

WAC 296-155-33805 Wire rope slings. (1) Manufacturing wire rope slings.

(a) Wire rope slings must be made from new or unused regular lay wire rope. The wire rope must be manufactured and tested in accordance with ASTM A 1023-02 and ASTM A 586.

(b) The following fabrication methods must be used to make wire rope slings:

- (i) Hand splicing;
- (ii) Turnback eye;
- (iii) Return loop;
- (iv) Flemish eye mechanical splicing;
- (v) Poured or swaged socketing.

(c) Wire rope slings must have a design factor of 5.

(d) Wire rope slings must meet the requirements in Table 6.

(e) Using any of the following when making wire rope slings is prohibited:

- (i) Rotation resistant wire rope;
- (ii) Malleable cast iron clips;
- (iii) Knots;
- (iv) Wire rope clips, unless:

- The application of the sling prevents using prefabricated slings;

- The specific application is designed by a qualified person.

(f) Wire rope clips, if used, must be installed and maintained in accordance with the recommendations of the clip manufacturer or a qualified person, or in accordance with the provisions of ASME B30.26-2010.

(g) You must not use slings made with wire rope clips as a choker hitch.

Note: If using wire rope clips under these conditions, follow the guidance given in Table 5.

Table 5

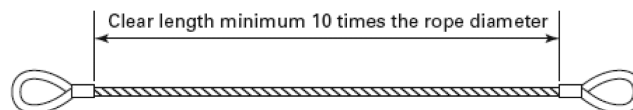
Number, Torque Values, and Turn Back Requirements for U-Bolt Wire Rope Clips				Number, Torque Values, and Turn Back Requirements for Double Saddle (Fist Grip) Wire Rope Clips			
Clip & Wire Rope Size (inches)	Min. No. of Clips	Amount of Rope Turn Back in Inches	*Torque in Ft. Lbs.	Clip & Wire Rope Size (inches)	Min. No. of Clips	Amount of Rope Turn Back in Inches	*Torque in Ft. Lbs.
1/8	2	3-1/4	4.5	3/16-1/4	2	4	30
3/16	2	3-3/4	7.5	5/16	2	5	30
1/4	2	4-3/4	15	3/8	2	5-1/4	45
5/16	2	5-1/4	30	7/16	2	6-1/2	65
3/8	2	6-1/2	45	1/2	3	11	65
7/16	2	7	65	9/16	3	12-3/4	130
1/2	3	11-1/2	65	5/8	3	13-1/2	130
9/16	3	12	95	3/4	4	16	225
5/8	3	12	95	7/8	4	26	225
3/4	4	18	130	1	5	37	225
7/8	4	19	225	1-1/8	5	41	360
1	5	26	225	1-1/4	6	55	360
1-1/8	6	34	225	1-3/8	6	62	500
1-1/4	7	44	360	1-1/2	7	78	500
1-3/8	7	44	360				

Number, Torque Values, and Turn Back Requirements for U-Bolt Wire Rope Clips				Number, Torque Values, and Turn Back Requirements for Double Saddle (Fist Grip) Wire Rope Clips			
Clip & Wire Rope Size (inches)	Min. No. of Clips	Amount of Rope Turn Back in Inches	*Torque in Ft. Lbs.	Clip & Wire Rope Size (inches)	Min. No. of Clips	Amount of Rope Turn Back in Inches	*Torque in Ft. Lbs.
1-1/2	8	54	360				
1-5/8	8	58	430				
1-3/4	8	61	590				
2	8	71	750				
2-1/4	8	73	750				
2-1/2	9	84	750				
2-3/4	10	100	750				
3	10	106	1200				
3-1/2	12	149	1200				

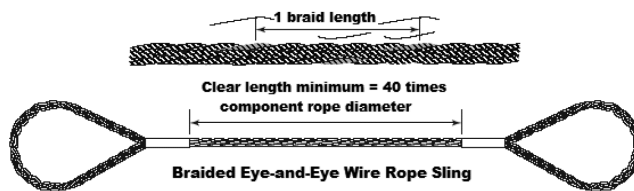
* The tightening torque values shown are based upon the threads being clean, dry, and free of lubrication.

**Table 6
Wire Rope Sling Configuration Requirements**

If you have:	Then you need:
<ul style="list-style-type: none"> Slings made of rope with 6x19 and 6x36 classification. Cable laid slings. 	A minimum clear length of rope 10 times the rope diameter between splices, sleeves, or end fittings (see Figure 4, Minimum Sling Length) unless approved by a qualified person.
<ul style="list-style-type: none"> Braided slings. 	A minimum clear length of rope 40 times the component rope diameter between the loops or end fittings (see Figure 5, Minimum Braided Sling Length) unless approved by a qualified person.
<ul style="list-style-type: none"> Grommets and endless slings. 	A minimum circumferential length of 96 times the body diameter of the grommet or endless sling unless approved by a qualified person.
<ul style="list-style-type: none"> Other configurations. 	Specific limitation data provided by a qualified person. These slings must meet all other requirements of ASME B30.9-2010.



**Figure 4 Minimum Sling Length
For rope with 6x19 and 6x36 classification or Cable Laid Slings**



**Figure 5
Minimum Braided Sling Length**

(2) Wire rope sling fittings.

(a) You must use fittings according to the fitting manufacturer's directions.

(b) You must rate slings with the load capacity of the lowest rated component of the sling. For example, if you use fittings that are rated lower than the sling material itself, identify the sling with the lower rated capacity.

(c) You must weld any end attachments, except covers to thimbles, before assembling the sling.

(3) Identification information. All wire rope slings must have legible identification information attached to the sling which includes the information below, see sample tag in Figure 6. For slings in use that are manufactured before the effective date of this rule, the information below must be added before use or at the time the periodic inspection is completed.







(a) Name or trademark of the manufacturer.

(b) Diameter or size.

(c) Rated loads for the types of hitches used and the angle that the load is based on.

(d) Number of legs, if more than one.

(e) Repairing agency, if the sling is ever repaired.

Vert. 	Chock 	Vert. Basket 
2.2 Tons	1.6 Tons	4.4 Tons
Rated Capacity by Angle		
60° 	45° 	30° 
3.8 Tons	3.1 Tons	2.2 Tons

**Figure 6
Sample Wire Rope Sling ID Tag**

Note: Sample tag for a 1/2" single-leg sling 6x19 or 6x36 classification, extra improved plow steel (EIPS) grade fiber core (FC) wire rope with a mechanical splice (ton = 2,000 lb).

(4) Inspection.

(a) A qualified person must inspect wire rope slings before their initial use, according to Table 7, both:

(i) When the sling is new; and

(ii) Whenever a repair, alteration, or modification has been done.

(b) A qualified person must perform a visual inspection for damage, each day or shift the wire rope sling is used:

(i) Include all fastenings and attachments;

- (ii) Immediately remove any sling from service that is damaged beyond the criteria listed in Table 7; or
- (iii) Remove fiber core wire rope slings that have been exposed to temperatures higher than 180 degrees Fahrenheit.
- (c) A qualified person must perform periodic inspections on wire rope slings according to Table 7.
 - (5) **Repair, alterations, or modifications.**
 - (a) You must repair wire rope slings as follows:
 - (i) Make sure slings are only repaired by the sling manufacturer or a qualified person;
 - (ii) Mark the sling to show the repairing agency;
 - (iii) Do not repair wire rope used in slings, wire rope must be replaced. Only end attachments and fittings can be repaired on a wire rope sling.
 - (b) You must consider modification or alterations to end attachments or fittings must be considered as repairs and must conform to all other provisions of this part.
 - (c) You must proof load test repaired slings according to the requirements in subsection (6) of this section.
 - (6) **Proof load tests.** You must make sure the sling manufacturer or a qualified person proof load tests the following slings before initial use, according to Table 8:
 - (a) All repaired slings;
 - (b) All slings incorporating previously used or welded fittings;
 - (c) For single- or multiple-leg slings and endless slings, each leg must be proof loaded according to the requirements listed in Table 8 based on fabrication method. The proof load test must not exceed 50% of the component ropes' or structural strands' minimum breaking strength;

**Table 7
Wire Rope Sling Inspection and Removal Criteria**

Inspect wire rope slings for the following conditions:	Perform inspections:
<ul style="list-style-type: none"> • Missing or illegible sling identification. • Severe localized abrasion or scraping. • Kinking, crushing, birdcaging, or any other condition resulting in damage to the rope structure. • Evidence of heat damage. • Severe corrosion of the rope, end attachments, or fittings. • End attachments that are cracked, deformed, or worn to the extent that the strength of the sling is substantially affected. • Broken wires: 	<ul style="list-style-type: none"> • At least once a year for slings in normal service. • At least once a quarter for slings in severe service. • As recommended by a qualified person for slings in special service.

Inspect wire rope slings for the following conditions:	Perform inspections:
<ul style="list-style-type: none"> – For strand-laid and single-part slings, 10 randomly distributed broken wires in one rope lay, or 5 broken wires in one strand in one rope lay; – For cable-laid slings, 20 broken wires per lay; – For 6-part braided slings, 20 broken wires per braid; – For 8-part braided slings, 40 broken wires per braid. • Hooks that have any of the following conditions: <ul style="list-style-type: none"> – Any visibly apparent bend or twist from the plane of the unbent hook; – Any distortion causing an increase in throat opening 5%, not to exceed 1/4 inch, or as recommended by the manufacturer; – Wear exceeding 10%, of the original section dimension of the hook or its load pin, or as recommended by the manufacturer; – Self-locking mechanism that does not lock. • Other visible damage that raises doubt about the safety of the sling. 	

Table 8
Wire Rope Sling Proof Load Test Requirements

Type of equipment:	Proof load test:
<ul style="list-style-type: none"> • Mechanical splice slings. 	Each leg to at least two times the single leg vertical hitch rated load.
<ul style="list-style-type: none"> • Swaged socket and poured socket slings. 	Each leg to at least two times, but not more than two and 1/2 times, the single-leg vertical hitch rated load.

Type of equipment:	Proof load test:
<p>Note: For mechanical splice, swaged socket and poured socket slings follow the rope manufacturer's recommendations for proof load testing provided that it is within the above-specified proof load range, including (c) of this subsection.</p>	
<ul style="list-style-type: none"> Hand tucked slings, if proof load tested. 	<p>To at least one, but not more than one and 1/4, times the single-leg vertical hitch rated load.</p>

(d) The proof load test for components (fittings) attached to single legs must meet the requirements in (c) of this subsection;

(e) Proof load testing for master links must be in accordance with Table 9.

**Table 9
Proof Load Test for Master Links on Wire Rope Slings**

<ul style="list-style-type: none"> Master links for two-leg bridle slings. 	<p>To at least 4 times the single-leg vertical hitch rated load.</p>
<ul style="list-style-type: none"> Master links for 3-leg bridle slings. 	<p>To at least 6 times the single-leg vertical hitch rated load.</p>
<ul style="list-style-type: none"> Master links for 4-leg bridle slings. 	<p>To at least 8 times the single-leg vertical hitch rated load.</p>

(7) **Rated load.** The term "rated capacity" is commonly used to describe rated load.

Note: Rated loads are based on the following factors:

- Strength of sling material;
- Design factor;
- Type of hitch;
- Angle of loading (see Figure 7, Angle of Loading);
- Diameter of curvature over which the sling is used (D/d) (see Figure 8, D/d ratio);
- Fabrication efficiency.

(a) You must use wire rope slings within the rated loads shown in Tables 7 through 15 in ASME B30.9-2010. For angles that are not shown in these tables, either use the rated load for the next lower angle or have a qualified person calculate the rated load.

(b) You must prohibit the use of horizontal sling angles less than 30 degrees unless recommended by the sling manufacturer or a qualified person. See Figure 7.

(c) Rated loads for slings used in a choker hitch must conform to the values shown in the above referenced tables, provided that the angle of choke is 120 degrees or greater. See Figure 9 and Table 10, Angle of Choke.

(d) You must use either Figure 9 and Table 10, the manufacturer, or a qualified person to determine the rated load if the angle of choke in a choker hitch is less than 120 degrees.

(i) You must inspect the entire length of the sling including splices, end attachments, and fittings.

(ii) You must remove slings from use if any of the conditions in Table 7 are found.

(iii) You must keep a record of the most recent periodic inspection available, including the condition of the sling.

Note: An external code mark on the sling is an acceptable means of recording the inspection as long as the code can be traced back to a record.

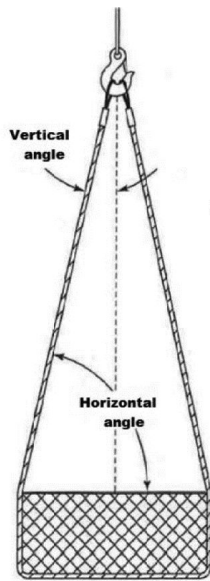


Figure 7
Angle of Loading

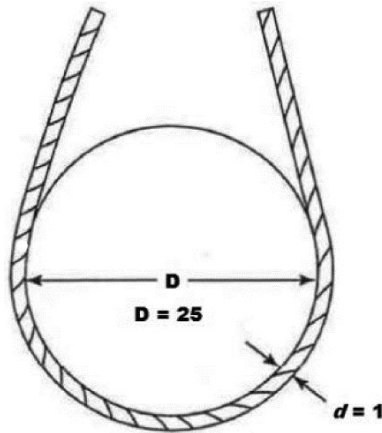


Figure 8
D/d Ratio

Note: When D is 25 times the component rope diameter (*d*) the D/*d* ratio is expressed as 25/1.

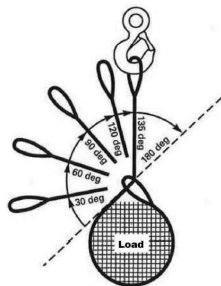


Figure 9
Angle of Choke

Table 10
Angle of Choke

Angle of Choke, deg.	Rated Capacity, %
Over 120	100
90 - 120	87

Angle of Choke, deg.	Rated Capacity, %
60 - 89	74
30 - 59	62
0 - 29	49

Note: Percent of sling rated capacity in a choker hitch.

(8) **Use of wire rope slings.**

(a) You must hitch the slings in a way that provides control of the load.

(b) You must shorten or adjust slings using only the methods approved by the manufacturer or qualified person.

(i) You must **not** shorten or lengthen by knotting, twisting, or by wire rope clips.

(c) You must keep all parts of the human body from between the sling and the load, crane, or hoist hook.

(d) You must prohibit all of the following:

(i) Intentional shock loading;

(ii) Avoid twisting and kinking.

(e) You must decrease the rated load of the sling when D/d ratios (Figure 8) smaller than 25 to one. Consult the sling manufacturer for specific data or refer to the *Wire Rope Sling User's Manual* (wire rope technical board).

(f) You must follow Table 11, Use of Wire Rope Slings or Clips, when using any of the identified wire rope slings or clips.

(g) Slings in contact with edges, corners, or protrusions must be protected with a material of sufficient strength, thickness, and construction to prevent damage to the sling. See Figure 3.

**Table 11
Use of Wire Rope Slings or Clips**

If you are using:	Then:
Single leg slings used with multiple-leg slings.	Make sure the rating shown is not exceeded in any leg of the multiple-leg sling.
Hand tucked slings are used in a single leg vertical lift.	Do not allow the sling or load to rotate.
Slings made with wire rope clips.	Must not be used as a choker hitch.
U-bolt wire rope clips.	Use only U-bolt wire rope clips that are made of drop-forged steel.
	Follow Table 5 for the number and spacing of the clips.
	Apply the U-bolt so the "U" section is in contact with the dead end of the rope (see Figure 10, Installation and Loading).

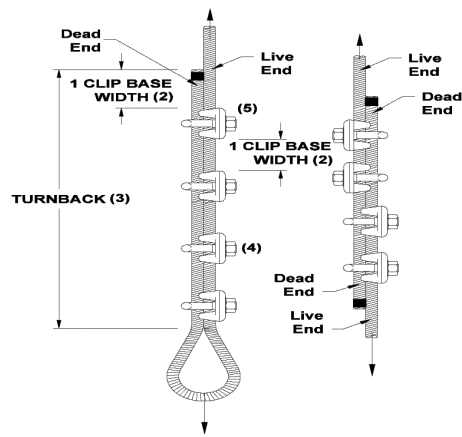


Figure 10

Installation and Loading

Proper Installation Requires

- Correct number of clips for wire rope size
- Correct spacing of clips
- Correct turnback length
- Correct torque on nuts
- Correct orientation of saddle on live end

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 16-09-085, § 296-155-33805, filed 4/19/16, effective 5/20/16. Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060 and chapter 49.17 RCW, and 29 C.F.R. 1926, Subpart CC. WSR 13-02-068, § 296-155-33805, filed 12/31/12, effective 2/1/13.]