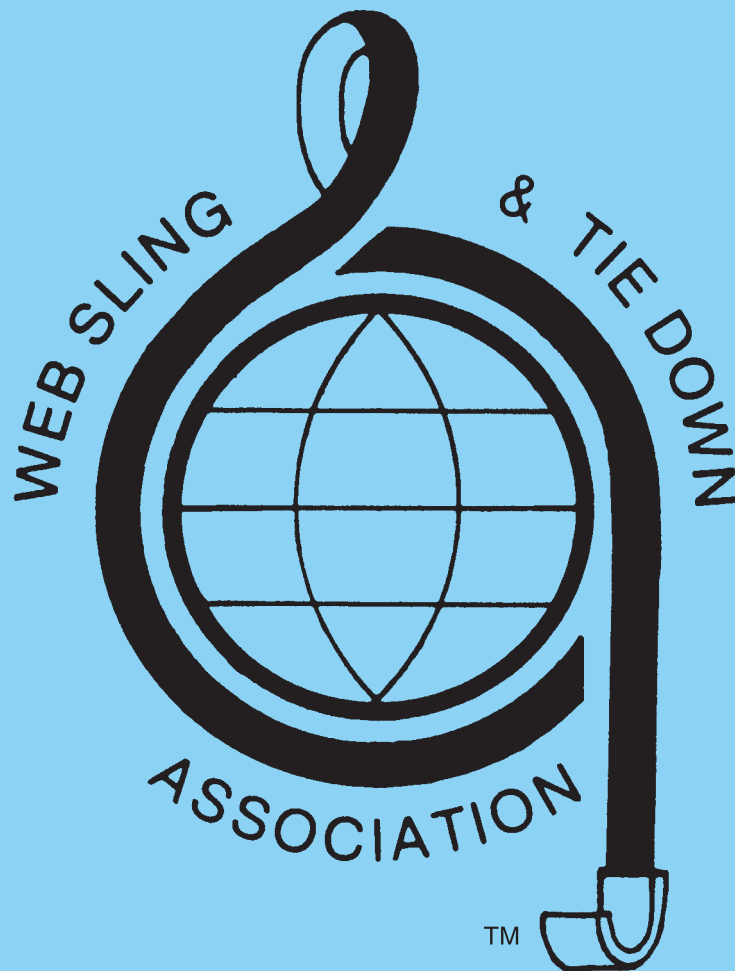


RECOMMENDED STANDARD SPECIFICATION

For
Synthetic Polyester Roundslings

WSTDA-RS-1



FOREWORD

This Recommended Standard Specification applies to roundslings made of polyester fibers used for the lifting, suspending, transporting, lowering and handling of materials. It recommends construction, identification and marking of these polyester roundslings. In addition, it gives capacities and important practical advice on the use, maintenance and inspection of polyester roundslings.

The exclusion from this recommended standard specification of polyester roundslings of different synthetic materials and capabilities is not intended to preclude their use and shall not be interpreted in this manner.

Roundslings made from materials or construction other than those detailed in this Recommended Standard Specification shall be used in accordance with the recommendations of the roundsling manufacturer or qualified person. The specifications contained in this Recommended Standard Specification For Synthetic Polyester Roundslings were formulated under the auspices of the Web Sling & Tie Down Association, Inc. The recommended standard specification is intended to assist users in specifying the proper synthetic polyester roundsling for their particular needs; to serve as a guide to industry in the construction and use of synthetic polyester roundslings; and to serve as a guide to governmental and other regulatory bodies responsible for the proper use and inspection of synthetic polyester roundslings.

Safety is the paramount consideration involved in the use of any Synthetic Web Tie Downs. The appropriate synthetic web tie down shall be selected by the user for their specific application. Also, users shall be knowledgeable about federal, state, provincial and industry regulations applicable to Cargo Securement.

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.

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THIS STANDARD IS AVAILABLE THROUGH WCTDA

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CHAPTER 1.0

TERMINOLOGY AND DEFINITIONS

SECTION 1.1 PURPOSE

- 1.1.1 This chapter provides a description of synthetic polyester roundslings and definitions which apply to such roundslings

SECTION 1.2 WEBBING

- 1.2.1 **DESCRIPTION** A polyester roundsling, also referred to as a tubular sling, is comprised of continuous load bearing core(s) made from synthetic yarns, not wove, fully enclosed in a protective cover(s) with or without fitting(s) or coupling component(s).

SECTION 1.3 BASIC TYPES

- 1.3.1 **ENDLESS** A polyester roundsling in which the load bearing core(s) is wound in a continuous manner and fully enclosed within a protective cover(s). See Figure 1

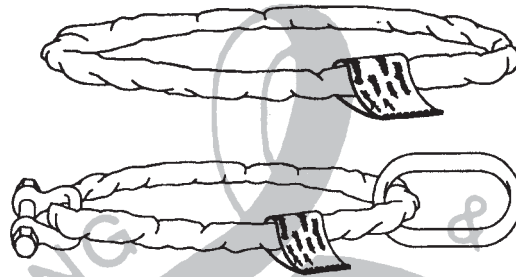


FIGURE 1

- 1.3.2 **EYE & EYE** A polyester roundsling with a loop eye at each end typically formed with a sleeve over the body. See Figure 2



FIGURE 2

- 1.3.3 **BRIDLE (Multi-Legged)** A polyester roundsling with multiple legs. See Figure 3

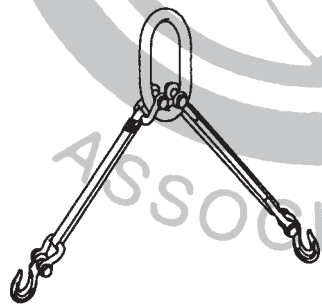


FIGURE 3

TM

SECTION 1.4 DEFINITION OF TERMS

ABRASION The mechanical wearing of a surface resulting from frictional contact with materials or objects.

BREAKING STRESS The compressive stress located at the contact surfaces between two objects that occurs when they are attached together and then loaded in tension.

BREAKING STRENGTH That load in pounds or kilograms at which point the load bearing core of the polyester roundsling fails.

COATING A finish applied for a special purpose.

COUPLING A load bearing device for the purpose of attaching fittings to the roundsling.

CORE That yarn which comprises the load bearing part(s) of the polyester roundsling.

COVER A seamed or seamless protective material that completely encloses the core(s).

DESIGN FACTOR The ratio of the breaking strength to the designated "rated capacity" for each polyester roundsling.

DESIGNATED PERSON Selected or assigned by the employer or employer's representative as being competent to perform specific duties.

ELONGATION The measurement of stretch at a given load, expressed as a percentage of the original unloaded length.

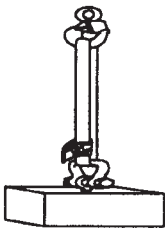
FITTING A load bearing device that is attached to the polyester roundsling.

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. See Figure 4

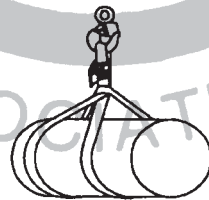
HITCH / CHOKER A method of rigging in which the polyester roundsling is passed around the load, then through itself, then attached to the lifting device. See Figure 4

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. See Figure 4

Hitch / Vertical



Hitch / Choker



Hitch / Basket

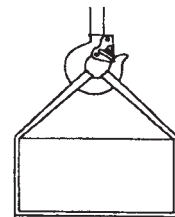


FIGURE 4

LENGTH (reach) The distance between the extreme end bearing points of the polyester roundsling including fittings, if applicable. See Figure 5

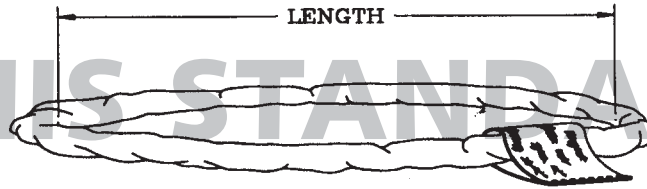


FIGURE 5

NATURAL FLATTENED WIDTH of a ROUNDSLING The width or spread that results at the hardware location when a roundsling is attached and then loaded in tension. For the purposes of this standard, the assumption was made that each sling will flatten to a 3:1 width to height ratio at the connection. It is understood, however, that the actual measured width may be slightly wider than this designated value.

PROOF LOAD TEST A non-destructive load test of the polyester roundsling to some multiple of the rated capacity of that roundsling, including fittings if applicable (usually two (2) times the rated capacity).

PROTECTIVE SLEEVE An additional non-load bearing, cover material that provides extra protection to the polyester roundsling.

QUALIFIED PERSON A person who, by possession of a recognized degree, or certificate of professional standing; or who, by extensive knowledge, training and experience, has successfully demonstrated the ability to solve or resolve problems related to the subject matter and work.

RATED CAPACITY (Working Load Limit) The maximum allowable load for each polyester roundsling assembly for the type of hitch used.

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

SHOCK LOADING An unintended condition of rapid lift, sudden shifting of load, or arrest of falling load that causes the forces in a sling to notably exceed that which would have occurred under normal loading conditions. This increase in force is due to a high rate of loading and may be caused by inertia effects, changes in the properties of sling members, or both.

SYNTHETIC FIBER Man-made fibers.

THREAD The synthetic yarn that is used to sew the cover.

WORKING LOAD LIMIT See Rated Capacity.

YARN The synthetic fibers used to make the core, cover and thread.

CHAPTER 2.0

MATERIALS & CONSTRUCTION

SECTION 2.1 PURPOSE

2.1.1 This chapter provides an outline of materials and construction characteristics of polyester roundsling.

SECTION 2.2 CORE YARN

- 2.2.1 The core(s) shall be formed from one or more ends of yarn, wound together on a plurality of turns. The core(s) should be uniformly wound to ensure even distribution of the load.

SECTION 2.3 COVER

- 2.3.1 The cover(s) should be of the same type as the load bearing core(s). When the cover is of a different fiber type than the load bearing core, follow the manufacturer's recommendations for use.
- 2.3.2 The cover should be made from one length of material.

SECTION 2.4 THREAD

- 2.4.1 When the core and cover are of the same fiber, the thread shall also be of that fiber type. When the core and cover are of different fiber types, the thread should be of the same fiber type as the core.

SECTION 2.5 STITCHING

- 2.5.1 All stitching shall be lock-stitched type and should be continuous. When not continuous, they shall be backstitched or overstitched to prevent raveling.

SECTION 2.6 FITTINGS



WARNING

The use of improper fittings and/or materials may result in severe personal injury or death.

- 2.6.1 This section relates to fitting of metal, or other suitable materials, which may be attached to polyester roundslings for the purpose of engaging a lifting device. The fitting(s) may be a permanent or detachable part of the roundslings.
- 2.6.1.1 **MATERIAL** The material selected shall be compatible with the mechanical and environmental requirements imposed on the fitting.
- 2.6.1.2 **FINISH** All surfaces shall be cleanly finished and sharp edges shall be removed so as not to cause damage to the polyester roundslings.
- 2.6.1.3 **DESIGN CRITERIA** Fitting(s) shall have a minimum design factor of five (5) and have sufficient strength to sustain (2) times the rated capacity without permanent deformation.
- 2.6.1.4 **REUSE OF FITTINGS** Fittings shall be inspected prior to reuse. Fittings shall not be used if excessive wear, pitting corrosion, cracks, distortion or breaks are visible.
- 2.6.1.5 **PROOF LOAD TEST** Permanently attached fittings that are reused or welded fittings shall be proof tested to a minimum of two (2) times the rated capacity.

SECTION 2.7 COATINGS

- 2.7.1 Finishes and coatings shall be compatible with material of the core(s) and cover(s), and shall not impair the performance of the polyester roundslings.

SECTION 2.8 DESIGN FACTOR FOR NEW POLYESTER ROUNDSLINGS

WARNING

Never exceed the rated capacity of any polyester roundsling(s). The loading of any polyester roundsling beyond its rated capacity can result in severe personal injury or death. The sling design factor is based on destructive, laboratory controlled testing conditions, which will not be exactly duplicated during actual loading conditions.

- 2.8.1 The design factor for new polyester roundslings and polyester roundslings incorporating fittings shall be a minimum of five (5) when tested in accordance with Chapter 3.

SECTION 2.9 IDENTIFICATION

- 2.9.1 Polyester roundsling protective covers should be color coded to correspond with the rated capacity shown in Table 1. Always check the identification tag to determine if the polyester roundsling's rated capacity is applicable for the lift.
- 2.9.2 Polyester roundslings with a color code different from those shown in Table I shall be used in accordance with the roundsling manufacturer's recommendation. Always check the identification tag to determine if the polyester roundsling's rated capacity is applicable for the lift.
- 2.9.3 Each polyester roundsling shall be durable marked or labels showing.
1. Name or trademark of manufacturer.
 2. Manufacturer's code or stock number.
 3. Rated capacities for the three basic hitches, (Vertical, Choker, Vertical Basket), or for the designated hitch of intended use.
 4. Core fiber type - If the cover(s) is of a different fiber type, both fiber types shall be identified.
 5. Length (reach) - bearing point to bearing point.
- 2.9.4 Each manufacturer shall internally identify their product with name or trademark for traceability.

SECTION 2.10 RATED CAPACITY

- 2.10.1 A polyester roundsling shall not be loaded in excess of the rated capacity in Table I and/or on its identification tag. Polyester roundslings not included in this table shall only be used in accordance with the manufacturer's recommendations.
- 2.10.2 Each manufacturer shall retain test data to verify the minimum breaking strength. Destructive tests shall be conducted according to the test procedure outline in Chapter 3.
- 2.10.3 The choker hitch shall be rated at a maximum of 80 percent of the vertical capacity. (see paragraph 3.3.4B and Figure 7)
- 2.10.4 The vertical basket hitch capacity shall be rated at a maximum of two (2) times the vertical capacity.

Table 1 RATED CAPACITY FOR POLYESTER ROUNDSLING

Roundsling Size / #	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.

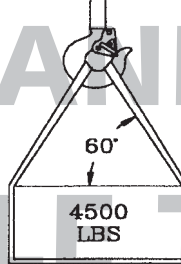
2.10.5 Sling lifting capacities are affected by angle of lift (roundsling to load angle) measured from the horizontal, when used with multi-legged roundslings or choker/basket hitches. To determine the actual capacity at a given angle of lift, multiply the original roundsling rating by the appropriate loss factor determined from Table 2.

Table 2 SLING ANGLE CHART (Angle of Lift)

Angle In Degrees From Horizontal	Factor	Angle In Degrees From Horizontal	Factor
90	1.00	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: Polyester roundsling size number 1 (purple) without fittings, 5,200 vertical basket hitch rating, used in a basket hitch, at a 60 degree angle.

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5,200 LBS X **0.866** = **4,500 LB Rated Capacity**

Roundsling Rating **Factor From** = **Rated Capacity**
Vertical Basket From Table 1 **Paragraph 2.10.5**

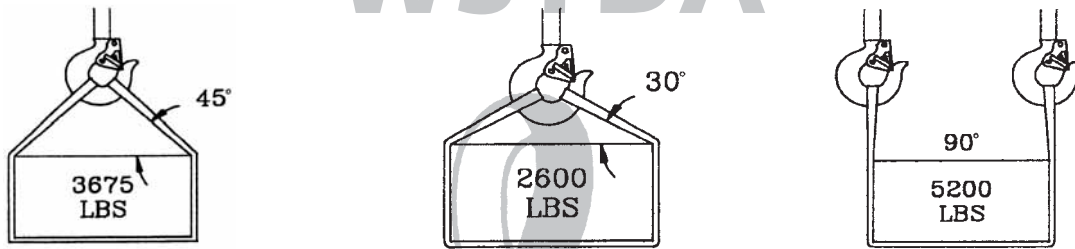


FIGURE 6

2.10.6 Rated Capacity of Choker Hitch. See Figure 7

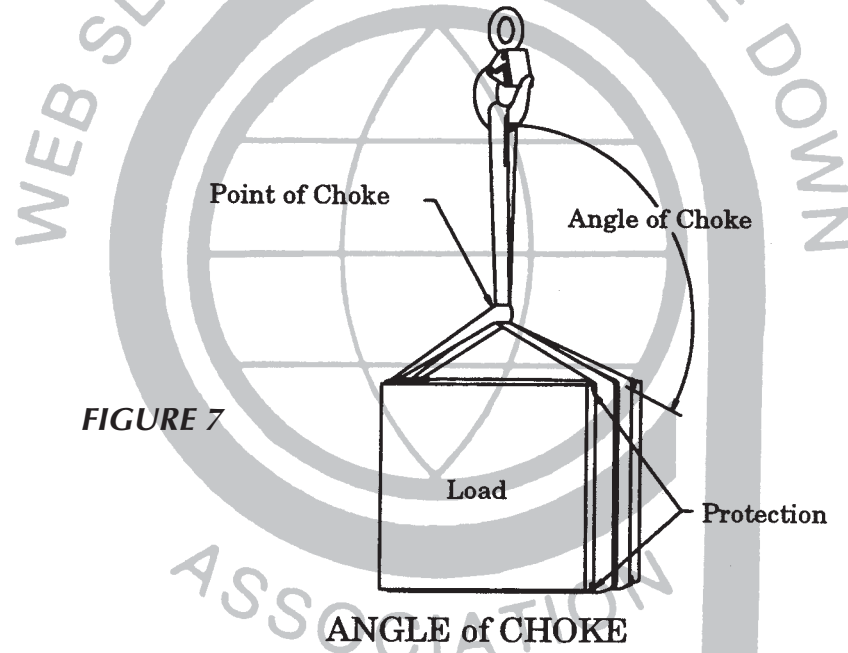


FIGURE 7

Table 3 Rated Capacity of Choker Hitch

Angle In Choke (degrees)	Sling Rated Load Factor
120-180	1.00
105-120	0.93
90-105	0.87

CHAPTER 3.0

STANDARD PROCEDURES FOR TESTING

SECTION 3.1 PURPOSE

- 3.1.1 This chapter provides standard procedures for the testing of synthetic polyester roundslings

SECTION 3.2 TYPE OF TESTS

- 3.2.1 **DESTRUCTIVE** A tensile test of a polyester roundsling for the purpose of verifying the rated capacity. The polyester roundsling shall be pulled in a vertical hitch until the load bearing core(s) fails.
- 3.2.2 **PROOF LOAD** A non-destructive load test of a polyester roundsling to some multiple of the rated capacity of the roundsling, including fittings, if applicable, usually two (2) times the rated capacity.
- 3.2.2.1 The polyester roundsling shall not be preloaded prior to testing unless this is part of the manufacturer's normal production process.

SECTION 3.3 TEST CHARACTERISTICS

- 3.3.1 **SAMPLE** For purposes of verification of rated capacities, the test polyester roundsling should be taken from a production lot.
- 3.3.2 **LENGTH** Polyester roundsling length, pull to pull, should be a minimum of three (3) feet (900mm) not including fittings.
- 3.3.3 **FITTINGS** Polyester roundslings incorporating fittings shall be tested with the fittings attached.
- 3.3.4 **HITCHES** (For Testing Only)
- A VERTICAL** The polyester roundsling shall be rigged in the test machine so that tension is applied in a straight line of pull. See Figure 8



FIGURE 8

- B CHOKER** The polyester roundsling shall be rigged in the test machine so that the minimum angle (a) of choke is 120 degrees. See Figure 9

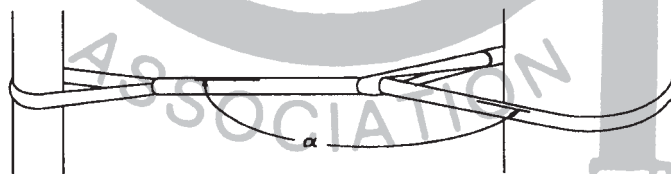


FIGURE 8

- C **BASKET** The polyester roundsling shall be rigged in the test machine so that the maximum included angle (\angle) of the legs is 60 degrees. See Figure 10

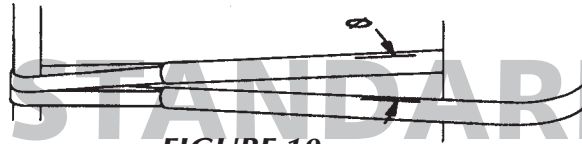


FIGURE 10

- 3.3.5 Proof testing should be conducted using a pin diameter of not less than shown in Table 4.

SECTION 3.4 CERTIFICATION

- 3.4.1 When certification is required, a certificate shall be issued describing the type, date, and result of test by the company performing the test.

SECTION 3.5 TEST PROCEDURE OF POLYESTER ROUNDSLINGS FOR THE VERIFICATION OF RATED CAPACITY



WARNING

The use of improper fittings and/or materials may result in severe personal injury or death.

- 3.5.1 Destructive testing of polyester roundslings without fittings shall be tested on the following maximum pin diameters. The pins shall be capable of sustaining the maximum applied load without deformation or failure.

FIGURE 11

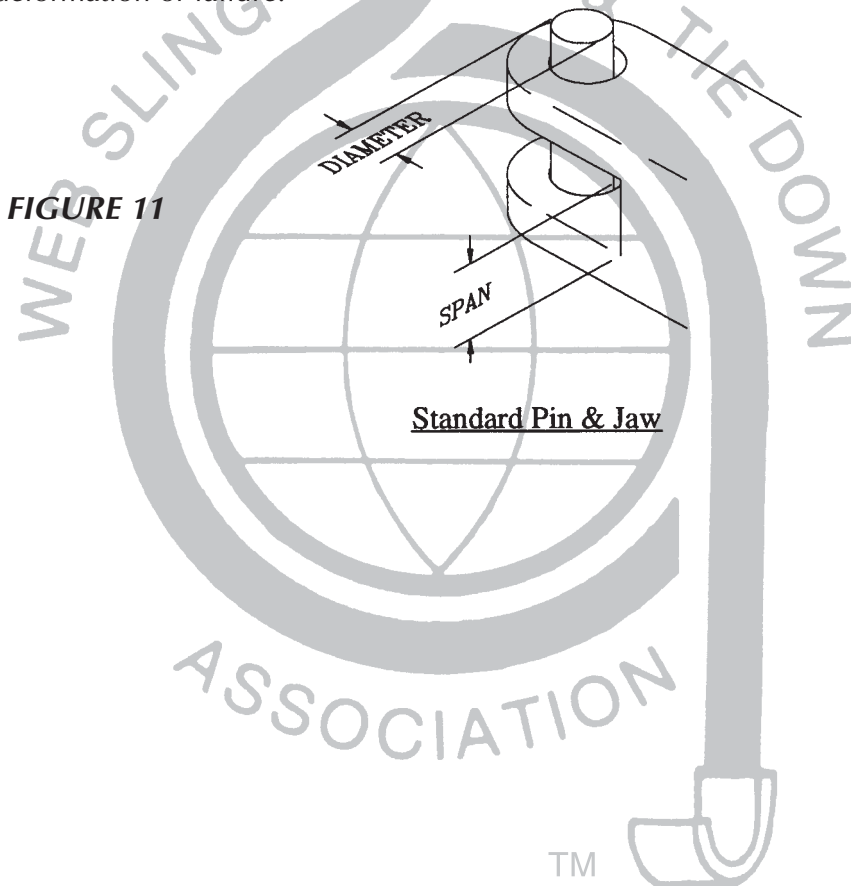


Table 4 TESTING HARDWARE

Sling Capacity Range- Vertical Hitch (lbs)	Referenced WSTDA Sling Size Number	Sling Vertical Hitch Capacity (lbs)	Pin Span. Minimum (inches)	Pin Diameter (inches)	Allowable Diameter Tolerances (inches)
Up To 6,000	1 2	2,600 5,300	2-3/16 in (56 mm)	1-1/8 in (28 mm)	+ - 1/16 in.
6,001 to 15,000	3 4 5	8,400 10,600 13,200	2-3/4 in (70 mm)	1-1/2 in (38 mm)	+ - 1/8 in.
15,001 to 30,000	9 10 11	16,800 21,200 25,000	3-1/4 in. (82 mm)	2 in. (50 mm)	+ - 1/8 in.
30,001 to 60,000	6 7 8	31,000 40,000 53,000	6 in. (150 mm)	3-1/4 in. (82 mm)	+ - 1/8 in.
60,001 to 100,000	12 13	66,000 90,000	7 in. (175 mm)	4 in. (100 mm)	+ - 1/8 in.

*Caution: The above pin sizes shall be used to develop the polyester roundsling vertical rated capacities. Pin sizes smaller than these may reduce the rated capacity of the polyester roundsling. **These pin sizes may not be adequate for testing polyester roundslings in a basket configuration.***

- 3.5.2 Polyester roundslings shall be tested in a manner that allows the load bearing fibers to spread out and share the load evenly.
- 3.5.3 All polyester roundslings shall be pulled at a head speed of 4 to 10 inches (100-250mm) per minute, or a maximum of 3,000 pounds (1,365kg) per second.
- 3.5.4 Polyester roundslings should be tested at ambient temperatures unless otherwise specified.
- 3.5.5 The test machine shall be certified annually to ASTM-E4.

SECTION 3.6 SAMPLE TESTING OF POLYESTER ROUNDSLINGS

- 3.6.1 **NUMBER OF TEST SAMPLES** A minimum number of polyester roundsling samples shall be destructive load tested annually by the manufacturer according to the following sampling rate schedule.

Table 5 SAMPLE SLING TESTING RATE SCHEDULE

Range For The Number Of Slings Manufactured Annually Per Sling Size	Number Of Sling Samples
Less Than 500	One for each 500 slings manufactured and at least one sling every three years.
At Least 500, But Less Than 1,000	One Sling Annually
At Least 1,000, But Less Than 2,000	Two Slings Annually
At Least 2,000, But Less Than 10,000	One Sling for every 1,000 manufactured
At Least 10,000, But Less Than 50,000	One Sling for every 2,000 manufactured
50,000 Or More	One Sling for every 4,000 manufactured

- 3.6.2 **PASS CRITERIA** If all test values meet or exceed the required breaking strength value, the sample group meets this test criteria.
- 3.6.3 **RETEST CRITERIA** If any single test value falls below the required breaking strength value, two additional samples shall be tested. These two additional samples shall meet or exceed the required breaking strength value, or otherwise the process is rejected.
- 3.6.4 **REJECTION CRITERIA** If the retest of the sample group fails to meet or exceed the required breaking strength value, the sample group fails and the process is rejected.
- 3.6.5 **CORRECTIVE ACTION** Following any process rejection, the manufacturing practice shall be examined and adjusted as necessary. Then the product shall be retested prior to any distribution.

CHAPTER 4.0 RECOMMENDED OPERATING PRACTICES

SECTION 4.1 PURPOSE

- 4.1.1 The purpose of this chapter is to provide guidelines for the designated person responsible for polyester roundsling selection, rigging, inspection and use.

SECTION 4.2 MECHANICAL CONSIDERATIONS

- 4.2.1 Determine weight of the load. The weight of the load shall be within the rated capacity of the polyester roundsling(s).
- 4.2.2 Select a polyester roundsling having suitable characteristics for the type of load, hitch and environment.
- 4.2.3 Polyester roundslings shall not be loaded in excess of the rated capacity. Consideration shall be given to the roundsling to load angle, which affects rated capacities. See 2.10.5
- 4.2.4 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 roundsling, and never on the fitting.
- 4.2.5 Polyester roundslings used in a basket hitch shall have the load balanced to prevent slippage.
- 4.2.6 The openings in fittings shall be the proper shape and size to ensure that the fittings will seat properly on the polyester roundsling, crane hook or other attachments.
- 4.2.7 Polyester roundslings shall always be protected from being cut by sharp corners, sharp edges, protrusions or abrasive surfaces.
- 4.2.8 Polyester roundslings should not be dragged on the floor or over an abrasive surface.
- 4.2.9 Polyester roundslings shall not be twisted, shortened, lengthened, tied into knots or joined by knotting.
- 4.2.10 Polyester roundslings should not be pulled from under loads when the load is resting on the polyester roundsling.
- 4.2.11 Do not drop polyester roundslings equipped with metal fittings.

- 4.2.12 Polyester roundslings that appear to be damaged shall not be used unless inspected and accepted as usable under Sections 4.5 and 4.6.
- 4.2.13 The polyester roundsling shall be hitched in a manner providing control of the load.
- 4.2.14 Personnel, including all portions of the human body, shall be kept from between the polyester roundsling and the load; and from between the polyester roundsling and the crane hook or hoist hook.
- 4.2.15 Personnel shall stand clear of the suspended load.
- 4.2.16 Personnel shall not ride the roundsling, or a load suspended by the roundsling.
- 4.2.17 Shock loading shall be avoided.
- 4.2.18 Twisting the legs (branches) shall be avoided.
- 4.2.19 Load applied to a hook shall be centered in the bowl of the hook to prevent point loading.
- 4.2.20 During lifting, personnel shall be alert for possible snagging of the polyester roundsling.
- 4.2.21 The polyester roundsling's legs (branches) shall contain or support the load from the sides above the center of gravity when using a basket hitch.
- 4.2.22 Polyester roundslings shall be long enough so the rated capacity is adequate when the sling to load angle is taken into consideration. See 2.10.5
- 4.2.23 Tags and labels should be kept away from the load, hook and point of choke.
- 4.2.24 Polyester roundslings should not be constricted or bunched between the ears of a clevis, or a shackle or in a hook. When a polyester roundsling is used with a shackle, it is recommended that it be used (rigged) in the bow of the shackle.
- 4.2.25 Place blocks under load prior to setting the load down to allow removal of the polyester roundsling, if applicable.

SECTION 4.3 SELECTION OF PROPER CONNECTION HARDWARE

- 4.3.1 Connection hardware should be selected such that it either:
- A** Conforms to the size requirements listed in Tables 6 and 7.
- OR**
- B** Sized such that the bearing stress value at the connection does not exceed 7,000 Lbs/in² during the sling loading. See calculations in Table 6, next page.

Table 6 SUITABLE CONNECTION HARDWARE SIZES - VERTICAL / CHOKER HITCH

ROUNDSLING		HARDWARE SIZE	
WSTDA Roundsling 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 7 SUITABLE CONNECTION HARDWARE SIZES - BASKET HITCH

ROUNDSLING		HARDWARE SIZE**	
WSTDA Roundsling Size	Rated Capacity - Vertical 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.

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

4.3.1.1 EFFECTIVE CONTACT WIDTH BETWEEN THE SLING AND CONNECTION HARDWARE

- 1. 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 12). Please note, however, that the effective contact width will never exceed the natural flattening width of the sling as listed in Tables 6 and 7.
- 2. Connection to Round Bottom (or Curved) Surface 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 13). 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 width will never exceed the natural flattening width of the sling as listed in Tables 6 and 7.

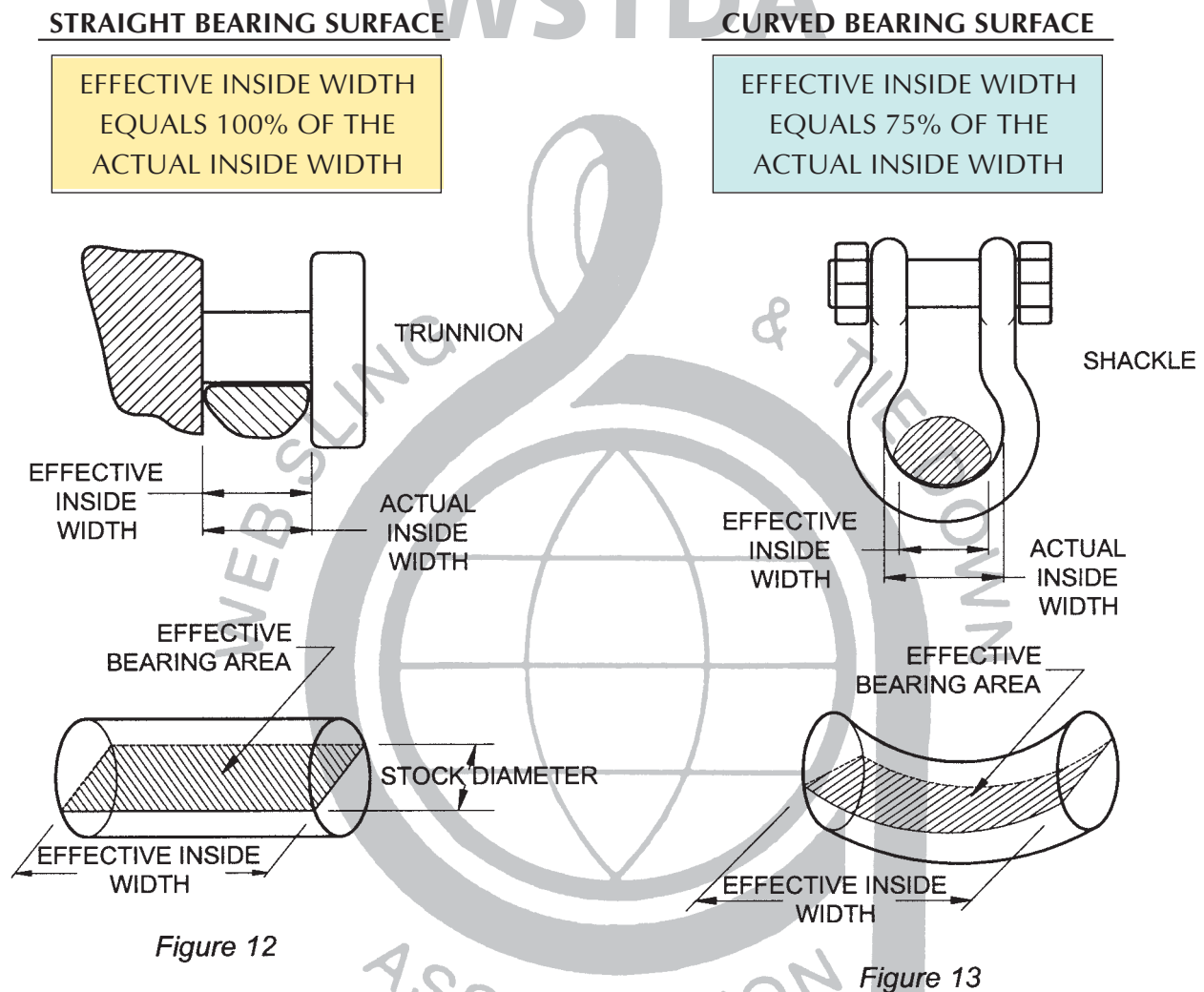


Figure 12

Figure 13

Note:

Roundsling strength is affected by the size of the connection hardware. The size of the recommended hardware reference in this section has been selected in order to retain a design factor of approximately 4 which roundslings are tested using this hardware under laboratory controlled test conditions. For special applications wherein a retained design factor of 5 is required, either the roundsling rated capacity must be reduced accordingly, or the connection hardware should be selected such that its size is equal to, or larger than, the specified test pin sizes listed in Table 4 or Section 3.5.

4.3.1.2 **LOAD BEARING AREA AT THE HARDWARE CONNECTION** The load bearing area at the hardware connection is determined by multiplying the thickness of stock diameter of the hardware by the effective contact width at the connection.

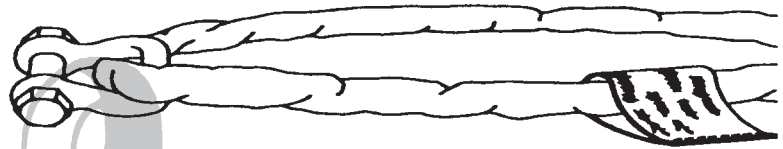
$$\text{Load Bearing Area} = (\text{Hardware Thickness or Stock Diameter}) \times (\text{Effective Contact Width})$$

4.3.1.3 **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.

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

EXAMPLE: A size 3 roundsling, 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 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 pounds is applied, noticeably less than the rated capacity of the sling. Is this use of the shackle acceptable?

6,000 Lbs. of Force ←



ANSWER: Since the shackle size is smaller than recommended for a size 3 roundsling per Table 6, we need to establish that the bearing stress value does not exceed 7,000 Lbs per inch² during use.

Since the bearing surface of the shackle is rounded:

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

And:

$$\begin{aligned} \text{Load Bearing Area} &= (\text{the shackle stock diameter}) \times (\text{the effective contact width}) \\ &= (.62 \text{ inches}) \times (1.50 \text{ inches}) = \mathbf{.93 \text{ in}^2} \end{aligned}$$

$$\begin{aligned} \text{Bearing Stress Value} &= (\text{the applied force}) / (\text{load bearing area}) \\ &= (6,000 \text{ lbs}) / (.93 \text{ in}^2) \\ &= \mathbf{6,451 \text{ lbs per in}^2} \end{aligned}$$

Thus:

Since the bearing stress value is less than 7,000 lbs per inch² during use, **the selected shackle size is suitable.**

SECTION 4.4 ENVIRONMENTAL CONSIDERATIONS

- 4.4.1 Polyester roundslings should be stored in a cool, dry and dark place to prevent loss of strength when not in use through exposure to ultra-violet rays. Polyester roundslings shall not be stored in chemically active area.
- 4.4.2 Chemically active environments can affect the strength of polyester roundslings in varying degrees, ranging from little to total degradation. The polyester roundsling manufacturer, or a qualified person, should be consulted before roundslings are used in a chemically active environment.

4.4.2.1 ACIDS

4.4.2.1.1 Polyester is resistant to many acids, but is subject to degradation, ranging from little to moderate in some acids.

4.4.2.1.2 Each application shall be evaluated, taking into consideration the following:

1. Type of Acid
2. Exposure Conditions
3. Concentration
4. Temperature

4.4.2.2 ALKALIS

4.4.2.2.1 Polyester is subject to degradation in alkalis, ranging from little to total degradation.

4.4.2.2.2 Each application shall be evaluated, taking into consideration the following:

1. Type of Alkali
2. Exposure Conditions
3. Concentration
4. Temperature

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

4.4.4 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.

SECTION 4.5 INSPECTION

4.5.1 Polyester roundslings shall be visually inspected by a designated person handling the polyester roundslings before each use. These visual observations shall be concerned with the identification tag and discovering damage, such as listed in Section 4.6. Polyester roundslings shall be removed from service if there is any doubt as to the condition of the roundslings.

4.5.2 TYPE OF INSPECTION

A Initial Inspection Before any polyester roundslings is placed into service it shall be inspected by a designated person to ensure that the correct roundslings is being used, as well as to determine that the roundslings meets the requirements of this specification.

B Frequent Inspection This inspection shall be made by the user or other designated personnel each time the roundslings is used (records not required).

C Periodic Inspection This inspection shall be conducted by a designated person. Frequency of inspection should be based on:

1. Frequency of use
2. Severity of service conditions
3. Experience gain on service life of polyester roundslings used in similar applications
4. Periodic inspections should be conducted at least annually

SECTION 4.6 REMOVAL FROM SERVICE

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

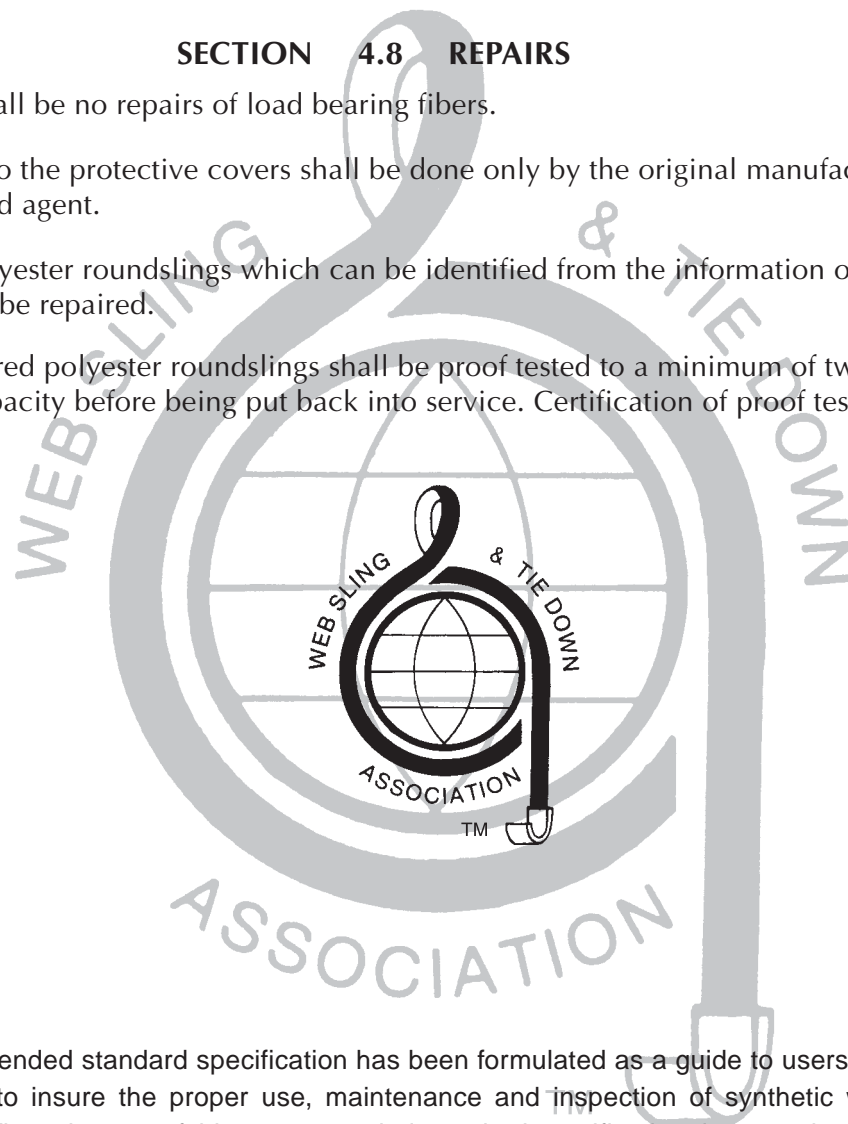
1. If polyester roundsling identification tag is missing or not readable.
2. Melting, charring or weld spatter on any part of the polyester roundsling
3. Holes, tears, cuts, embedded particles, excessive abrasive wear, or snags that expose the core fibers of the polyester roundsling
4. Broken or worn stitching in the cover which exposes the core fibers
5. Fittings when damaged, stretched, corroded, cracked or distorted in any way
6. Polyester roundslings that are knotted
7. Acid or alkali burns of the polyester roundsling
8. Any conditions which cause doubt as to the strength of the polyester roundsling

SECTION 4.7 INSPECTION RECORDS

4.7.1 Written inspection records, utilizing the identification for each polyester roundsling as established by the user, should be kept on file. These records should show a description of the new polyester roundsling and its condition on each periodic inspection.

SECTION 4.8 REPAIRS

- 4.8.1 There shall be no repairs of load bearing fibers.
- 4.8.2 Repairs to the protective covers shall be done only by the original manufacturer or their appointed agent.
- 4.8.3 Only polyester roundslings which can be identified from the information on the identification tag shall be repaired.
- 4.8.4 All repaired polyester roundslings shall be proof tested to a minimum of two (2) times the rated capacity before being put back into service. Certification of proof test should be provided.



This recommended standard specification has been formulated as a guide to users, industry and government to insure the proper use, maintenance and inspection of synthetic web tie down assemblies. The existence of this recommended standard specification does not, however, prevent members of the Web Sling & Tie Down Association, Inc. and other manufacturers from manufacturing or selling products not conforming to the standards.

OTHER WEB SLING & TIE DOWN ASSOCIATION PUBLICATIONS

Recommended Standard Specifications:

Recommended Standard Specifications:

Printed Books

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
All Standards In A Three-Ring Binder	WSTDA-ASB-2006

PDF Files On CD

Synthetic Web Slings	WSTDA-SCD-WS-1
Synthetic Polyester Roundslings	WSTDA-SCD-RS-1
Webbing for Synthetic Web Slings	WSTDA-SCD-WB-1
Sewing Threads for Slings & Tie Downs	WSTDA-SCD-TH-1
Synthetic Web Tie Downs	WSTDA-SCD-T-1
Winches Used With Web Tie Downs	WSTDA-SCD-T-3
Synthetic Webbing Used for Tie Downs	WSTDA-SCD-T-4
All Standards CD - (All above on one CD)	WSTDA-ASCD-2006

Operating & Inspection Manuals

Synthetic Web Slings	WSTDA-WS-2
Synthetic Web Slings	WSTDA-WS-PS-2 (pocket sized)
Synthetic Polyester Roundslings	WSTDA-RS-2
Synthetic Polyester Roundslings	WSTDA-RS-2-PS (pocket sized)
Synthetic Web Tie Downs	WSTDA-T-2

Video

Synthetic Web Sling Care & Inspection	WSTDA-WSV-1-VHS
Synthetic Web Sling Care & Inspection	WSTDA-WSV-1-CD

Illustrated Wall Chart

Inspection of Web Slings & Round Slings	WSTDA-WSWC-1
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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
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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, contact the association office or visit our website:

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