

§ 1910.184

29 CFR Ch. XVII (7-1-04 Edition)

§ 1910.184 Slings.

(a) *Scope.* This section applies to slings used in conjunction with other material handling equipment for the movement of material by hoisting, in employments covered by this part. The types of slings covered are those made from alloy steel chain, wire rope, metal mesh, natural or synthetic fiber rope (conventional three strand construction), and synthetic web (nylon, polyester, and polypropylene).

(b) *Definitions.* *Angle of loading* is the inclination of a leg or branch of a sling measured from the horizontal or vertical plane as shown in Fig. N-184-5; provided that an angle of loading of five degrees or less from the vertical may be considered a vertical angle of loading.

Basket hitch is a sling configuration whereby the sling is passed under the load and has both ends, end attachments, eyes or handles on the hook or a single master link.

Braided wire rope is a wire rope formed by plaiting component wire ropes.

Bridle wire rope sling is a sling composed of multiple wire rope legs with the top ends gathered in a fitting that goes over the lifting hook.

Cable laid endless sling-mechanical joint is a wire rope sling made endless by joining the ends of a single length of cable laid rope with one or more metallic fittings.

Cable laid grommet-hand tucked is an endless wire rope sling made from one length of rope wrapped six times around a core formed by hand tucking the ends of the rope inside the six wraps.

Cable laid rope is a wire rope composed of six wire ropes wrapped around a fiber or wire rope core.

Cable laid rope sling-mechanical joint is a wire rope sling made from a cable laid rope with eyes fabricated by pressing or swaging one or more metal sleeves over the rope junction.

Choker hitch is a sling configuration with one end of the sling passing under the load and through an end attachment, handle or eye on the other end of the sling.

Coating is an elastomer or other suitable material applied to a sling or to a sling component to impart desirable properties.

Cross rod is a wire used to join spirals of metal mesh to form a complete fabric. (See Fig. N-184-2.)

Designated means selected or assigned by the employer or the employer's representative as being qualified to perform specific duties.

Equivalent entity is a person or organization (including an employer) which, by possession of equipment, technical knowledge and skills, can perform with equal competence the same repairs and tests as the person or organization with which it is equated.

Fabric (metal mesh) is the flexible portion of a metal mesh sling consisting of a series of transverse coils and cross rods.

Female handle (choker) is a handle with a handle eye and a slot of such dimension as to permit passage of a male handle thereby allowing the use of a metal mesh sling in a choker hitch. (See Fig. N-184-1.)

Handle is a terminal fitting to which metal mesh fabric is attached. (See Fig. N-184-1.)

Handle eye is an opening in a handle of a metal mesh sling shaped to accept a hook, shackle or other lifting device. (See Fig. N-184-1.)

Hitch is a sling configuration whereby the sling is fastened to an object or load, either directly to it or around it.

Link is a single ring of a chain.

Male handle (triangle) is a handle with a handle eye.

Master coupling link is an alloy steel welded coupling link used as an intermediate link to join alloy steel chain to master links. (See Fig. N-184-3.)

Master link or *gathering ring* is a forged or welded steel link used to support all members (legs) of an alloy steel chain sling or wire rope sling. (See Fig. N-184-3.)

Mechanical coupling link is a non-welded, mechanically closed steel link used to attach master links, hooks, etc., to alloy steel chain.

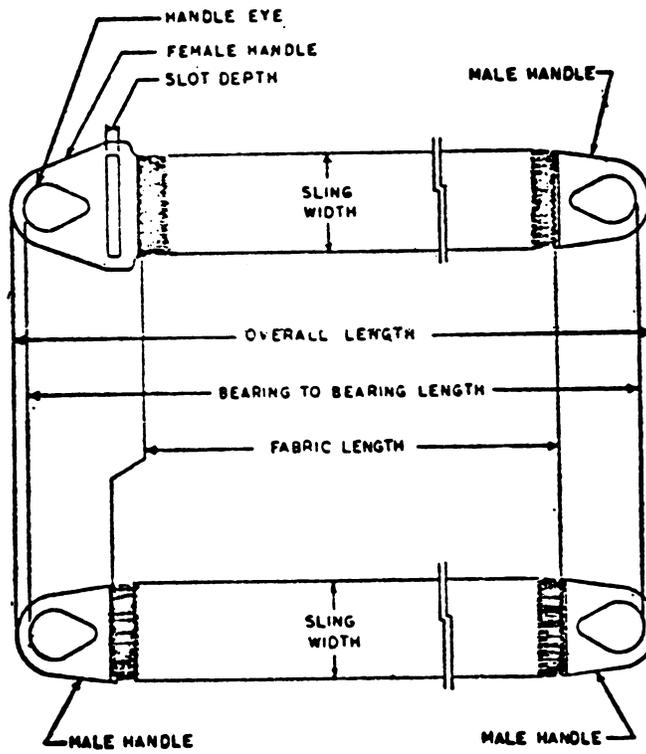


FIG. N-184-1
Metal Mesh Sling (Typical)

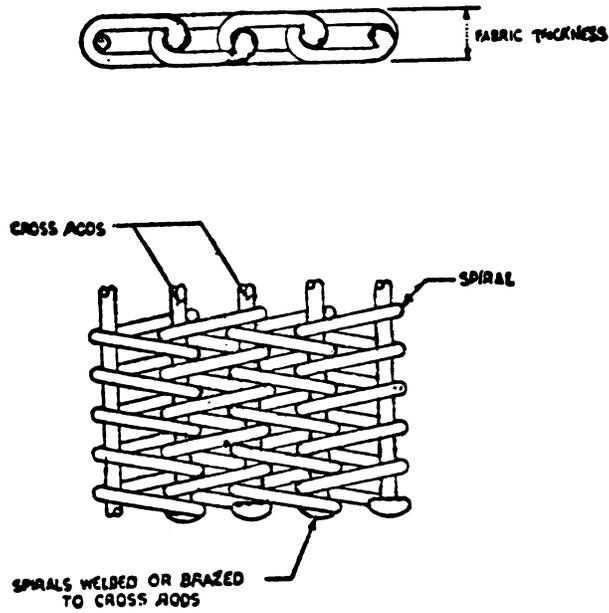


FIG. N-184-2
Metal Mesh Construction

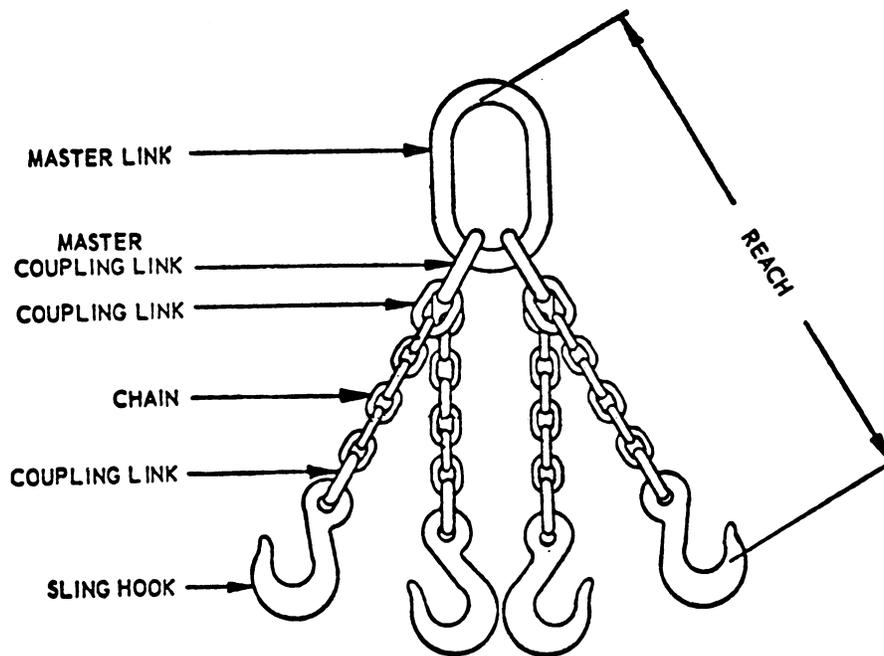


FIG. N-184-3 MAJOR COMPONENTS OF A QUADRUPLE SLING.

Proof load is the load applied in performance of a proof test.

Proof test is a nondestructive tension test performed by the sling manufacturer or an equivalent entity to verify construction and workmanship of a sling.

Rated capacity or working load limit is the maximum working load permitted by the provisions of this section.

Reach is the effective length of an alloy steel chain sling measured from the top bearing surface of the upper terminal component to the bottom bearing surface of the lower terminal component.

Selvage edge is the finished edge of synthetic webbing designed to prevent unraveling.

Sling is an assembly which connects the load to the material handling equipment.

Sling manufacturer is a person or organization that assembles sling components into their final form for sale to users.

Spiral is a single transverse coil that is the basic element from which metal mesh is fabricated. (See Fig. N-184-2.)

Strand laid endless sling-mechanical joint is a wire rope sling made from one length of rope with the ends joined by one or more metallic fittings.

Strand laid grommet-hand tucked is an endless wire rope sling made from one length of strand wrapped six times around a core formed by hand tucking the ends of the strand inside the six wraps.

Strand laid rope is a wire rope made with strands (usually six or eight) wrapped around a fiber core, wire strand core, or independent wire rope core (IWRC).

Vertical hitch is a method of supporting a load by a single, vertical part or leg of the sling. (See Fig. N-184-4.)

(c) *Safe operating practices.* Whenever any sling is used, the following practices shall be observed:

(1) Slings that are damaged or defective shall not be used.

(2) Slings shall not be shortened with knots or bolts or other makeshift devices.

(3) Sling legs shall not be kinked.

(4) Slings shall not be loaded in excess of their rated capacities.

(5) Slings used in a basket hitch shall have the loads balanced to prevent slippage.

(6) Slings shall be securely attached to their loads.

(7) Slings shall be padded or protected from the sharp edges of their loads.

(8) Suspended loads shall be kept clear of all obstructions.

(9) All employees shall be kept clear of loads about to be lifted and of suspended loads.

(10) Hands or fingers shall not be placed between the sling and its load while the sling is being tightened around the load.

(11) Shock loading is prohibited.

(12) A sling shall not be pulled from under a load when the load is resting on the sling.

(d) *Inspections.* Each day before being used, the sling and all fastenings and attachments shall be inspected for damage or defects by a competent person designated by the employer. Additional inspections shall be performed during sling use, where service conditions warrant. Damaged or defective slings shall be immediately removed from service.

(e) *Alloy steel chain slings.* (1) *Sling identification.* Alloy steel chain slings shall have permanently affixed durable identification stating size, grade, rated capacity, and reach.

(2) *Attachments.* (i) Hooks, rings, oblong links, pear shaped links, welded or mechanical coupling links or other attachments shall have a rated capacity at least equal to that of the alloy steel chain with which they are used or the sling shall not be used in excess of the rated capacity of the weakest component.

(ii) Makeshift links or fasteners formed from bolts or rods, or other such attachments, shall not be used.

(3) *Inspections.* (i) In addition to the inspection required by paragraph (d) of this section, a thorough periodic inspection of alloy steel chain slings in use shall be made on a regular basis, to

be determined on the basis of (A) frequency of sling use; (B) severity of service conditions; (C) nature of lifts being made; and (D) experience gained on the service life of slings used in similar circumstances. Such inspections shall in no event be at intervals greater than once every 12 months.

(ii) The employer shall make and maintain a record of the most recent month in which each alloy steel chain sling was thoroughly inspected, and shall make such record available for examination.

(iii) The thorough inspection of alloy steel chain slings shall be performed by a competent person designated by the employer, and shall include a thorough inspection for wear, defective welds, deformation and increase in length. Where such defects or deterioration are present, the sling shall be immediately removed from service.

(4) *Proof testing.* The employer shall ensure that before use, each new, repaired, or reconditioned alloy steel chain sling, including all welded components in the sling assembly, shall be proof tested by the sling manufacturer or equivalent entity, in accordance with paragraph 5.2 of the American Society of Testing and Materials Specification A391-65, which is incorporated by reference as specified in §1910.6 (ANSI G61.1-1968). The employer shall retain a certificate of the proof test and shall make it available for examination.

(5) *Sling use.* Alloy steel chain slings shall not be used with loads in excess of the rated capacities prescribed in Table N-184-1. Slings not included in this table shall be used only in accordance with the manufacturer's recommendations.

(6) *Safe operating temperatures.* Alloy steel chain slings shall be permanently removed from service if they are heated above 1000 °F. When exposed to service temperatures in excess of 600 °F, maximum working load limits permitted in Table N-184-1 shall be reduced in accordance with the chain or sling manufacturer's recommendations.

(7) *Repairing and reconditioning alloy steel chain slings.* (i) Worn or damaged alloy steel chain slings or attachments shall not be used until repaired. When

welding or heat testing is performed, slings shall not be used unless repaired, reconditioned and proof tested by the sling manufacturer or an equivalent entity.

(ii) Mechanical coupling links or low carbon steel repair links shall not be used to repair broken lengths of chain.

(8) *Effects of wear.* If the chain size at any point of any link is less than that stated in Table N-184-2, the sling shall be removed from service.

(9) *Deformed attachments.* (i) Alloy steel chain slings with cracked or deformed master links, coupling links or other components shall be removed from service.

TABLE N-184-1—RATED CAPACITY (WORKING LOAD LIMIT), FOR ALLOY STEEL CHAIN SLINGS
 Rated Capacity (Working Load Limit), Pounds
 [Horizontal angles shown in parentheses]

Chain size, inches	Single branch sling—90° loading	Double sling vertical angle (1)			Triple and quadruple sling (3) vertical angle (1)		
		30° (60°)	45° (45°)	60° (30°)	30° (60°)	45° (45°)	60° (30°)
1/4	3,250	5,650	4,550	3,250	8,400	6,800	4,900
3/8	6,600	11,400	9,300	6,600	17,000	14,000	9,900
1/2	11,250	19,500	15,900	11,250	29,000	24,000	17,000
5/8	16,500	28,500	23,300	16,500	43,000	35,000	24,500
3/4	23,000	39,800	32,500	23,000	59,500	48,500	34,500
7/8	28,750	49,800	40,600	28,750	74,500	61,000	43,000
1	38,750	67,100	5,800	38,750	101,000	82,000	58,000
1 1/8	44,500	77,000	63,000	44,500	115,500	94,500	66,500
1 1/4	57,500	99,500	61,000	57,500	149,000	121,500	86,000
1 3/8	67,000	116,000	94,000	67,000	174,000	141,000	100,500
1 1/2	80,000	138,000	112,900	80,000	207,000	169,000	119,500
1 3/4	100,000	172,000	140,000	100,000	258,000	210,000	150,000

(1) Rating of multileg slings adjusted for angle of loading measured as the included angle between the inclined leg and the vertical as shown in Figure N-184-5.
 (2) Rating of multileg slings adjusted for angle of loading between the inclined leg and the horizontal plane of the load, as shown in Figure N-184-5.
 (3) Quadruple sling rating is same as triple sling because normal lifting practice may not distribute load uniformly to all 4 legs.

TABLE N-184-2—MINIMUM ALLOWABLE CHAIN SIZE AT ANY POINT OF LINK

Chain size, inches	Minimum allowable chain size, inches
1/4	13/64
3/8	19/64
1/2	25/64
5/8	31/64
3/4	19/32
7/8	45/64
1	13/16
1 1/8	29/32
1 1/4	1
1 3/8	13/32
1 1/2	13/16
1 3/4	113/32

(ii) Slings shall be removed from service if hooks are cracked, have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.

(f) *Wire rope slings.* (1) *Sling use.* Wire rope slings shall not be used with loads in excess of the rated capacities shown in Tables N-184-3 through N-184-14. Slings not included in these tables

shall be used only in accordance with the manufacturer's recommendations.

(2) *Minimum sling lengths.* (i) Cable laid and 6x19 and 6x37 slings shall have a minimum clear length of wire rope 10 times the component rope diameter between splices, sleeves or end fittings.

(ii) Braided slings shall have a minimum clear length of wire rope 40 times the component rope diameter between the loops or end fittings.

(iii) Cable laid grommets, strand laid grommets and endless slings shall have a minimum circumferential length of 96 times their body diameter.

(3) *Safe operating temperatures.* Fiber core wire rope slings of all grades shall be permanently removed from service if they are exposed to temperatures in excess of 200 °F. When nonfiber core wire rope slings of any grade are used at temperatures above 400 °F or below minus 60 °F, recommendations of the sling manufacturer regarding use at that temperature shall be followed.

(4) *End attachments.* (i) Welding of end attachments, except covers to thimbles, shall be performed prior to the assembly of the sling.
 (ii) All welded end attachments shall not be used unless proof tested by the

manufacturer or equivalent entity at twice their rated capacity prior to initial use. The employer shall retain a certificate of the proof test, and make it available for examination.

TABLE N-184-3—RATED CAPACITIES FOR SINGLE LEG SLINGS
 6×19 and 6×37 Classification Improved Plow Steel Grade Rope With Fiber Core (FC)

Rope		Rated capacities, tons (2,000 lb)								
Dia (inches)	Constr	Vertical			Choker			Vertical basket ¹		
		HT	MS	S	HT	MS	S	HT	MS	S
1/4	6×19	0.49	0.51	0.55	0.37	0.38	0.41	0.99	1.0	1.1
5/16	6×19	0.76	0.79	0.85	0.57	0.59	0.64	1.5	1.6	1.7
3/8	6×19	1.1	1.1	1.2	0.80	0.85	0.91	2.1	2.2	2.4
7/16	6×19	1.4	1.5	1.6	1.1	1.1	1.2	2.9	3.0	3.3
1/2	6×19	1.8	2.0	2.1	1.4	1.5	12.6	3.7	3.9	4.3
9/16	6×19	2.3	2.5	2.7	1.7	1.9	2.0	4.6	5.0	5.4
5/8	6×19	2.8	3.1	3.3	2.1	2.3	2.5	5.6	6.2	6.7
3/4	6×19	3.9	4.4	4.8	2.9	3.3	3.6	7.8	8.8	9.5
7/8	6×19	5.1	5.9	6.4	3.9	4.5	4.8	10.0	12.0	13.0
1	6×19	6.7	7.7	8.4	5.0	5.8	6.3	13.0	15.0	17.0
1 1/8	6×19	8.4	9.5	10.0	6.3	7.1	7.9	17.0	19.0	21.0
1 1/4	6×37	9.8	11.0	12.0	7.4	8.3	9.2	20.0	22.0	25.0
1 3/8	6×37	12.0	13.0	15.0	8.9	10.0	11.0	24.0	27.0	30.0
1 1/2	6×37	14.0	16.0	15.0	10.0	12.0	13.0	28.0	32.0	35.0
1 5/8	6×37	16.0	18.0	21.0	12.0	14.0	15.0	33.0	27.0	41.0
1 3/4	6×37	19.0	21.0	24.0	14.0	16.0	18.0	38.0	43.0	48.0
2	6×37	25.0	28.0	31.0	18.0	21.0	23.0	49.0	55.0	62.0

HT = Hand Tucked Splice and Hidden Tuck Splice. For hidden tuck splice (IWRC) use values in HT columns.
 MS = Mechanical Splice.
 S = Swaged or Zinc Poured Socket.
¹ These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S slings is 20 or greater where: D=Diameter of curvature around which the body of the sling is bent; d=Diameter of rope.

TABLE N-184-4—RATED CAPACITIES FOR SINGLE LEG SLINGS
 6×19 and 6×37 Classification Improved Plow Steel Grade Rope With Independent Wire Rope Core (IWRC)

Rope		Rated capacities, tons (2,000 lb)								
Dia (inches)	Constr	Vertical			Choker			Vertical basket ¹		
		HT	MS	S	HT	MS	S	HT	MS	S
1/4	6×19	0.53	0.56	0.59	0.40	0.42	0.44	1.0	1.1	1.2
5/16	6×19	0.81	0.87	0.92	0.61	0.65	0.69	1.6	1.7	1.8
3/8	6×19	1.1	1.2	1.3	0.86	0.93	0.98	2.3	2.5	2.6
7/16	6×19	1.5	1.7	1.8	1.2	1.3	1.3	3.1	3.4	3.5
1/2	6×19	2.0	2.2	2.3	1.5	1.6	1.7	3.9	4.4	4.6
9/16	6×19	2.5	2.7	2.9	1.8	2.1	2.2	4.9	5.5	5.8
5/8	6×19	3.0	3.4	3.6	2.2	2.5	2.7	6.0	6.8	7.2
3/4	6×19	4.2	4.9	5.1	3.1	3.6	3.8	8.4	9.7	10.0
7/8	6×19	5.5	6.6	6.9	4.1	4.9	5.2	11.0	13.0	14.0
1	6×19	7.2	8.5	9.0	5.4	6.4	6.7	14.0	17.0	18.0
1 1/8	6×19	9.0	10.0	11.0	6.8	7.8	8.5	18.0	21.0	23.0
1 1/4	6×37	10.0	12.0	13.0	7.9	9.2	9.9	21.0	24.0	26.0
1 3/8	6×37	13.0	15.0	16.0	9.6	11.0	12.0	25.0	29.0	32.0
1 1/2	6×37	15.0	17.0	19.0	11.0	13.0	14.0	30.0	35.0	38.0
1 5/8	6×37	18.0	20.0	22.0	13.0	15.0	17.0	35.0	41.0	44.0
1 3/4	6×37	20.0	24.0	26.0	15.0	18.0	19.0	41.0	47.0	51.0
2	6×37	26.0	30.0	33.0	20.0	23.0	25.0	53.0	61.0	66.0

HT = Hand Tucked Splice. For hidden tuck splice (IWRC) use Table I values in HT column.
 MS = Mechanical Splice.
 S = Swaged or Zinc Poured Socket.
¹ These values only apply when the D/d ratio for HT slings is 10 or greater, and for MS and S Slings is 20 or greater where: D=Diameter of curvature around which the body of the sling is bent; d=Diameter of rope.

TABLE N-184-5—RATED CAPACITIES FOR SINGLE LEG SLINGS

Cable Laid Rope—Mechanical Splice Only
 7×7×7&7×19 Constructions Galvanized Aircraft Grade Rope
 7×6×19 IWRC Construction Improved Plow Steel Grade Rope

Rope		Rated capacities, tons (2,000 lb)		
Dia (inches)	Constr	Vertical	Choker	Vertical basket ¹
1/4	7×7×7	0.50	0.38	1.0
3/8	7×7×7	1.1	0.81	2.0
1/2	7×7×7	1.8	1.4	3.7
5/8	7×7×7	2.8	2.1	5.5
3/4	7×7×7	3.8	2.9	7.6
5/8	7×7×19	2.9	2.2	5.8
3/4	7×7×19	4.1	3.0	8.1
7/8	7×7×19	5.4	4.0	11.0
1	7×7×19	6.9	5.1	14.0
1 1/8	7×7×19	8.2	6.2	16.0
1 1/4	7×7×19	9.9	7.4	20.0
3/4	7×6×19 IWRC	3.8	2.8	7.6
7/8	7×6×19 IWRC	5.0	3.8	10.0
1	7×6×19 IWRC	6.4	4.8	13.0
1 1/8	7×6×19 IWRC	7.7	5.8	15.0
1 1/4	7×6×19 IWRC	9.2	6.9	18.0
1 5/16	7×6×19 IWRC	10.0	7.5	20.0
1 3/8	7×6×19 IWRC	11.0	8.2	22.0
1 1/2	7×6×19 IWRC	13.0	9.6	26.0

¹These values only apply when the D/d ratio is 10 or greater where: D=Diameter of curvature around which the body of the sling is bent; d=Diameter of rope.

TABLE N-184-6—RATED CAPACITIES FOR SINGLE LEG SLINGS

8-Part and 6-Part Braided Rope
 6×7 and 6×19 Construction Improved Plow Steel Grade Rope
 7×7 Construction Galvanized Aircraft Grade Rope

Component ropes		Rated capacities, tons (2,000 lb)					
Diameter (inches)	Constr	Vertical		Choker		Basket, vertical to 30° ¹	
		8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6×7	0.42	0.32	0.32	0.24	0.74	0.55
1/8	6×7	0.75	0.57	0.57	0.42	1.3	0.98
3/16	6×7	1.7	1.3	1.3	0.94	2.9	2.2
3/32	7×7	0.51	0.39	0.38	0.29	0.89	0.67
1/8	7×7	0.95	0.7	0.71	0.53	1.6	1.2
3/16	7×7	2.1	1.5	1.5	1.2	3.6	2.7
3/16	6×19	1.7	1.3	1.3	0.98	3.0	2.2
1/4	6×19	3.1	2.3	2.3	1.7	5.3	4.0
5/16	6×19	4.8	3.6	3.6	2.7	8.3	6.2
3/8	6×19	6.8	5.1	5.1	3.8	12.0	8.9
7/16	6×19	9.3	6.9	6.9	5.2	16.0	12.0
1/2	6×19	12.0	9.0	9.0	6.7	21.0	15.0
9/16	6×19	15.0	11.0	11.0	8.5	26.0	20.0
5/8	6×19	19.0	14.0	14.0	10.0	32.0	24.0
3/4	6×19	27.0	20.0	20.0	15.0	46.0	35.0
7/8	6×19	36.0	27.0	27.0	20.0	62.0	47.0
1	6×19	47.0	35.0	35.0	26.0	81.0	61.0

¹These values only apply when the D/d ratio is 20 or greater where: D=Diameter of curvature around which the body of the sling is bent; d=Diameter of component rope.

TABLE N-184-7—RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS
 6×19 and 6×37 Classification Improved Plow Steel Grade Rope With Fiber Core (FC)
 [Horizontal angles shown in parentheses]

Rope		Rated capacities, tons (2,000 lb)											
Dia (in.)	Constr	2-Leg bridle slings						3-Leg bridle slings					
		30° (60°)		45° angle		60° (30°)		30° (60°)		45° angle		60° (30°)	
		HT	MS	HT	MS	HT	MS	HT	MS	HT	MS	HT	MS
1/4	6×19	0.85	0.83	0.70	0.72	0.49	0.51	1.3	1.3	1.0	1.1	0.74	0.76
5/16	6×19	1.3	1.4	1.1	1.1	0.76	0.79	2.0	2.0	1.6	1.7	1.1	1.2
3/8	6×19	1.8	1.9	1.5	1.6	1.1	1.1	2.8	2.9	2.3	2.4	1.6	1.7
7/16	6×19	2.5	2.6	2.0	2.2	1.4	1.5	3.7	4.0	3.0	3.2	2.1	2.3
1/2	6×19	3.2	3.4	2.6	2.8	1.8	2.0	4.8	5.1	3.9	4.2	2.8	3.0
9/16	6×19	4.0	4.3	3.2	3.5	2.3	2.5	6.0	6.5	4.9	5.3	3.4	3.7
5/8	6×19	4.8	5.3	4.0	4.4	2.8	3.1	7.3	8.0	5.9	6.5	4.2	4.6
3/4	6×19	6.8	7.6	5.5	6.2	3.9	4.4	10.0	11.0	8.3	9.3	5.8	6.6
7/8	6×19	8.9	10.0	7.3	8.4	5.1	5.9	13.0	15.0	11.0	13.0	7.7	8.9
1	6×19	11.0	13.0	9.4	11.0	6.7	7.7	17.0	20.0	14.0	16.0	10.0	11.0
1 1/8	6×19	14.0	16.0	12.0	13.0	8.4	9.3	22.0	24.0	18.0	20.0	13.0	14.0
1 1/4	6×37	17.0	19.0	14.0	16.0	9.8	11.0	25.0	29.0	21.0	23.0	15.0	17.0
1 3/8	6×37	20.0	23.0	17.0	19.0	12.0	13.0	31.0	35.0	25.0	28.0	18.0	20.0
1 1/2	6×37	24.0	27.0	20.0	22.0	14.0	16.0	36.0	41.0	30.0	33.0	21.0	24.0
1 5/8	6×37	28.0	32.0	23.0	26.0	16.0	18.0	43.0	48.0	35.0	39.0	25.0	28.0
1 3/4	6×37	33.0	37.0	27.0	30.0	19.0	21.0	49.0	56.0	40.0	45.0	28.0	32.0
2	6×37	43.0	48.0	35.0	39.0	25.0	28.0	64.0	72.0	52.0	59.0	37.0	41.0

HT=Hand Tucked Splice. MS=Mechanical Splice.

TABLE N-184-8—RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS
 6×19 and 6×37 Classification Improved Plow Steel Grade Rope With Independent Wire Rope Core (IWRC)
 [Horizontal angles shown in parentheses]

Rope		Rated capacities, tons (2,000 lb)											
Dia (in.)	Constr	2-Leg bridle slings						3-Leg bridle slings					
		30° (60°)		45° angle		60° (30°)		30° (60°)		45° angle		60° (30°)	
		HT	MS	HT	MS	HT	MS	HT	MS	HT	MS	HT	MS
1/4	6×19	0.92	0.97	0.75	0.79	0.53	0.56	1.4	1.4	1.1	1.2	0.79	0.84
5/16	6×19	1.4	1.5	1.1	1.2	0.81	0.87	2.1	2.3	1.7	1.8	1.2	1.3
3/8	6×19	2.0	2.1	1.6	1.8	1.1	1.2	3.0	3.2	2.4	2.6	1.7	1.9
7/16	6×19	2.7	2.9	2.2	2.4	1.5	1.7	4.0	4.4	3.3	3.6	2.3	2.5
1/2	6×19	3.4	3.8	2.8	3.1	2.0	2.2	5.1	5.7	4.2	4.6	3.0	3.3
9/16	6×19	4.3	4.8	3.5	3.9	2.5	2.7	6.4	7.1	5.2	5.8	3.7	4.1
5/8	6×19	5.2	5.9	4.2	4.8	3.0	3.4	7.8	8.8	6.4	7.2	4.5	5.1
3/4	6×19	7.3	8.4	5.9	6.9	4.2	4.9	11.0	13.0	8.9	10.0	6.3	7.3
7/8	6×19	9.6	11.0	7.8	9.3	5.5	6.6	14.0	17.0	12.0	14.0	8.3	9.9
1	6×19	12.0	15.0	10.0	12.0	7.2	8.5	19.0	22.0	15.0	18.0	11.0	13.0
1 1/8	6×19	16.0	18.0	13.0	15.0	9.0	10.0	23.0	27.0	19.0	22.0	13.0	16.0
1 1/4	6×37	18.0	21.0	15.0	17.0	10.0	12.0	27.0	32.0	22.0	26.0	16.0	18.0
1 3/8	6×37	22.0	25.0	18.0	21.0	13.0	15.0	33.0	38.0	27.0	31.0	19.0	22.0
1 1/2	6×37	26.0	30.0	21.0	25.0	15.0	17.0	39.0	45.0	32.0	37.0	23.0	26.0
1 5/8	6×37	31.0	35.0	25.0	29.0	18.0	20.0	46.0	53.0	38.0	43.0	27.0	31.0
1 3/4	6×37	35.0	41.0	29.0	33.0	20.0	24.0	53.0	61.0	43.0	50.0	31.0	35.0
2	6×37	46.0	53.0	37.0	43.0	26.0	30.0	68.0	79.0	56.0	65.0	40.0	46.0

HT=Hand Tucked Splice. MS=Mechanical Splice.

TABLE N-184-9—RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS
 Cable Laid Rope—Mechanical Splice Only
 7×7×7 and 7×7×19 Constructions Galvanized Aircraft Grade Rope
 7×6×19 IWRC Construction Improved Plow Steel Grade Rope
 [Horizontal angles shown in parentheses]

Rope		Rated capacities, tons (2,000 lb)					
Dia (inches)	Constr	2-Leg bridle sling			3-Leg bridle sling		
		30° (60°)	45° angle	60° (30°)	30° (60°)	45° angle	60° (30°)
		1/4	7×7×7	0.87	0.71	0.50	1.3

TABLE N-184-9—RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS—Continued

Cable Laid Rope—Mechanical Splice Only
 7×7×7 and 7×7×19 Constructions Galvanized Aircraft Grade Rope
 7×6×19 IWRC Construction Improved Plow Steel Grade Rope
 [Horizontal angles shown in parentheses]

Rope		Rated capacities, tons (2,000 lb)					
Dia (inches)	Constr	2-Leg bridle sling			3-Leg bridle sling		
		30° (60°)	45° angle	60° (30°)	30° (60°)	45° angle	60° (30°)
3/8	7×7×7	1.9	1.5	1.1	2.8	2.3	1.6
1/2	7×7×7	3.2	2.6	1.8	4.8	3.9	2.8
5/8	7×7×7	4.8	3.9	2.8	7.2	5.9	4.2
3/4	7×7×7	6.6	5.4	3.8	9.9	8.1	3.7
5/8	7×7×19	5.0	4.1	2.9	7.5	6.1	4.3
3/4	7×7×19	7.0	5.7	4.1	10.0	8.6	6.1
7/8	7×7×19	9.3	7.6	5.4	14.0	11.0	8.1
1	7×7×19	12.0	9.7	6.9	18.0	14.0	10.0
1 1/8	7×7×19	14.0	12.0	8.2	21.0	17.0	12.0
1 1/4	7×7×19	17.0	14.0	9.9	26.0	21.0	15.0
3/4	7×6×19 IWRC	6.6	5.4	3.8	9.9	8.0	5.7
7/8	7×6×19 IWRC	8.7	7.1	5.0	13.0	11.0	7.5
1	7×6×19 IWRC	11.0	9.0	6.4	17.0	13.0	9.6
1 1/8	7×6×19 IWRC	13.0	11.0	7.7	20.0	16.0	11.0
1 1/4	7×6×19 IWRC	16.0	13.0	9.2	24.0	20.0	14.0
1 5/16	7×6×19 IWRC	17.0	14.0	10.0	26.0	21.0	15.0
1 3/8	7×6×19 IWRC	19.0	15.0	11.0	28.0	23.0	16.0
1 1/2	7×6×19 IWRC	22.0	18.0	13.0	33.0	27.0	19.0

TABLE N-184-10—RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS

8-Part and 6-Part Braided Rope
 6×7 and 6×19 Construction Improved Plow Steel Grade Rope
 7×7 Construction Galvanized Aircraft Grade Rope
 [Horizontal angles shown in parentheses]

Rope		Rated capacities, tons (2,000 lb)											
Dia (in.)	Constr	2-Leg bridle slings						3-Leg bridle slings					
		30° (60°)		45° angle		60° (30°)		30° (60°)		45° angle		60° (30°)	
		8-Part	6-Part	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6×7	0.74	0.55	0.60	0.45	0.42	0.32	1.1	0.83	0.90	0.68	0.64	0.48
1/8	6×7	1.3	0.98	1.1	0.80	0.76	0.57	2.0	1.5	1.6	1.2	1.1	0.85
3/16	6×7	2.9	2.2	2.4	1.8	1.7	1.3	4.4	3.3	3.6	2.7	2.5	1.9
3/32	7×7	0.89	0.67	0.72	0.55	0.51	0.39	1.3	1.0	1.1	0.82	0.77	0.58
1/8	7×7	1.6	1.2	1.3	1.0	0.95	0.71	2.5	1.8	2.0	1.5	1.4	1.1
3/16	7×7	3.6	2.7	2.9	2.2	2.1	1.5	5.4	4.0	4.4	3.3	3.1	2.3
3/16	6×19	3.0	2.2	2.4	1.8	1.7	1.3	4.5	3.4	3.7	2.8	2.6	1.9
1/4	6×19	5.3	4.0	4.3	3.2	3.1	2.3	8.0	6.0	6.5	4.9	4.6	3.4
5/16	6×19	8.3	6.2	6.7	5.0	4.8	3.6	12.0	9.3	10.0	7.6	7.1	5.4
3/8	6×19	12.0	8.9	9.7	7.2	6.8	5.1	18.0	13.0	14.0	11.0	10.0	7.7
7/16	6×19	16.0	12.0	13.0	9.8	9.3	6.9	24.0	18.0	20.0	15.0	14.0	10.0
1/2	6×19	21.0	15.0	17.0	13.0	12.0	9.0	31.0	23.0	25.0	19.0	18.0	13.0
9/16	6×19	26.0	20.0	21.0	16.0	15.0	11.0	39.0	29.0	32.0	24.0	23.0	17.0
5/8	6×19	32.0	24.0	26.0	20.0	20.0	14.0	48.0	36.0	40.0	30.0	28.0	21.0
3/4	6×19	46.0	35.0	38.0	28.0	27.0	20.0	69.0	52.0	56.0	42.0	40.0	30.0
7/8	6×19	62.0	47.0	51.0	38.0	36.0	27.0	94.0	70.0	76.0	57.0	54.0	40.0
1	6×19	81.0	61.0	66.0	50.0	47.0	35.0	122.0	91.0	99.0	74.0	70.0	53.0

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TABLE N-184-11—RATED CAPACITIES FOR STRAND LAID GROMMET—HAND TUCKED Improved Plow Steel Grade Rope

Rope body		Rated capacities, tons (2,000 lb)		
Dia (inches)	Constr	Vertical	Choker	Vertical basket ¹
1/4	7×19	0.85	0.64	1.7
5/16	7×19	1.3	1.0	2.6
3/8	7×19	1.9	1.4	3.8
7/16	7×19	2.6	1.9	5.2
1/2	7×19	3.3	2.5	6.7
9/16	7×19	4.2	3.1	8.4
5/8	7×19	5.2	3.9	10.0
3/4	7×19	7.4	5.6	15.0
7/8	7×19	10.0	7.5	20.0
1	7×19	13.0	9.7	26.0
1 1/8	7×19	16.0	12.0	32.0
1 1/4	7×37	18.0	14.0	37.0
1 3/8	7×37	22.0	16.0	44.0
1 1/2	7×37	26.0	19.0	52.0

¹ These values only apply when the D/d ratio is 5 or greater where: D=Diameter of curvature around which rope is bent. d=Diameter of rope body.

TABLE N-184-12—RATED CAPACITIES FOR CABLE LAID GROMMET—HAND TUCKED

7×6×7 and 7×6×19 Constructions Improved Plow Steel Grade Rope
7×7×7 Construction Galvanized Aircraft Grade Rope

Cable body		Rated capacities, tons (2,000 lb)		
Dia (inches)	Constr	Vertical	Choker	Vertical basket ¹
3/8	7×6×7	1.3	0.95	2.5
9/16	7×6×7	2.8	2.1	5.6
5/8	7×6×7	3.8	2.8	7.6
3/8	7×7×7	1.6	1.2	3.2
9/16	7×7×7	3.5	2.6	6.9
5/8	7×7×7	4.5	3.4	9.0
5/8	7×6×19	3.9	3.0	7.9
3/4	7×6×19	5.1	3.8	10.0
15/16	7×6×19	7.9	5.9	16.0
1 1/8	7×6×19	11.0	8.4	22.0
1 1/4	7×6×19	15.0	11.0	30.0
1 1/2	7×6×19	19.0	14.0	39.0
1 11/16	7×6×19	24.0	18.0	49.0
1 7/8	7×6×19	30.0	22.0	60.0
2 1/4	7×6×19	42.0	31.0	84.0
2 5/8	7×6×19	56.0	42.0	112.0

¹ These values only apply when the D/d ratio is 5 or greater where: D=Diameter of curvature around which cable body is bent. d=Diameter of cable body.

TABLE N-184-13—RATED CAPACITIES FOR STRAND LAID ENDLESS SLINGS—MECHANICAL JOINT

Improved Plow Steel Grade Rope

Rope body		Rated capacities, tons (2,000 lb)		
Dia (inches)	Constr	Vertical	Choker	Vertical basket ¹
1/4	2 6×19	0.92	0.69	1.8
3/8	2 6×19	2.0	1.5	4.1
1/2	2 6×19	3.6	2.7	7.2
5/8	2 6×19	5.6	4.2	11.0
3/4	2 6×19	8.0	6.0	16.0
7/8	2 6×19	11.0	8.1	21.0

TABLE N-184-13—RATED CAPACITIES FOR STRAND LAID ENDLESS SLINGS—MECHANICAL JOINT—Continued

Improved Plow Steel Grade Rope

Rope body		Rated capacities, tons (2,000 lb)		
Dia (inches)	Constr	Vertical	Choker	Vertical basket ¹
1	2 6×19	14.0	10.0	28.0
1 1/8	2 6×19	18.0	13.0	35.0
1 1/4	2 6×37	21.0	15.0	41.0
1 3/8	2 6×37	25.0	19.0	50.0
1 1/2	2 6×37	29.0	22.0	59.0

¹ These values only apply when the D/d ratio is 5 or greater where: D=Diameter of curvature around which rope is bent. d=Diameter of rope body.
² IWRC.

TABLE N-184-14—RATED CAPACITIES FOR CABLE LAID ENDLESS SLINGS—MECHANICAL JOINT

7×7×7 and 7×7×19 Constructions Galvanized Aircraft Grade Rope
7×6×19 IWRC Construction Improved Plow Steel Grade Rope

Cable body		Rated capacities, tons (2,000 lb)		
Dia (inches)	Constr	Vertical	Choker	Vertical basket ¹
1/4	7×7×7	0.83	0.62	1.6
3/8	7×7×7	1.8	1.3	3.5
1/2	7×7×7	3.0	2.3	6.1
5/8	7×7×7	4.5	3.4	9.1
3/4	7×7×7	6.3	4.7	12.0
5/8	7×7×19	4.7	3.5	9.5
3/4	7×7×19	6.7	5.0	13.0
7/8	7×7×19	8.9	6.6	18.0
1	7×7×19	11.0	8.5	22.0
1 1/8	7×7×19	14.0	10.0	28.0
1 1/4	7×7×19	17.0	12.0	33.0
3/4	2 7×6×19	6.2	4.7	12.0
7/8	2 7×6×19	8.3	6.2	16.0
1	2 7×6×19	10.0	7.9	21.0
1 1/8	2 7×6×19	13.0	9.7	26.0
1 1/4	2 7×6×19	16.0	12.0	31.0
1 3/8	2 7×6×19	18.0	14.0	37.0
1 1/2	2 7×6×19	22.0	16.0	43.0

¹ These values only apply when the D/d value is 5 or greater where: D=Diameter of curvature around which cable body is bent. d=Diameter of cable body.
² IWRC.

(5) *Removal from service.* Wire rope slings shall be immediately removed from service if any of the following conditions are present:

- (i) Ten randomly distributed broken wires in one rope lay, or five broken wires in one strand in one rope lay.
- (ii) Wear or scraping of one-third the original diameter of outside individual wires.
- (iii) Kinking, crushing, bird caging or any other damage resulting in distortion of the wire rope structure.
- (iv) Evidence of heat damage.
- (v) End attachments that are cracked, deformed or worn.

(vi) Hooks that have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.

(vii) Corrosion of the rope or end attachments.

(g) *Metal mesh slings*—(1) *Sling marking*. Each metal mesh sling shall have permanently affixed to it a durable marking that states the rated capacity for vertical basket hitch and choker hitch loadings.

(2) *Handles*. Handles shall have a rated capacity at least equal to the metal fabric and exhibit no deformation after proof testing.

(3) *Attachments of handles to fabric*. The fabric and handles shall be joined so that:

(i) The rated capacity of the sling is not reduced.

(ii) The load is evenly distributed across the width of the fabric.

(iii) Sharp edges will not damage the fabric.

(4) *Sling coatings*. Coatings which diminish the rated capacity of a sling shall not be applied.

(5) *Sling testing*. All new and repaired metal mesh slings, including handles, shall not be used unless proof tested by the manufacturer or equivalent entity at a minimum of 1½ times their rated capacity. Elastomer impregnated slings shall be proof tested before coating.

(6) *Proper use of metal mesh slings*. Metal mesh slings shall not be used to lift loads in excess of their rated capacities as prescribed in Table N-184-15. Slings not included in this table shall be used only in accordance with the manufacturer's recommendations.

(7) *Safe operating temperatures*. Metal mesh slings which are not impregnated with elastomers may be used in a temperature range from minus 20 °F to plus 550 °F without decreasing the working load limit. Metal mesh slings impregnated with polyvinyl chloride or neoprene may be used only in a temperature range from zero degrees to plus 200 °F. For operations outside these temperature ranges or for metal mesh slings impregnated with other materials, the sling manufacturer's recommendations shall be followed.

(8) *Repairs*. (i) Metal mesh slings which are repaired shall not be used unless repaired by a metal mesh sling manufacturer or an equivalent entity.

(ii) Once repaired, each sling shall be permanently marked or tagged, or a written record maintained, to indicate the date and nature of the repairs and the person or organization that performed the repairs. Records of repairs shall be made available for examination.

(9) *Removal from service*. Metal mesh slings shall be immediately removed from service if any of the following conditions are present:

(i) A broken weld or broken brazed joint along the sling edge.

(ii) Reduction in wire diameter of 25 per cent due to abrasion or 15 per cent due to corrosion.

(iii) Lack of flexibility due to distortion of the fabric.

TABLE N-184-15—RATED CAPACITIES
Carbon Steel and Stainless Steel Metal Mesh Slings
[Horizontal angles shown in parentheses]

Sling width in inches	Vertical or choker	Vertical basket	Effect of angle on rated capacities in basket hitch		
			30° (60°)	45° (45°)	60° (30°)
Heavy Duty—10 Ga 35 Spirals/Ft of sling width					
2	1,500	3,000	2,600	2,100	1,500
3	2,700	5,400	4,700	3,800	2,700
4	4,000	8,000	6,900	5,600	4,000
6	6,000	12,000	10,400	8,400	6,000
8	8,000	16,000	13,800	11,300	8,000
10	10,000	20,000	17,000	14,100	10,000
12	12,000	24,000	20,700	16,900	12,000
14	14,000	28,000	24,200	19,700	14,000
16	16,000	32,000	27,700	22,600	16,000
18	18,000	36,000	31,100	25,400	18,000
20	20,000	40,000	34,600	28,200	20,000
Medium Duty—12 Ga 43 Spirals/Ft of sling width					
2	1,350	2,700	2,300	1,900	1,400
3	2,000	4,000	3,500	2,800	2,000
4	2,700	5,400	4,700	3,800	2,700
6	4,500	9,000	7,800	6,400	4,500
8	6,000	12,000	10,400	8,500	6,000
10	7,500	15,000	13,000	10,600	7,500
12	9,000	18,000	15,600	12,700	9,000
14	10,500	21,000	18,200	14,800	10,500
16	12,000	24,000	20,800	17,000	12,000
18	13,500	27,000	23,400	19,100	13,500
20	15,000	30,000	26,000	21,200	15,000
Light Duty—14 Ga 59 Spirals/Ft of sling width					
2	900	1,800	1,600	1,300	900
3	1,400	2,800	2,400	2,000	1,400
4	2,000	4,000	3,500	2,800	2,000
6	3,000	6,000	5,200	4,200	3,000
8	4,000	8,000	6,900	5,700	4,000
10	5,000	10,000	8,600	7,100	5,000

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TABLE N-184-15—RATED CAPACITIES—
Continued

Carbon Steel and Stainless Steel Metal Mesh Slings
[Horizontal angles shown in parentheses]

Sling width in inches	Vertical or choker	Vertical basket	Effect of angle on rated capacities in basket hitch		
			30° (60°)	45° (45°)	60° (30°)
12	6,000	12,000	10,400	8,500	6,000
14	7,000	14,000	12,100	9,900	7,000
16	8,000	16,000	13,900	11,300	8,000
18	9,000	18,000	15,600	12,700	9,000
20	10,000	20,000	17,300	14,100	10,000

(iv) Distortion of the female handle so that the depth of the slot is increased more than 10 per cent.

(v) Distortion of either handle so that the width of the eye is decreased more than 10 per cent.

(vi) A 15 percent reduction of the original cross sectional area of metal at any point around the handle eye.

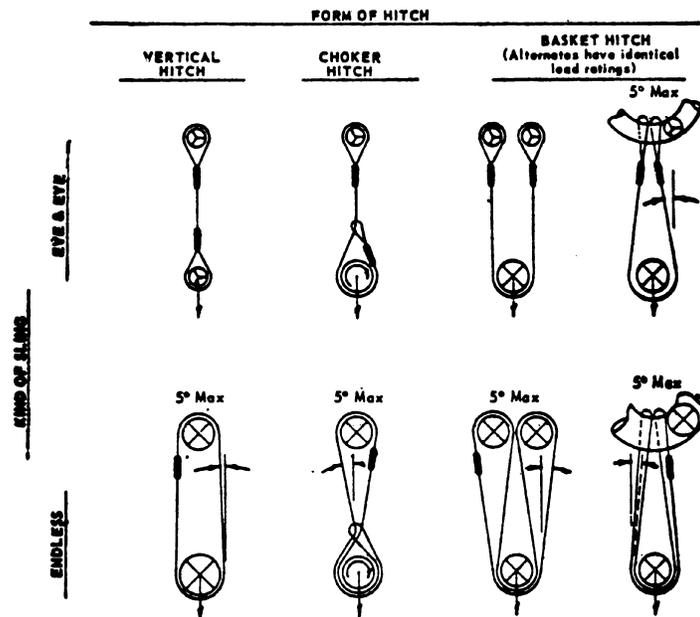
(vii) Distortion of either handle out of its plane.

(h) *Natural and synthetic fiber rope slings—(1) Sling use.* (i) Fiber rope slings made from conventional three strand construction fiber rope shall not be used with loads in excess of the rated capacities prescribed in Tables N-184-16 through N-184-19.

(ii) Fiber rope slings shall have a diameter of curvature meeting at least the minimums specified in Figs. N-184-4 and N-184-5.

(iii) Slings not included in these tables shall be used only in accordance with the manufacturer's recommendations.

FIGURE N-184.4

Basic Sling Configurations
with Vertical Legs

NOTES: Angles 5° or less from the vertical may be considered vertical angles.

For slings with legs more than 5° off vertical, the actual angle as shown in Figure N-184-5 must be considered.

EXPLANATION OF SYMBOLS: MINIMUM DIAMETER OF CURVATURE

- Represents a contact surface which shall have a diameter of curvature at least double the diameter of the rope from which the sling is made.
- Represents a contact surface which shall have a diameter of curvature at least 8 times the diameter of the rope.
- Represents a load in a choker hitch and illustrates the rotary force on the load and/or the slippage of the rope in contact with the load. Diameter of curvature of load surface shall be at least double the diameter of the rope.

FIGURE N-184-5

Sling Configurations with Angled Legs

		FORM OF HITCH		
		VERTICAL HITCH	CHOKER HITCH	BASKET HITCH (Alternates have identical load ratings)
KIND OF SLING	EYE & EYE	NOT APPLICABLE	NOT APPLICABLE	
	ENDLESS	NOT APPLICABLE	NOT APPLICABLE	

NOTES: For vertical angles of 5° or less, refer to Figure N-184-4 "Basic Sling Configurations with Vertical Legs".

See Figure N-184-4 for explanation of symbols.

TABLE N-184-16—MANILA ROPE SLINGS
[Angle of rope to vertical shown in parentheses]

Rope dia nominal in inches	Nominal wt. per 100 ft in pounds	Eye and eye sling				Endless sling							
		Vertical hitch	Choker hitch	Basket hitch; Angle of rope to horizontal		Vertical hitch	Choker hitch	Basket hitch; Angle of rope to horizontal					
				90° (0°)	60° (30°)			45° (45°)	30° (60°)	90° (0°)	60° (30°)	45° (45°)	30° (60°)
1/2	7.5	480	240	960	830	680	480	865	430	1,730	1,500	1,220	865
9/16	10.4	620	310	1,240	1,070	875	620	1,120	560	2,230	1,930	1,580	1,120
5/8	13.3	790	395	1,580	1,370	1,120	790	1,420	710	2,840	2,460	2,010	1,420
3/4	16.7	970	485	1,940	1,680	1,370	970	1,750	875	3,490	3,020	2,470	1,750
13/16	19.5	1,170	585	2,340	2,030	1,650	1,170	2,110	1,050	4,210	3,650	2,980	2,110
7/8	22.5	1,390	695	2,780	2,410	1,970	1,390	2,500	1,250	5,000	4,330	3,540	2,500
1	27.0	1,620	810	3,240	2,810	2,290	1,620	2,920	1,460	5,830	5,050	4,120	2,920
1 1/16	31.3	1,890	945	3,780	3,270	2,670	1,890	3,400	1,700	6,800	5,890	4,810	3,400
1 1/8	36.0	2,160	1,080	4,320	3,740	3,050	2,160	3,690	1,940	7,780	6,730	5,500	3,690
1 1/4	41.7	2,430	1,220	4,860	4,210	3,440	2,430	4,370	2,190	8,750	7,580	6,190	4,370
1 1/2	47.9	2,700	1,350	5,400	4,680	3,820	2,700	4,860	2,430	9,720	8,420	6,870	4,860
1 5/8	54.9	3,330	1,670	6,660	5,770	4,710	3,330	5,990	3,000	12,000	10,400	8,480	5,990
1 3/4	74.6	4,050	2,030	8,100	7,010	5,730	4,050	7,290	3,650	14,600	12,600	10,300	7,290
2	89.3	4,770	2,390	9,540	8,260	6,740	4,770	8,590	4,290	17,200	14,900	12,100	8,590
2 1/8	107.5	5,580	2,790	11,200	9,660	7,890	5,580	10,000	5,020	20,100	17,400	14,200	10,000
2 1/4	125.0	6,480	3,240	13,000	11,200	9,160	6,480	11,700	5,830	23,300	20,200	16,500	11,700
2 1/2	146.0	7,380	3,690	14,800	12,800	10,400	7,380	13,300	6,640	26,600	23,000	18,800	13,300
2 5/8	166.7	8,370	4,190	16,700	14,500	11,800	8,370	15,100	7,530	30,100	26,100	21,300	15,100
3	190.8	9,360	4,680	18,700	16,200	13,200	9,360	16,800	8,420	33,700	29,200	23,800	16,800

See Figs. N-184-4 and N-184-5 for sling configuration descriptions.

TABLE N-184-17—NYLON ROPE SLINGS
[Angle of rope to vertical shown in parentheses]

Rope dia nominal in inches	Nominal wt. per 100 ft in pounds	Eye and eye sling				Endless sling							
		Vertical hitch	Choker hitch	Basket hitch; Angle of rope to horizontal		Vertical hitch	Choker hitch	Basket hitch; Angle of rope to horizontal					
				90° (0°)	60° (30°)			45° (45°)	30° (60°)	90° (0°)	60° (30°)	45° (45°)	30° (60°)
1/2	6.5	635	320	1,270	1,100	900	635	1,140	570	2,290	1,980	1,620	1,140
9/16	8.3	790	395	1,580	1,370	1,120	790	1,420	710	2,840	2,460	2,010	1,420
5/8	10.5	1,030	515	2,060	1,780	1,460	1,030	1,850	925	3,710	3,210	2,620	1,850
3/4	14.5	1,410	705	2,820	2,440	1,990	1,410	2,540	1,270	5,080	4,400	3,590	2,540
13/16	17.0	1,680	840	3,360	2,910	2,380	1,680	3,020	1,510	6,050	5,240	4,280	3,020
7/8	20.0	1,980	990	3,960	3,430	2,800	1,980	3,560	1,780	7,130	6,170	5,040	3,560
1	26.0	2,480	1,240	4,960	4,300	3,510	2,480	4,460	2,230	8,930	7,730	6,310	4,460
1 1/16	29.0	2,850	1,430	5,700	4,940	4,030	2,850	5,130	2,570	10,300	8,890	7,260	5,130
1 1/8	34.0	3,270	1,640	6,540	5,660	4,620	3,270	5,890	2,940	11,800	10,200	8,330	5,890
1 1/4	40.0	3,710	1,860	7,420	6,430	5,250	3,710	6,680	3,340	13,400	11,600	9,450	6,680
1 5/8	45.0	4,260	2,130	8,520	7,380	6,020	4,260	7,670	3,830	15,300	13,300	10,800	7,670

TABLE N-184-17—NYLON ROPE SLINGS—Continued
[Angle of rope to vertical shown in parentheses]

Rope dia. nominal in inches	Nominal wt. per 100 ft in pounds	Eye and eye sling				Endless sling							
		Vertical hitch	Choker hitch	Basket hitch; Angle of rope to horizontal		Vertical hitch	Choker hitch	Basket hitch; Angle of rope to horizontal					
				90° (0°)	60° (30°)			45° (45°)	30° (60°)	90° (0°)	60° (30°)	45° (45°)	30° (60°)
1½	55.0	5,250	2,630	10,500	9,090	7,420	5,250	9,450	4,730	18,900	16,400	13,400	9,450
1⅝	68.0	6,440	3,220	12,900	11,200	9,110	6,440	11,600	5,800	23,200	20,100	16,400	11,600
1¾	83.0	7,720	3,860	15,400	13,400	10,900	7,720	13,900	6,950	27,800	24,100	19,700	13,900
2	95.0	9,110	4,560	18,200	15,800	12,900	9,110	16,400	8,200	32,800	28,400	23,200	16,400
2⅛	109.0	10,500	5,250	21,000	18,200	14,900	10,500	18,900	9,450	37,800	32,700	26,700	18,900
2¼	129.0	12,400	6,200	24,800	21,500	17,500	12,400	22,300	11,200	44,600	38,700	31,600	22,300
2½	149.0	13,900	6,950	27,800	24,100	19,700	13,900	25,000	12,500	50,000	43,300	35,400	25,000
2⅝	168.0	16,000	8,000	32,000	27,700	22,600	16,000	28,800	14,400	57,600	49,900	40,700	28,800

See Figs. N-184-4 and N-184-5 for sling configuration descriptions.

TABLE N-184-18—POLYESTER ROPE SLINGS
[Angle of rope to vertical shown in parentheses]

Rope dia. nominal in inches	Nominal wt. per 100 ft in pounds	Eye and eye sling				Endless sling							
		Vertical hitch	Choker hitch	Basket hitch; Angle of rope to horizontal		Vertical hitch	Choker hitch	Basket hitch; Angle of rope to horizontal					
				90° (0°)	60° (30°)			45° (45°)	30° (60°)	90° (0°)	60° (30°)	45° (45°)	30° (60°)
½	8.0	635	320	1,270	1,100	900	635	1,140	570	2,290	1,980	1,620	1,140
⅝	10.2	790	395	1,580	1,370	1,120	790	1,420	710	2,840	2,460	2,010	1,420
⅞	13.0	990	495	1,980	1,710	1,400	990	1,780	890	3,570	3,090	2,520	1,780
¾	17.5	1,240	620	2,480	2,150	1,750	1,240	2,230	1,120	4,470	3,870	3,160	2,230
⅞	21.0	1,540	770	3,080	2,670	2,180	1,540	2,770	1,390	5,540	4,800	3,920	2,770
1	25.0	1,780	890	3,560	3,080	2,520	1,780	3,200	1,600	6,410	5,550	4,530	3,200
1⅛	30.5	2,180	1,090	4,360	3,780	3,080	2,180	3,920	1,960	7,850	6,800	5,550	3,920
1¼	34.5	2,530	1,270	5,060	4,380	3,580	2,530	4,550	2,280	9,110	7,990	6,440	4,550
1½	40.0	2,920	1,460	5,840	5,060	4,130	2,920	5,260	2,630	10,500	9,100	7,440	5,260
1⅝	46.3	3,290	1,650	6,580	5,700	4,650	3,290	5,920	2,960	11,800	10,300	8,380	5,920
1¾	52.5	3,710	1,860	7,420	6,430	5,250	3,710	6,680	3,340	13,400	11,600	9,450	6,680
1½	66.8	4,630	2,320	9,260	8,020	6,550	4,630	8,330	4,170	16,700	14,600	11,800	8,330
1¾	82.0	5,640	2,820	11,300	9,770	7,980	5,640	10,200	5,080	20,300	17,600	14,400	10,200
1¾	98.0	6,710	3,360	13,400	11,600	9,490	6,710	12,100	6,040	24,200	20,900	17,100	12,100
2	118.0	7,920	3,960	15,800	13,700	11,200	7,920	14,300	7,130	28,500	24,700	20,200	14,300
2⅛	135.0	9,110	4,460	18,200	15,800	12,900	9,110	16,400	8,200	32,800	28,400	23,200	16,400
2¼	157.0	10,600	5,300	21,200	18,400	15,000	10,600	19,100	9,540	38,200	33,100	27,000	19,100
2½	181.0	12,100	6,050	24,200	21,000	17,100	12,100	21,800	10,900	43,600	37,700	30,800	21,800
2⅝	205.0	13,600	6,800	27,200	23,600	19,200	13,600	24,500	12,200	49,000	42,400	34,600	24,500

See Figs. N-184-4 and N-184-5 for sling configuration descriptions.

TABLE N-184-19—POLYPROPYLENE ROPE SLINGS
[Angle of rope to vertical shown in parentheses]

Rope dia. nominal in inches	Nominal wt. per 100 ft in pounds	Eye and eye sling				Endless sling							
		Vertical hitch	Choker hitch	Basket hitch; Angle of rope to horizontal			Vertical hitch	Choker hitch	Basket hitch; Angle of rope to horizontal				
				90° (0°)	60° (30°)	45° (45°)			30° (60°)	90° (0°)	60° (60°)	45° (45°)	30° (60°)
1/2	4.7	645	325	1,290	1,120	910	645	1,160	580	2,320	2,010	1,640	1,160
9/16	6.1	780	390	1,560	1,350	1,100	780	1,400	700	2,810	2,430	1,990	1,400
5/8	7.5	950	475	1,900	1,650	1,340	950	1,710	855	3,420	2,960	2,420	1,710
3/4	10.7	1,300	650	2,600	2,250	1,840	1,300	2,340	1,170	4,680	4,050	3,310	2,340
13/16	12.7	1,520	760	3,040	2,630	2,150	1,520	2,740	1,370	5,470	4,740	3,870	2,740
7/8	15.0	1,760	880	3,520	3,050	2,490	1,760	3,170	1,580	6,340	5,490	4,480	3,170
1	18.0	2,140	1,070	4,280	3,700	3,030	2,140	3,850	1,930	7,700	6,670	5,450	3,860
1 1/16	20.4	2,450	1,225	4,900	4,240	3,460	2,450	4,410	2,210	8,820	7,640	6,240	4,410
1 1/8	23.7	2,800	1,400	5,600	4,850	3,960	2,800	5,040	2,520	10,100	8,730	7,130	5,040
1 1/4	27.0	3,210	1,610	6,420	5,560	4,540	3,210	5,780	2,890	11,600	10,000	8,170	5,780
1 1/2	30.5	3,600	1,800	7,200	6,240	5,090	3,600	6,480	3,240	13,000	11,200	9,170	6,480
1 5/8	38.5	4,540	2,270	9,080	7,860	6,420	4,540	8,170	4,090	16,300	14,200	11,600	8,170
1 3/4	47.5	5,510	2,760	11,000	9,540	7,790	5,510	9,920	4,960	19,800	17,200	14,000	9,920
2	57.0	6,580	3,290	13,200	11,400	9,300	6,580	11,800	5,920	23,700	20,500	16,800	11,800
2 1/8	69.0	7,960	3,980	15,900	13,800	11,300	7,960	14,300	7,160	28,700	24,800	20,300	14,300
2 1/4	80.0	9,330	4,670	18,700	16,200	13,200	9,330	16,800	8,400	33,600	29,100	23,800	16,800
2 1/2	92.0	10,600	5,300	21,200	18,400	15,000	10,600	19,100	9,540	38,200	33,100	27,000	19,100
2 3/4	107.0	12,200	6,100	24,400	21,100	17,300	12,200	22,000	11,000	43,900	38,000	31,100	22,000
2 5/8	120.0	13,800	6,900	27,600	23,900	19,600	13,800	24,800	12,400	49,700	43,000	35,100	24,800

See Figs. N-184-4 and N-184-5 for sling configuration descriptions.

(2) *Safe operating temperatures.* Natural and synthetic fiber rope slings, except for wet frozen slings, may be used in a temperature range from minus 20 °F to plus 180 °F without decreasing the working load limit. For operations outside this temperature range and for wet frozen slings, the sling manufacturer's recommendations shall be followed.

(3) *Splicing.* Spliced fiber rope slings shall not be used unless they have been spliced in accordance with the following minimum requirements and in accordance with any additional recommendations of the manufacturer:

(i) In manila rope, eye splices shall consist of at least three full tucks, and short splices shall consist of at least six full tucks, three on each side of the splice center line.

(ii) In synthetic fiber rope, eye splices shall consist of at least four full tucks, and short splices shall consist of at least eight full tucks, four on each side of the center line.

(iii) Strand end tails shall not be trimmed flush with the surface of the rope immediately adjacent to the full tucks. This applies to all types of fiber rope and both eye and short splices. For fiber rope under one inch in diameter, the tail shall project at least six rope diameters beyond the last full tuck. For fiber rope one inch in diameter and larger, the tail shall project at least six inches beyond the last full tuck. Where a projecting tail interferes with the use of the sling, the tail shall be tapered and spliced into the body of the rope using at least two additional tucks (which will require a tail length of approximately six rope diameters beyond the last full tuck).

(iv) Fiber rope slings shall have a minimum clear length of rope between eye splices equal to 10 times the rope diameter.

(v) Knots shall not be used in lieu of splices.

(vi) Clamps not designed specifically for fiber ropes shall not be used for splicing.

(vii) For all eye splices, the eye shall be of such size to provide an included angle of not greater than 60 degrees at the splice when the eye is placed over the load or support.

(4) *End attachments.* Fiber rope slings shall not be used if end attachments in

contact with the rope have sharp edges or projections.

(5) *Removal from service.* Natural and synthetic fiber rope slings shall be immediately removed from service if any of the following conditions are present:

(i) Abnormal wear.

(ii) Powdered fiber between strands.

(iii) Broken or cut fibers.

(iv) Variations in the size or roundness of strands.

(v) Discoloration or rotting.

(vi) Distortion of hardware in the sling.

(6) *Repairs.* Only fiber rope slings made from new rope shall be used. Use of repaired or reconditioned fiber rope slings is prohibited.

(i) *Synthetic web slings—(1) Sling identification.* Each sling shall be marked or coded to show the rated capacities for each type of hitch and type of synthetic web material.

(2) *Webbing.* Synthetic webbing shall be of uniform thickness and width and selvage edges shall not be split from the webbing's width.

(3) *Fittings.* Fittings shall be:

(i) Of a minimum breaking strength equal to that of the sling; and

(ii) Free of all sharp edges that could in any way damage the webbing.

(4) *Attachment of end fittings to webbing and formation of eyes.* Stitching shall be the only method used to attach end fittings to webbing and to form eyes. The thread shall be in an even pattern and contain a sufficient number of stitches to develop the full breaking strength of the sling.

(5) *Sling use.* Synthetic web slings illustrated in Fig. N-184-6 shall not be used with loads in excess of the rated capacities specified in Tables N-184-20 through N-184-22. Slings not included in these tables shall be used only in accordance with the manufacturer's recommendations.

(6) *Environmental conditions.* When synthetic web slings are used, the following precautions shall be taken:

(i) Nylon web slings shall not be used where fumes, vapors, sprays, mists or liquids of acids or phenolics are present.

(ii) Polyester and polypropylene web slings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

(iii) Web slings with aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

Fig. N-184-6
Basic Synthetic Web Slings
Constructions

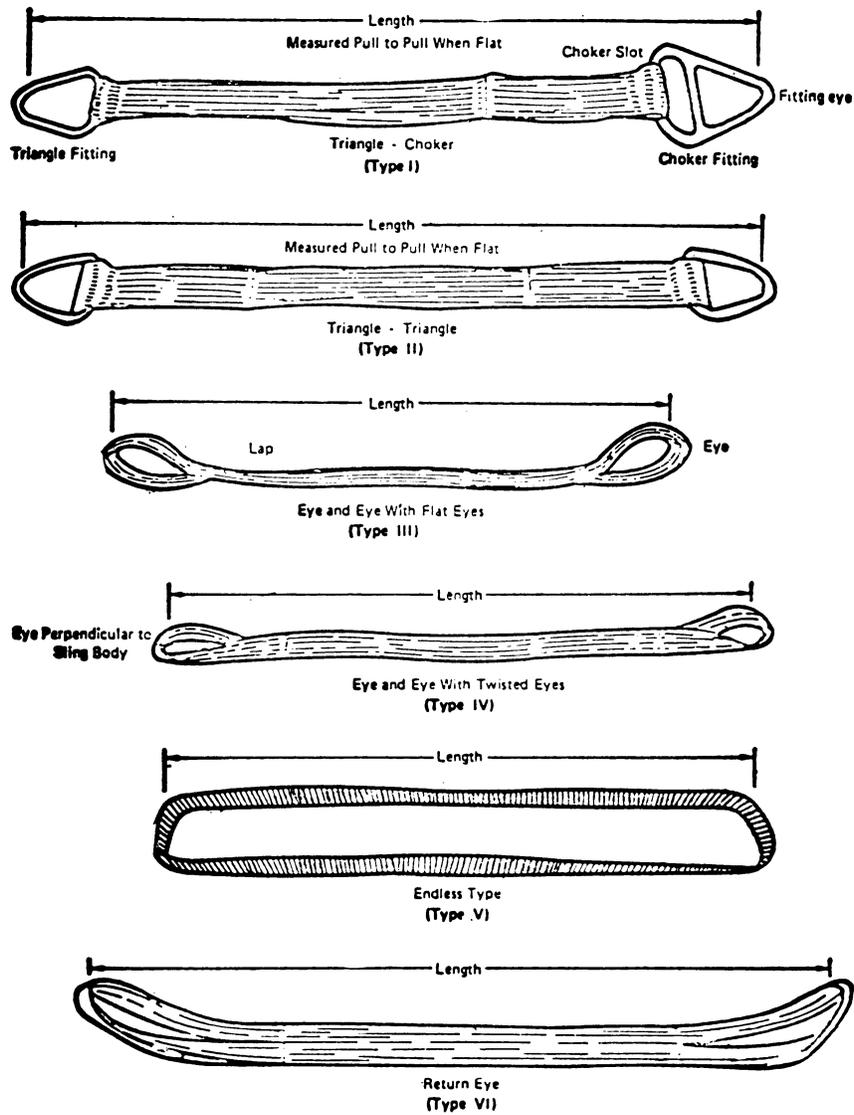


TABLE N-184-20—SYNTHETIC WEB SLINGS—1,000 POUNDS PER INCH OF WIDTH—SINGLE-PLY
[Rated capacity in pounds]

Slings body width, inches	Triangle—Choker slings, type I: Triangle—Triangle slings, type II: Eye and eye with flat eye slings, type III: Eye and eye with twisted eye slings, type IV						Endless slings, type V						Return eye slings, type VI													
	Vert.		30° basket		45° basket		Vert.		Choker basket		30° basket		45° basket		60° basket		Vert.		Choker		30° basket		45° basket		60° basket	
	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket
1	1,000	2,000	1,700	1,400	1,000	1,600	1,300	3,200	2,800	2,300	1,600	800	650	1,600	1,400	1,150	800	1,600	1,300	1,000	800	650	1,600	1,400	1,150	800
2	2,000	4,000	3,500	2,800	2,000	3,200	2,600	6,400	5,600	4,800	3,200	1,600	1,300	3,200	2,800	2,300	1,600	3,200	2,600	2,000	1,600	1,300	3,200	2,800	2,300	1,600
3	3,000	6,000	5,200	4,200	3,000	4,800	3,800	9,600	8,400	7,200	4,800	2,400	1,950	4,800	4,150	3,400	2,400	4,800	3,800	2,800	2,400	1,950	4,800	4,150	3,400	2,400
4	4,000	8,000	6,900	5,700	4,000	6,400	5,100	12,800	11,100	9,000	6,400	3,200	2,600	6,400	5,500	4,500	3,200	6,400	5,100	4,000	3,200	2,600	6,400	5,500	4,500	3,200
5	5,000	10,000	8,700	7,100	5,000	8,000	6,400	16,000	13,900	11,300	8,000	4,000	3,250	8,000	6,900	5,650	4,000	8,000	6,400	5,000	4,000	3,250	8,000	6,900	5,650	4,000
6	6,000	12,000	10,400	8,500	6,000	9,600	7,700	19,200	16,600	13,600	9,600	4,800	3,800	9,600	8,300	6,800	4,800	9,600	7,700	6,000	4,800	3,800	9,600	8,300	6,800	4,800

NOTES: 1. All angles shown are measured from the vertical.
2. Capacities for intermediate widths not shown may be obtained by interpolation.

TABLE N-184-21—SYNTHETIC WEB SLINGS—1,200 POUNDS PER INCH OF WIDTH—SINGLE-PLY
[Rated capacity in pounds]

Slings body width, inches	Triangle—Choker slings, type I: Triangle—Triangle slings, type II: Eye and eye with flat eye slings, type III: Eye and eye with twisted eye slings, type IV						Endless slings, type V						Return eye slings, type VI													
	Vert.		30° basket		45° basket		Vert.		Choker basket		30° basket		45° basket		60° basket		Vert.		Choker		30° basket		45° basket		60° basket	
	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket
1	1,200	2,400	2,100	1,700	1,200	1,900	1,500	3,800	3,300	2,700	1,900	950	750	1,900	1,650	1,350	950	1,900	1,500	1,100	950	750	1,900	1,650	1,350	950
2	2,400	4,800	4,200	3,400	2,400	3,800	3,000	7,600	6,600	5,400	3,800	1,900	1,500	3,800	3,300	2,700	1,900	3,800	3,000	2,200	1,900	1,500	3,800	3,300	2,700	1,900
3	3,600	7,200	6,200	5,100	3,600	5,800	4,600	11,600	10,000	8,200	5,800	2,850	2,250	5,800	5,000	4,050	2,850	5,800	4,600	3,400	2,850	2,250	5,800	5,000	4,050	2,850
4	4,800	9,600	8,300	6,800	4,800	7,700	6,200	15,400	13,300	10,900	7,700	3,800	3,000	7,700	6,600	5,400	3,800	7,700	6,200	4,600	3,800	3,000	7,700	6,600	5,400	3,800
5	6,000	12,000	10,400	8,500	6,000	9,600	7,700	19,200	16,600	13,600	9,600	4,750	3,750	9,600	8,250	6,750	4,750	9,600	7,700	6,000	4,750	3,750	9,600	8,250	6,750	4,750
6	7,200	14,400	12,500	10,200	7,200	11,500	9,200	23,000	19,900	16,300	11,500	5,800	4,600	11,500	10,000	8,200	5,800	11,500	9,200	7,000	5,800	4,600	11,500	10,000	8,200	5,800

NOTES: 1. All angles shown are measured from the vertical.
2. Capacities for intermediate widths not shown may be obtained by interpolation.

TABLE N-184-22—SYNTHETIC WEB SLINGS—1,600 POUNDS PER INCH OF WIDTH—SINGLE-PLY
[Rated capacity in pounds]

Slings body width, inches	Triangle—Choker slings, type I: Triangle—Triangle slings, type II: Eye and eye with flat eye slings, type III: Eye and eye with twisted eye slings, type IV						Endless slings, type V						Return eye slings, type VI														
	Vert.		30° basket		45° basket		Vert.		Choker basket		30° basket		45° basket		60° basket		Vert.		Choker		30° basket		45° basket		60° basket		
	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	Choker	Vert. basket	
1	1,600	3,200	2,800	2,300	1,600	2,600	2,100	5,200	4,500	3,700	2,600	1,050	1,050	2,600	2,250	1,850	1,050	5,200	4,500	3,700	2,600	1,050	1,050	2,600	2,250	1,850	1,050

2	3,200	2,400	6,400	5,500	4,500	3,200	5,100	4,100	10,200	8,800	7,200	5,100	2,600	2,100	5,200	4,500	3,700	2,600
3	4,800	3,600	9,600	8,300	6,800	4,800	7,700	6,200	15,400	13,300	10,900	7,700	3,900	3,150	7,800	6,750	5,500	3,900
4	6,400	4,800	12,800	11,100	9,000	6,400	10,100	8,200	20,400	17,700	14,400	10,200	5,100	4,100	10,200	8,800	7,200	5,100
5	8,000	6,000	16,000	13,800	11,300	8,000	12,800	10,200	25,600	22,200	18,100	12,800	6,400	5,150	12,800	11,050	9,050	6,400
6	9,600	7,200	19,200	16,600	13,600	9,600	15,400	12,300	30,800	26,700	21,800	15,400	7,700	6,200	15,400	13,300	10,900	7,700

NOTES: 1. All angles shown are measured from the vertical.
 2. Capacities for intermediate widths not shown may be obtained by interpolation.

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(7) *Safe operating temperatures.* Synthetic web slings of polyester and nylon shall not be used at temperatures in excess of 180 °F. Polypropylene web slings shall not be used at temperatures in excess of 200 °F.

(8) *Repairs.* (i) Synthetic web slings which are repaired shall not be used unless repaired by a sling manufacturer or an equivalent entity.

(ii) Each repaired sling shall be proof tested by the manufacturer or equivalent entity to twice the rated capacity prior to its return to service. The employer shall retain a certificate of the proof test and make it available for examination.

(iii) Slings, including webbing and fittings, which have been repaired in a temporary manner shall not be used.

(9) *Removal from service.* Synthetic web slings shall be immediately removed from service if any of the following conditions are present:

- (i) Acid or caustic burns;
- (ii) Melting or charring of any part of the sling surface;
- (iii) Snags, punctures, tears or cuts;
- (iv) Broken or worn stitches; or
- (v) Distortion of fittings.

[40 FR 27369, June 27, 1975, as amended at 40 FR 31598, July 28, 1975; 41 FR 13353, Mar. 30, 1976; 58 FR 35309, June 30, 1993; 61 FR 9240, Mar. 7, 1996]

Subpart O—Machinery and Machine Guarding

AUTHORITY: Sections 4, 6, and 8 of the Occupational Safety and Health Act of 1970 (29 U.S.C. 653, 655, 657); Secretary of Labor's Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), 1-90 (55 FR 9033), or 5-2002 (67 FR 65008), as applicable; 29 CFR part 1911. Sections 1910.217 and 1910.219 also issued under 5 U.S.C. 553.

§ 1910.211 Definitions.

(a) As used in §§ 1910.213 and 1910.214 unless the context clearly requires otherwise, the following woodworking machinery terms shall have the meaning prescribed in this paragraph.

(1) *Point of operations* means that point at which cutting, shaping, boring, or forming is accomplished upon the stock.

(2) *Push stick* means a narrow strip of wood or other soft material with a

notch cut into one end and which is used to push short pieces of material through saws.

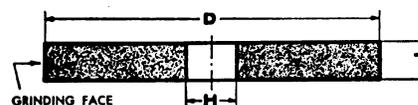
(3) *Block* means a short block of wood, provided with a handle similar to that of a plane and a shoulder at the rear end, which is used for pushing short stock over revolving cutters.

(b) As used in § 1910.215 unless the context clearly requires otherwise, the following abrasive wheel machinery terms shall have the meanings prescribed in this paragraph.

(1) *Type 1 straight wheels* means wheels having diameter, thickness, and hole size dimensions, and they should be used only on the periphery. Type 1 wheels shall be mounted between flanges.

LIMITATION: Hole dimension (H) should not be greater than two-thirds of wheel diameter dimension (D) for precision, cylindrical, centerless, or surface grinding applications. Maximum hole size for all other applications should not exceed one-half wheel diameter.

FIGURE NO. 0-1—TYPE 1 STRAIGHT WHEELS



TYPE 1—STRAIGHT WHEEL

Peripheral grinding wheel having a diameter, thickness and hole.

(2) *Type 2 cylinder wheels* means wheels having diameter, wheel thickness, and rim thickness dimensions. Grinding is performed on the rim face only, dimension W. Cylinder wheels may be plain, plate mounted, inserted nut, or of the projecting stud type.

LIMITATION: Rim height, T dimension, is generally equal to or greater than rim thickness, W dimension.