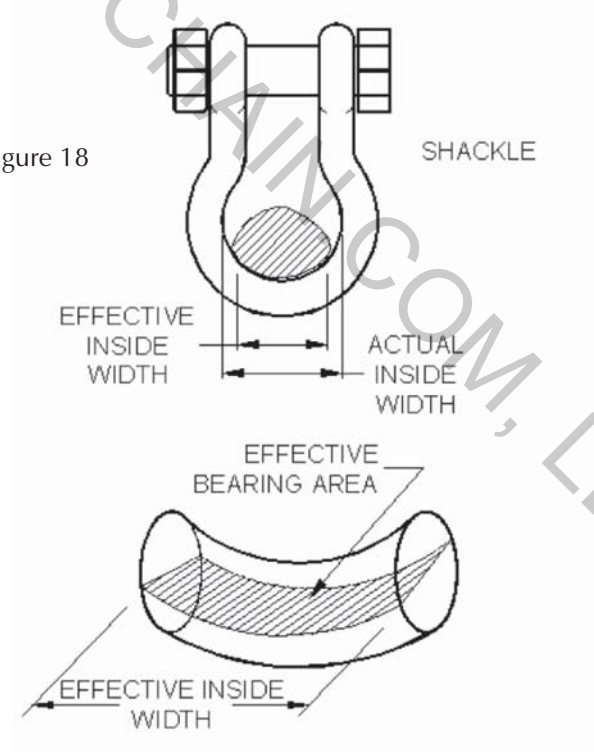
Figure 17



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 .75 (See Figure 18). 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 1 and 2, per Table 2 footnote.

EFFECTIVE INSIDE WIDTH EQUALS 75% OF THE ACTUAL INSIDE WIDTH FOR A CURVED SURFACE

Figure 18



Note:

Roundsling strength is affected by the size of the connection hardware. For special applications wherein a specific design factor is required to be maintained during the lift, please refer to the WSTDA Standard Specification for Synthetic Polyester Roundslings RS-1.

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.

Load Bearing Area =
(Hardware Thickness or Stock Diameter) x (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.

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

INSPECTION, REMOVAL AND REPAIR

Roundsling Inspection

Initial Inspection -

Prior to use, all new, altered, modified, or repaired slings shall be inspected by a designated person to verify compliance with the applicable provisions of this chapter.

Frequent Inspection -

(a) A visual inspection for damage shall be performed by the user or other designated person before each use.

(b) Conditions such as those listed in the removal from service criteria shall cause the sling to be removed from service. Slings shall not be returned to service until approved by a qualified person.

(c) Written records are not required for frequent inspections.

Periodic Inspection -

(a) A complete inspection for damage to the sling shall be periodically performed by a designated person. Each sling and component shall be examined individually, taking care to expose and examine all surfaces. The sling shall be examined for condition such as those listed in the removal from service criteria.

(b) Periodic Inspection Frequency. Periodic inspection intervals shall not exceed 1 year. The frequency of periodic inspection should be based on:

1) frequency of sling use
2) severity of service conditions
3) nature of lifts being made
4) experience gained on the service life of slings used in similar circumstances

Guidelines for the time intervals are:

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

(c) Written records of the most recent periodic inspection should be maintained for each lot of slings and shall include their condition.

Removal From Service Criteria

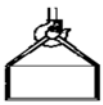
A polyester roundsling shall be removed from service if any of the following is visible:

a. Holes, tears, cuts, snags, embedded particles, or abrasive wear that expose the core fibers.
b. If the rated capacity tag is missing or not readable.
c. If roundsling has been tied into one or more knots.
d. Melting, charring or weld spatter of any part of the roundsling.
e. Acid or alkali burns of the polyester roundsling.
f. Broken or worn stitching in the cover that exposes the core fibers.
g. Fittings that are pitted, corroded, cracked, stretched, bent, twisted, gouged, or broken.
h. Any conditions which cause doubt as to the strength of the roundsling.

Repair of Polyester Roundslings

1. Repairs to the protective cover shall be done only by the original manufacturer or by a qualified person in accordance with the original manufacturer's instructions.
2. There shall be no repairs of load bearing yarn.
3. Only polyester roundslings which can be identified from the information on the identification tag shall be repaired.
4. All repaired polyester roundslings shall be proof tested in accordance with WSTDA specifications before being put back into service.
5. Certification of proof test should be provided.
6. If sling repair is not performed by the original manufacturer, it shall be marked to identify the repairing agency.
7. Temporary repairs of either roundslings or fittings shall not be permitted.

Table 3: Rated Capacities for Polyester Roundslings

TABLE 3		 Vertical		 Choker		 Vertical Basket		 45° Basket	
	Color*	Pounds	Kilograms	Pounds	Kilograms	Pounds	Kilograms	Pounds	Kilograms
1	Purple	2,600	1,200	2,100	1,000	5,200	2,400	3,700	1,700
2	Green	5,300	2,400	4,200	1,900	10,600	4,800	7,500	3,400
3	Yellow	8,400	3,800	6,700	3,000	16,800	7,600	11,900	5,400
4	Tan	10,600	4,800	8,500	3,800	21,200	9,600	15,000	6,800
5	Red	13,200	6,000	10,600	4,800	26,400	12,000	18,700	8,500
6	White	16,800	7,600	13,400	6,000	33,600	15,200	23,800	10,700
7	Blue	21,200	9,600	17,000	7,600	42,400	19,200	30,000	13,600
8	Orange	25,000	11,400	20,000	9,100	50,000	22,800	35,400	16,100
9	Orange	31,000	14,100	24,800	11,300	62,000	28,200	43,800	19,900
10	Orange	40,000	18,200	32,000	14,500	80,000	36,400	56,600	25,700
11	Orange	53,000	24,100	42,400	19,300	106,000	48,200	74,900	34,100
12	Orange	66,000	30,000	52,800	24,000	132,000	60,000	93,000	42,400
13	Orange	90,000	40,900	72,000	32,700	180,000	81,800	127,300	57,800

Caution:

Color Codes and rated capacities may vary among manufacturers. Always check the identification tag to determine if the polyester roundsling rated capacity is applicable for the lift.

Effect Of Sling Angles

Sling lifting capacities are affected by angle of lift (roundsling to load angle) measured from the horizontal, when used with multi-legged roundslings or choker/basket hitches. To determine the actual capacity at a given angle of lift, multiply the original sling rating by the appropriate angle factor from Table 4.

Table 4: Sling Angle Chart (Angle of Lift)

TABLE 4

Angle in Degrees from Horizontal	Angle Factor	Angle in Degrees from Horizontal	Angle Factor
90°	1.000	55°	0.819
85°	0.996	50°	0.766
80°	0.985	45°	0.707
75°	0.966	40°	0.643
70°	0.940	35°	0.574
65°	0.906	30°	0.500
60°	0.866		

Example: A size 1 (purple) roundsling is being used to lift a load in a basket hitch at a 60 degree angle. It has a rated capacity of 2,600 lbs. in a vertical hitch, and 5,200 lbs. in a basket.

Answer: The angle factor for 60 degrees is .866. The lifting capacity for this sling at 60 degrees in a basket hitch is:

(5,200 lbs.) x (.866 angle factor) = 4,500 lbs.

See figure 19, which illustrates the effect of several differing sling angles.

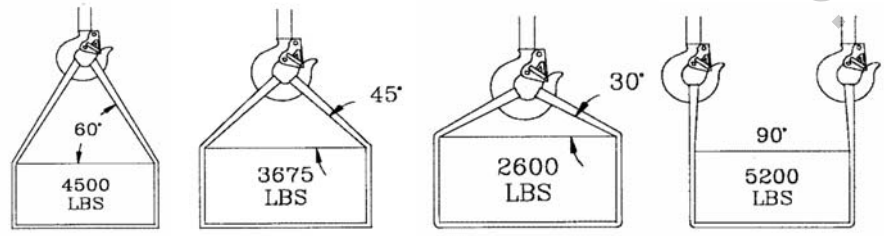


Figure 19

Choker Hitch Angle

When a choker hitch is used, the choker hitch rating is affected by the choker angle for choke angles of less than 120 degrees. The choker hitch rating should be multiplied by the choke angle factor from Table 5.

Table 5: Choker Hitch Angle Chart

TABLE 5

Angle of Choke (degrees)	Choke Angle Factor
120° - 180°	1.00
105° - 120°	0.93
90° - 105°	0.87

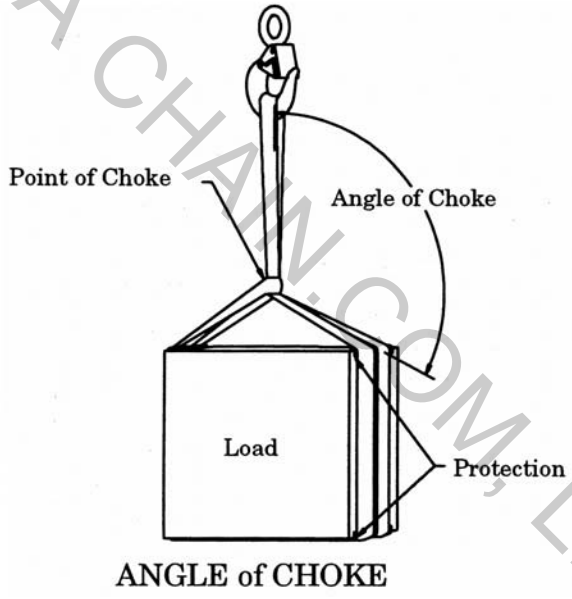


Figure 20

OTHER WEB SLING & TIE DOWN ASSOCIATION PUBLICATIONS

Recommended Standard Specifications:

Synthetic Web Slings	WSTDA-WS-1
Synthetic Polyester Roundslings	WSTDA-RS-1
Webbing for Synthetic Web 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

Operating & Inspection Manuals

Synthetic Web Slings	WSTDA-WS-2
Synthetic Polyester Roundslings	WSTDA-RS-2
Synthetic Web Tie Downs	WSTDA-T-2

Video

Synthetic Web Sling Care & Inspection	WSTDA-WSV-1-1994

Illustrated Wall Chart

Inspection of Web Slings & Round Slings	WSTDA-WSWC-1

UV Degradation Reports

Summary Report UV Degradation	WSTDA-UV-Sling-2003
UV Degradation Mini Manual	WSTDA-UV-MM-2005
UV Degradation Report	WSTDA-UVDR-1981 (Revised 2005)

Training CD-Rom

North America Cargo Securement Standard	WSTDA-CD-TP-2003

Fabric Warning Labels

Nylon Web Slings	WSTDA-SW-02-N
Polyester Web Slings	WSTDA-SW-02-P
Tie Downs	WSTDA-TW-02
Round Slings	WSTDA-RSW-03

Paper Warning Sheets

Synthetic Web Slings	WSTDA-WSWS-02
Polyester Roundslings	WSTDA-RSWS-04
Tie Downs	WSTDA-TWS-97

For ordering information and prices,
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