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DEPARTMENT OF LABOR

**Occupational Safety and
Health Administration**



**OCCUPATIONAL SAFETY AND
HEALTH STANDARDS**

Industrial Slings

DEPARTMENT OF LABOR

Occupational Safety and Health
Administration

[29 CFR Part 1910]

OCCUPATIONAL SAFETY AND HEALTH
STANDARDS

Industrial Slings

Pursuant to section 6(b) of the Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat. 1593; 29 U.S.C. 655), Secretary of Labor's Order No. 12-71 (36 FR 8754) and 29 CFR Part 1911, it is hereby proposed to adopt new standards for slings made from alloy steel chain, wire rope, metal mesh, natural or synthetic fiber rope, and synthetic webbing.

The proposed standards are based on the consensus standard, American National Standards Institute (ANSI) B30.9-1971, though the following changes have been made:

1. The frequency of sling inspections as required by the American National Standards Institute was increased so that all slings will be inspected each day they are in use. The daily inspections shall be conducted before the slings are put into service. In addition, slings made from alloy steel chain, wire rope and metal mesh shall receive a more thorough, periodic inspection at least every three months based on the extent of sling usage. The criteria for time lapse between inspections is based on 29 CFR 1918.64(b).

2. The proposed standards require the employer to designate a knowledgeable person to conduct the periodic inspections and to assume responsibility for the maintenance of safe equipment. This was not required by the ANSI standard in all cases.

3. The ANSI requirement that employers shall have the sling manufacturer perform the repairs and tests on the slings was changed to allow any organization, capable of performing the same repairs and tests with equal competence, do the work.

4. The provisions in the ANSI standard covering storage of slings have not been included because they do not directly concern employee safety.

5. A number of provisions within the ANSI standard which were advisory in nature have been made mandatory.

Interested persons are invited to submit written data, views, and arguments

concerning the proposal to the Office of Standards, Room 508, Railway Labor Building, 400 First Street NW., Washington, D.C. 20210 by October 26, 1973. The data, views, and arguments will be available for public inspection and copying at the Office of Standards located at the above address.

Pursuant to 29 CFR 1910.11(b) and (c), interested persons may, in addition to filing written matter as provided above, file objections to the proposal requesting an informal hearing with respect thereto, in accordance with the following conditions:

(1) The objections must include the name and address of the objector.

(2) The objections must be postmarked on or before October 26, 1973.

(3) The objections must specify with particularity the provision of the proposed rule to which objection is taken, and must state the grounds therefor.

(4) Each objection must be separately stated and numbered.

(5) The objections must be accompanied by a summary of the evidence proposed to be adduced at the requested hearing.

1. A new § 1910.190 would be added to 29 CFR Part 1910 to read as follows:

§ 1910.190 Slings.

(a) *Scope.* This section applies to slings made from alloy steel chain, wire rope, metal mesh, natural or synthetic fiber rope, and synthetic webbing, and used in conjunction with other equipment to move material by hoisting in general industrial operations. Specialized operations involving slings are covered by the following standards in this chapter: Ship Repairing, § 1915.62; Shipbuilding, § 1916.62; Shipbreaking, § 1917.62; Longshoring, §§ 1918.62, 1918.63, 1918.641 and Construction, § 1926.251. Slings of a size or made of a type of material not considered by this section shall be used only in accordance with the recommendations of the sling manufacturer.

(b) *Definitions applicable to this section.* (1) "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-190-5; provided that an angle of loading of five degrees or less from the vertical may be considered a vertical load.

(2) "Braided wire rope" is a rope formed by plaiting component wire ropes.

(3) "Braided wire rope sling" is a sling made from braided wire rope.

(4) "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.

(5) "Cable body 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.

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

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

(8) "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.

(9) "Coating" is an elastomer or other suitable material applied to a sling to impart desirable properties.

(10) "Cross rod" is a wire used to join spirals of metal mesh to form a complete fabric. (See Fig. N-190-2)

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

(12) "Equivalent entity" is an organization which, by possession of technical equipment and knowledgeable personnel can perform with equal competence the same repairs and tests as the organization with which it is equated.

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

(14) "Handle" is a terminal fitting to which metal mesh fabric is attached. (See Fig. N-190-1)

(15) "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 sling in a choker hitch.

(16) "Handle eye" is an opening in a handle shaped to accept a hook, shackle or other lifting device.

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

(18) "Hitch" is the method by which a load is supported by a sling.

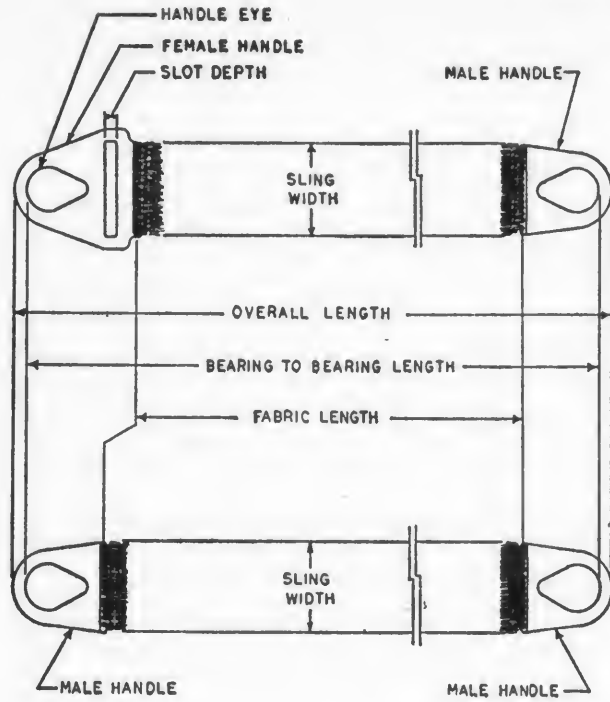


FIG. N-190-1

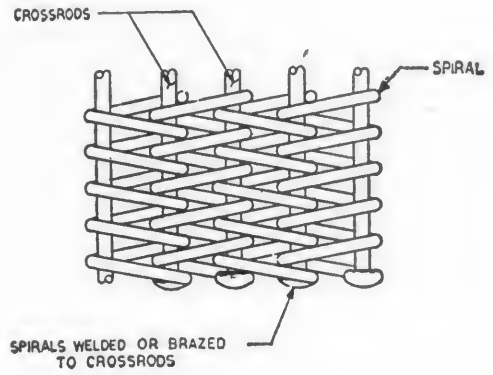


FIG. N-190-2

PROPOSED RULES

(19) "Basket hitch" is a method of supporting a load with the sling passed under the load with both ends, end attachments, eyes or handles on the hook or a single master link. (See Fig. N-190-4)

(20) "Choker hitch" is a method of supporting a load with one end of the sling passing through an end attachment, eye or handle on the other end and supporting the load. (See Fig. N-190-4)

(21) "Vertical hitch" is a method of supporting a load by a single, vertical part or leg of the sling. (See Fig. N-190-4)

(22) "Link" is a single ring of a chain.

(23) "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-190-3)

(24) "Master link (Gathering ring)" is a forged or welded steel link used to support all members (legs) of an alloy steel chain or wire rope sling. (See Fig. N-190-3)

(25) "Mechanical coupling link (Alloy steel chain)" is a nonwelded, mechanically closed link used primarily to attach master links, hooks, etc., to running alloy steel chain.

(26) "Minimum breaking strength" is the minimum load at which the sling will break when loaded to destruction in direct tension.

(27) "Nominal breaking strength" is the load at which the sling could be expected to break when loaded to destruction in direct tension.

(28) "Proof load" is the specific load applied in performance of the proof test.

(29) "Proof test" is a nondestructive tension test made by the sling manufacturer or equivalent entity to verify construction and workmanship of the individual sling.

(30) "Rated capacity (Working load limit)" is the maximum allowable working load.

(31) "Reach (Alloy steel chain)" is the effective length of an alloy steel chain sling measured from the top bearing surface of the master link to the bearing surface in the base (bowl) of the hook.

(32) "Safety factor" is the ratio of nominal or minimum breaking strength to the rated capacity of the sling.

(33) "Selvage edge" is the finished edge of synthetic webbing designed to prevent unraveling.

(34) "Sling manufacturer" is a person or company that assembles sling components into their final form.

(35) "Spiral" is a single transverse coil that is the basic element from which metal mesh is fabricated.

(36) "Strand laid endless sling—mechanical joint" is a wire rope sling made endless from one continuous length of rope with the ends joined by one or more metallic fittings.

(37) "Strand laid grommet—hand tucked" is an endless wire rope sling made from one continuous length of wire wrapped six times around a core formed by hand tucking the ends of the wire inside the six wraps.

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

(c) *General requirements.* (1) *Safe operating practices.*—Whenever any sling is to be used, the employer shall require that the following practices be observed:

(i) Slings that are unsafe shall not be used.

(ii) Slings shall not be exposed to temperatures in excess of the manufacturer's recommendations.

(iii) A sling shall be used that is long enough to provide the maximum practical angle between the sling leg and the horizontal (minimum practical angle at the crane hook if vertical angles are used).

(iv) Slings shall not be shortened with knots, bolts, or similar methods.

(v) Twisting and/or kinking the legs of a sling is prohibited.

(vi) A sling shall not be loaded in excess of its rated capacity.

(vii) The load shall be centered in the base (bowl) of the hook to prevent point loading.

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

(ix) A sling shall be padded or protected from the sharp edges of its load.

(x) Hands and fingers shall not be placed between the sling and its load.

(xi) Each sling shall be securely hitched to its load.

(xii) The load shall be free to move before lifting and shall be kept clear of all obstructions.

(xiii) Shock loading shall be avoided.

(xiv) All personnel must stand clear of a suspended load.

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

(2) *Inspections.*—(i) All slings, including end fastenings and attachments, shall be given a visual inspection for damage each day before being used. A thorough inspection of all alloy steel chain, wire rope, and metal mesh 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. However, such inspection shall in no event be at intervals greater than once every three months.

(ii) Each sling shall bear an indication of the month in which it was thoroughly inspected.

(iii) The thorough inspection shall be performed by designated personnel and shall include inspection for wear, defective welds where applicable, deformation and increase in length. Where such deterioration results in a loss of original strength, the sling shall be removed from service.

(d) *Alloy steel chain.* (1) *Chain properties.*—(i) The employer shall obtain and retain a certificate of proof test from the manufacturer or an equivalent entity for each new, repaired or reconditioned sling used showing that it has been tested in accordance with ASTM Specification for Alloy Steel Chain, A391-65 (ANSI G61.1-1968).

(ii) Minimum proof loads for alloy steel chain shall be equal to twice the working load limit values shown for single branch slings.

(2) *Chain use.*—Alloy steel chain slings shall not be used with loads in excess of those prescribed in Table N-190-1.

(3) *Sling identification.*—Welded alloy steel chain slings shall have permanently affixed durable identification stating size, grade, rated capacity and sling manufacturer.

(4) *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.

(ii) Attachments shall be of a size recommended by the manufacturer.

(iii) All welded components in the sling assembly shall be proof tested by the sling manufacturer or an equivalent entity before use. The employer shall retain a certificate of this proof test.

TABLE N-190-1
RATED CAPACITY (WORKING LOAD LIMIT), FOR ALLOY STEEL CHAIN SLINGS*
RATED CAPACITY (WORKING LOAD LIMIT), POUNDS

Chain Size, Inches	Single Branch Sling - 90 degree Loading	Double Sling Vertical Angle (1)		Triple end Quadruple Sling (3)	
		30 degree	45 degree	30 degree	45 degree
1/4	3,250	5,650	4,550	8,400	6,800
3/8	6,600	11,400	9,300	17,000	14,000
1/2	11,250	19,500	15,900	29,000	24,000
5/8	16,500	28,500	23,300	43,000	35,000
3/4	23,000	39,800	33,500	59,500	48,500
7/8	28,750	49,800	40,600	74,500	61,000
1	38,750	67,100	54,800	101,000	82,000
1-1/8	44,500	77,000	63,000	115,500	94,500
1-1/4	57,500	99,500	81,000	149,000	121,500
1-3/8	67,000	116,000	94,000	174,000	141,000
1-1/2	80,000	138,000	112,500	207,000	169,000
1-3/4	100,000	172,000	140,000	258,000	210,000

(1) Rating of multiple sling adjusted for angle of loading measured as the included angle between the inclined leg and the vertical as shown in Figure 5.
(2) Rating of multiple sling adjusted for angle of loading between the inclined leg and the horizontal plane of the load, as shown in Figure 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-190-2
MAXIMUM ALLOWABLE WEAR
AT ANY POINT OF LINK

Chain Size, Inches	Maximum Allowable Wear, Inch
1/4	3/64
3/8	5/64
1/2	7/64
5/8	9/64
3/4	5/32
7/8	11/64
1	3/16
1-1/8	7/32
1-1/4	1/4
1-3/8	9/32
1-1/2	5/16
1-3/4	11/32

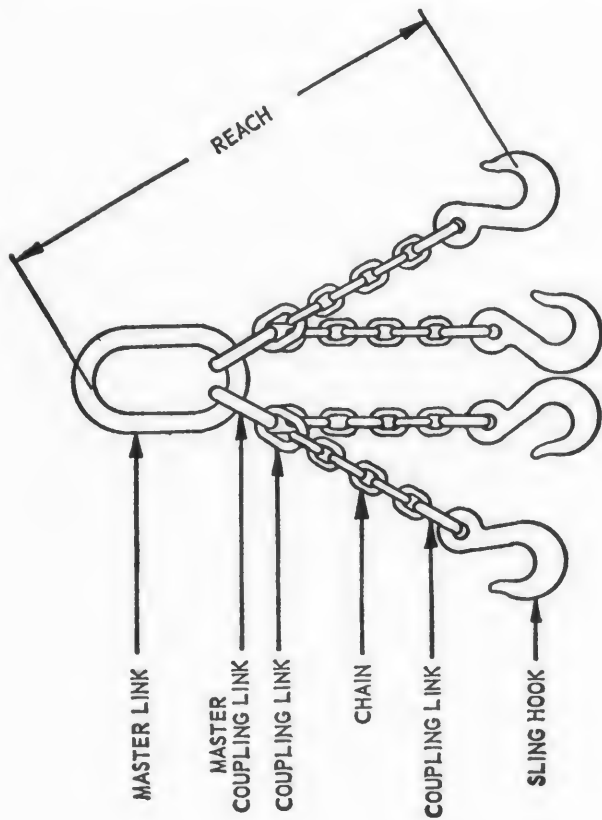


FIG. N-190-3 MAJOR COMPONENTS OF A QUADRUPLE SLING.

TABLE N-190-4
RATED CAPACITIES FOR SINGLE LEG SLINGS
6 x 19 AND 6 x 37 CLASSIFICATION IMPROVED FLOW STEEL GRADE ROPE
WITH INDEPENDENT WIRE ROPE CORE (IWRC)

Dia (Inches)	Rope Constr	Rated Capacities, Tons (2,000 lb)			HT	Vertical Basket*	
		HT	MS	S		HT	MS
1/4	6 x 19	0.53	0.57	0.59	0.40	0.44	1.0
5/16	6 x 19	0.81	0.86	0.92	0.61	0.65	1.1
3/8	6 x 19	1.1	1.2	1.3	0.86	0.98	1.6
7/16	6 x 19	1.5	1.7	1.8	1.2	1.3	2.5
1/2	6 x 19	2.0	2.2	2.3	1.5	1.6	3.1
9/16	6 x 19	2.5	2.7	2.9	1.8	2.1	4.4
5/8	6 x 19	3.0	3.4	3.6	2.2	2.5	5.5
3/4	6 x 19	4.2	4.9	5.1	3.1	3.6	7.2
7/8	6 x 19	5.5	6.6	6.9	4.1	4.9	10.0
1	6 x 19	7.2	8.5	9.0	5.4	6.7	14.0
1-1/8	6 x 19	9.0	10.0	11.0	6.8	8.5	18.0
1-1/4	6 x 37	10.0	12.0	13.0	7.9	9.9	21.0
1-3/8	6 x 37	13.0	15.0	16.0	9.6	11.0	24.0
1-1/2	6 x 37	15.0	17.0	19.0	11.0	13.0	29.0
1-5/8	6 x 37	18.0	20.0	22.0	13.0	15.0	35.0
1-3/4	6 x 37	20.0	24.0	26.0	15.0	18.0	41.0
2	6 x 37	26.0	30.0	33.0	20.0	25.0	53.0

HT = Hand Tucked Splice
For hidden tuck splices (IWRC) use Table 1 values in HT column.
MS = Mechanical Splice.
S = Swaged or Zinc Plated Socket.

*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-190-5
RATED CAPACITIES FOR SINGLE LEG SLINGS
CABLE LAID ROPE - MECHANICAL SPLICE ONLY
7 x 7 x 7 & 7 x 7 x 19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE
7 x 6 x 19 IWRC CONSTRUCTION IMPROVED FLOW STEEL GRADE ROPE

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

*These 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.

(iv) Homemade links, makeshift fasteners formed from bolts, rods, or other such attachments shall not be used.

(v) Repair and reconditioning alloy steel chain slings—(1) Worn or damaged alloy steel chain slings or attachments shall not be used until they are repaired by the sling manufacturer or an equivalent entity. (See paragraph (d) (1) (i) of this section.)

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

(6) Effects of wear.—If wear at any point of any chain link exceeds that shown in Table N-190-2, the assembly shall be removed from service.

(7) Deformed attachments.—(1) Assemblies with deformed master links or coupling links shall be removed from service.

(1) Assemblies 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.

(e) Wire rope. (1) General.—The wire rope slings covered by this subsection are set forth in Tables N-190-3 to 14. Other grades, types, sizes and constructions may be used. When such slings are used, they shall be used only in accordance with the recommendations of the sling manufacturer.

(2) Factor of safety.—The factor of safety for wire rope slings of all grades shall be a minimum of five (5). Rated capacities for wire rope slings are shown in Tables N-190-3 through 14, which apply this safety factor.

TABLE N-190-3
RATED CAPACITIES FOR SINGLE LEG SLINGS
6 x 19 AND 6 x 37 CLASSIFICATION IMPROVED FLOW STEEL GRADE ROPE
WITH FIBER CORE (FC)

Dia (Inches)	Rope Constr	Rated Capacities, Tons (2,000 lb)			HT	Vertical Basket*	
		HT	MS	S		HT	MS
1/4	6 x 19	0.49	0.51	0.55	0.37	0.41	1.1
5/16	6 x 19	0.76	0.79	0.85	0.57	0.64	1.7
3/8	6 x 19	1.1	1.2	1.2	0.80	0.91	2.4
7/16	6 x 19	1.4	1.5	1.6	1.1	1.2	3.3
1/2	6 x 19	1.8	2.0	2.1	1.4	1.6	4.3
9/16	6 x 19	2.3	2.5	2.7	1.7	1.9	5.4
5/8	6 x 19	2.8	3.1	3.3	2.1	2.5	6.7
3/4	6 x 19	3.9	4.4	4.8	2.9	3.6	9.5
7/8	6 x 19	5.1	5.9	6.4	3.9	4.5	13.0
1	6 x 19	6.7	7.7	8.4	5.0	5.8	17.0
1-1/8	6 x 19	8.4	9.5	10.0	6.3	7.1	21.0
1-1/4	6 x 37	9.8	11.0	12.0	7.4	8.3	25.0
1-3/8	6 x 37	12.0	13.0	15.0	8.9	10.0	30.0
1-1/2	6 x 37	14.0	16.0	17.0	10.0	12.0	35.0
1-5/8	6 x 37	16.0	18.0	21.0	12.0	14.0	41.0
1-3/4	6 x 37	19.0	21.0	24.0	14.0	16.0	48.0
2	6 x 37	25.0	28.0	31.0	18.0	21.0	62.0

HT = Hand Tucked Splice and Hidden Tuck Splice
For hidden tuck splices (IWRC) use values in HT column.
MS = Mechanical Splice.
S = Swaged or Zinc Plated Socket.

*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-190-6
RATED CAPACITIES FOR SINGLE LEG SLINGS
8-PART AND 6-PART BRAIDED ROPE
6 x 7 AND 6 x 19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE
7 x 7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

Component Ropes Diameter (Inches)	Constr	Rated Capacities, Tons (2,000 lb)			
		8-Part	6-Part	8-Part	6-Part
3/32	6 x 7	0.42	0.32	0.32	0.24
1/8	6 x 7	0.76	0.57	0.42	0.32
3/16	6 x 7	1.7	1.3	0.94	0.67
3/32	7 x 7	0.51	0.39	0.29	0.21
1/8	7 x 7	0.95	0.71	0.53	0.36
3/16	7 x 7	2.1	1.5	1.2	0.8
6 x 19	6 x 19	1.7	1.3	0.98	0.7
1/4	6 x 19	3.1	2.3	1.7	1.2
5/16	6 x 19	4.8	3.6	2.7	2.0
3/8	6 x 19	6.8	5.1	3.8	2.9
7/16	6 x 19	9.3	6.9	5.2	3.9
1/2	6 x 19	12.0	9.0	6.7	5.0
9/16	6 x 19	15.0	11.0	8.5	6.4
5/8	6 x 19	19.0	14.0	10.0	7.5
3/4	6 x 19	27.0	20.0	15.0	11.0
7/8	6 x 19	36.0	27.0	20.0	15.0
1	6 x 19	47.0	35.0	26.0	19.0

* These values 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-190-8
RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS
6 x 19 and 6 x 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH INDEPENDENT WIRE ROPE CORE (IWRC)

Repe Dia (Inches)	Constr	Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Sling		3-Leg Bridle Sling		3-Leg Bridle Sling	
		Vert 30 deg	45 degree	Vert 30 deg	45 degree	Vert 30 deg	45 degree
		HT	MS	HT	MS	HT	MS
1/4	6 x 19	0.92	0.75	0.79	0.56	1.4	1.4
5/16	6 x 19	1.4	1.1	1.2	0.81	2.1	2.3
3/8	6 x 19	2.0	1.6	1.8	1.1	3.0	3.2
7/16	6 x 19	2.7	2.2	2.4	1.5	4.0	4.4
1/2	6 x 19	3.4	2.8	3.1	2.0	5.1	5.7
9/16	6 x 19	4.3	3.5	3.9	2.5	6.4	7.1
5/8	6 x 19	5.2	4.2	4.8	3.0	7.8	8.8
3/4	6 x 19	7.3	5.9	6.9	4.2	11.0	13.0
7/8	6 x 19	9.6	7.8	9.3	5.5	14.0	17.0
1	6 x 19	12.0	10.0	12.0	7.2	18.0	22.0
1-1/8	6 x 19	16.0	13.0	15.0	9.0	23.0	27.0
1-1/4	6 x 37	18.0	15.0	17.0	10.0	27.0	32.0
1-3/8	6 x 37	22.0	18.0	21.0	13.0	33.0	38.0
1-1/2	6 x 37	26.0	21.0	25.0	15.0	39.0	45.0
1-5/8	6 x 37	31.0	25.0	29.0	18.0	46.0	53.0
1-3/4	6 x 37	35.0	29.0	33.0	20.0	53.0	61.0
2	6 x 37	46.0	37.0	43.0	26.0	68.0	79.0

HT = Hand Tucked Splice
MS = Mechanical Splice

TABLE N-190-9
RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS
CABLE LAID ROPE - MECHANICAL SPLICE ONLY
7 x 7 x 7 AND 7 x 7 x 19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE
7 x 6 x 19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

Repe Dia (Inches)	Constr	Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Sling		3-Leg Bridle Sling		3-Leg Bridle Sling	
		Vert 30 deg	45 degree	Vert 30 deg	45 degree	Vert 30 deg	45 degree
		HT	MS	HT	MS	HT	MS
1/4	7 x 7 x 7	0.87	0.71	0.50	1.3	1.1	0.75
3/8	7 x 7 x 7	1.9	1.5	1.1	2.8	2.3	1.6
1/2	7 x 7 x 7	3.2	2.6	1.8	4.8	3.9	2.8
5/8	7 x 7 x 7	4.8	3.9	2.8	7.2	5.9	4.2
3/4	7 x 7 x 7	6.6	5.4	3.8	9.9	8.1	5.7
5/8	7 x 7 x 19	5.0	4.1	2.9	7.5	6.1	4.3
3/4	7 x 7 x 19	7.0	5.7	4.1	10.0	8.1	6.1
7/8	7 x 7 x 19	9.3	7.6	5.4	14.0	11.0	8.1
1	7 x 7 x 19	12.0	9.7	6.9	18.0	14.0	10.0
1-1/8	7 x 7 x 19	14.0	12.0	8.2	21.0	17.0	12.0
1-1/4	7 x 7 x 19	17.0	14.0	9.9	26.0	21.0	15.0
3/4	7 x 6 x 19 IWRC	6.6	5.4	3.8	9.9	8.0	5.7
1	7 x 6 x 19 IWRC	8.7	7.1	5.0	13.0	11.0	7.5
1-1/8	7 x 6 x 19 IWRC	11.0	9.0	6.4	17.0	13.0	9.6
1-1/4	7 x 6 x 19 IWRC	13.0	11.0	7.7	20.0	16.0	11.0
1-5/8	7 x 6 x 19 IWRC	15.0	13.0	9.2	24.0	20.0	14.0
1-3/4	7 x 6 x 19 IWRC	17.0	14.0	10.0	26.0	21.0	15.0
2	7 x 6 x 19 IWRC	19.0	15.0	11.0	28.0	23.0	16.0
1-1/2	7 x 6 x 19 IWRC	22.0	18.0	13.0	33.0	27.0	19.0

HT = Hand Tucked Splice
MS = Mechanical Splice

TABLE N-190-7
RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS
6 x 19 AND 6 x 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH FIBER CORE (FC)

Component Ropes Diameter (Inches)	Constr	Rated Capacities, Tons (2,000 lb)			
		8-Part	6-Part	8-Part	6-Part
3/32	6 x 7	0.42	0.32	0.32	0.24
1/8	6 x 7	0.76	0.57	0.42	0.32
3/16	6 x 7	1.7	1.3	0.94	0.67
3/32	7 x 7	0.51	0.39	0.29	0.21
1/8	7 x 7	0.95	0.71	0.53	0.36
3/16	7 x 7	2.1	1.5	1.2	0.8
6 x 19	6 x 19	1.7	1.3	0.98	0.7
1/4	6 x 19	3.1	2.3	1.7	1.2
5/16	6 x 19	4.8	3.6	2.7	2.0
3/8	6 x 19	6.8	5.1	3.8	2.9
7/16	6 x 19	9.3	6.9	5.2	3.9
1/2	6 x 19	12.0	9.0	6.7	5.0
9/16	6 x 19	15.0	11.0	8.5	6.4
5/8	6 x 19	19.0	14.0	10.0	7.5
3/4	6 x 19	27.0	20.0	15.0	11.0
7/8	6 x 19	36.0	27.0	20.0	15.0
1	6 x 19	47.0	35.0	26.0	19.0


* These values 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-190-9
RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS
6 x 19 AND 6 x 37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE
WITH FIBER CORE (FC)

Repe Dia (Inches)	Constr	Rated Capacities, Tons (2,000 lb)					
		2-Leg Bridle Sling		3-Leg Bridle Sling		3-Leg Bridle Sling	
		Vert 30 deg	45 degree	Vert 30 deg	45 degree	Vert 30 deg	45 degree
		HT	MS	HT	MS	HT	MS
1/4	6 x 19	0.85	0.88	0.70	0.72	1.0	1.1
5/16	6 x 19	1.3	1.4	1.1	1.1	1.6	1.7
3/8	6 x 19	1.8	1.9	1.5	1.6	2.3	2.4
7/16	6 x 19	2.5	2.6	2.0	2.2	3.2	3.4
1/2	6 x 19	3.2	3.4	2.6	2.8	4.0	4.2
9/16	6 x 19	4.0	4.3	3.2	3.5	4.8	5.1
5/8	6 x 19	4.8	5.3	4.0	4.4	5.3	5.7
3/4	6 x 19	6.8	7.6	5.5	6.2	7.3	8.0
7/8	6 x 19	8.9	10.0	7.3	8.4	9.3	10.0
1	6 x 19	11.0	13.0	9.4	11.0	13.0	15.0
1-1/8	6 x 19	14.0	16.0	12.0	13.0	16.0	18.0
1-1/4	6 x 37	17.0	19.0	14.0	16.0	20.0	23.0
1-3/8	6 x 37	20.0	23.0	17.0	19.0	24.0	28.0
1-1/2	6 x 37	24.0	27.0	20.0	22.0	28.0	33.0
1-5/8	6 x 37	28.0	32.0	23.0	26.0	33.0	39.0
1-3/4	6 x 37	33.0	37.0	27.0	30.0	39.0	45.0
2	6 x 37	43.0	48.0	35.0	39.0	50.0	57.0


HT = Hand Tucked Splice
MS = Mechanical Splice

TABLE N-190-12
RATED CAPACITIES FOR CABLE LAID GROMMET - HAND TUCKED
7 x 6 x 7 AND 7 x 6 x 19 CONSTRUCTIONS IMPROVED PLOW STEEL GRADE ROPE
7 x 7 x 7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

CABLE BODY		RATED CAPACITIES, TONS (2,000 lb)			
Die (Inches)	Constr	Vertical		Choker	Vertical Basket*
		8-Part	6-Part		
3/8	7 x 6 x 7	1.3	0.95		2.5
9/16	7 x 6 x 7	2.8	2.1		5.6
5/8	7 x 6 x 7	3.8	2.8		7.6
3/8	7 x 7 x 7	1.6	1.2		3.2
9/16	7 x 7 x 7	3.5	2.6		6.9
5/8	7 x 7 x 7	4.5	3.4		9.0
5/8	7 x 6 x 19	3.9	3.0		7.9
3/8	7 x 6 x 19	5.1	3.8		10.0
5/8	7 x 6 x 19	7.9	5.9		16.0
15/16	7 x 6 x 19	11.0	8.4		22.0
1-7/8	7 x 6 x 19	15.0	11.0		30.0
1-5/8	7 x 6 x 19	19.0	14.0		39.0
1-1/2	7 x 6 x 19	24.0	18.0		49.0
1-11/16	7 x 6 x 19	30.0	22.0		60.0
1-7/8	7 x 6 x 19	42.0	31.0		84.0
2-1/8	7 x 6 x 19	56.0	42.0		112.0

* 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-190-13
RATED CAPACITIES FOR STRAND LAID ENDLESS SLINGS-MECHANICAL JOINT
IMPROVED PLOW STEEL GRADE ROPE


ROPE BODY		RATED CAPACITIES, TONS (2,000 lb)			
Die (Inches)	Constr	Vertical		Choker	Vertical Basket*
		6 x 19 IWRC	6 x 37 IWRC		
1/4	6 x 19 IWRC	0.92	0.69		1.8
3/8	6 x 19 IWRC	2.0	1.5		4.1
1/2	6 x 19 IWRC	3.6	2.7		7.2
5/8	6 x 19 IWRC	5.6	4.2		11.0
3/4	6 x 19 IWRC	8.0	6.0		16.0
7/8	6 x 19 IWRC	11.0	8.1		21.0
1	6 x 19 IWRC	14.0	10.0		28.0
1-1/8	6 x 19 IWRC	18.0	13.0		35.0
1-1/4	6 x 37 IWRC	21.0	15.0		41.0
1-3/8	6 x 37 IWRC	25.0	19.0		50.0
1-1/2	6 x 37 IWRC	29.0	22.0		59.0

* 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-190-10
RATED CAPACITIES FOR 2-LEG AND 3-LEG BRIDLE SLINGS
8-PART AND 6-PART BRAIDED ROPE
6 x 7 AND 6 x 19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE
7 x 7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

Component Rope Die (Inches)	Rated Capacities, Tons (2,000 lb)															
	2-Leg Bridle Slings				3-Leg Bridle Slings				8-Part				6-Part			
	Vert 30 degree	Vert 60 degree	Horz 30 degree	Horz 60 degree	Vert 30 degree	Vert 60 degree	Horz 30 degree	Horz 60 degree	Vert 30 degree	Vert 60 degree	Horz 30 degree	Horz 60 degree	Vert 30 degree	Vert 60 degree	Horz 30 degree	Horz 60 degree
3/32	0.74	0.55	0.60	0.45	0.32	1.1	0.83	0.90	0.68	0.64	0.48	0.85	0.64	0.48	0.85	0.64
1/8	1.3	0.98	1.1	0.80	0.76	2.0	1.5	1.6	1.2	1.1	1.9	1.9	1.1	1.1	1.9	1.1
3/16	2.9	2.2	2.4	1.8	1.7	4.4	3.3	3.6	2.7	2.5	4.8	3.6	3.1	3.1	4.8	3.1
3/32	0.89	0.67	0.72	0.55	0.51	1.3	1.0	1.1	0.82	0.77	0.58	1.1	0.82	0.77	0.58	0.82
1/8	1.6	1.2	1.3	1.0	0.95	2.5	1.8	2.0	1.5	1.4	3.1	2.3	2.3	2.3	3.1	2.3
3/16	3.6	2.7	2.9	2.2	2.1	5.4	4.0	4.4	3.3	3.1	6.3	4.6	4.6	4.6	6.3	4.6
3/16	3.0	2.2	2.4	1.8	1.7	4.5	3.4	3.7	2.8	2.6	5.1	3.7	3.7	3.7	5.1	3.7
1/4	4.0	3.0	3.2	2.4	2.3	6.0	4.5	5.0	3.7	3.4	7.1	5.0	5.0	5.0	7.1	5.0
5/16	5.3	4.0	4.3	3.2	3.1	8.0	6.0	6.5	4.9	4.6	9.4	6.5	6.5	6.5	9.4	6.5
3/8	8.3	6.0	6.7	5.0	4.8	12.0	9.3	10.0	7.6	7.1	14.0	10.0	10.0	10.0	14.0	10.0
7/16	12.0	8.9	9.7	7.2	6.9	18.0	13.0	14.0	11.0	10.0	21.0	15.0	15.0	15.0	21.0	15.0
1/2	16.0	12.0	13.0	9.8	9.3	24.0	18.0	20.0	15.0	14.0	28.0	20.0	20.0	20.0	28.0	20.0
9/16	21.0	15.0	17.0	13.0	12.0	31.0	23.0	25.0	19.0	18.0	37.0	27.0	27.0	27.0	37.0	27.0
5/8	26.0	20.0	21.0	16.0	15.0	40.0	30.0	32.0	24.0	23.0	47.0	34.0	34.0	34.0	47.0	34.0
3/4	32.0	24.0	26.0	20.0	20.0	50.0	40.0	42.0	30.0	30.0	59.0	44.0	44.0	44.0	59.0	44.0
7/8	46.0	35.0	38.0	28.0	27.0	70.0	50.0	56.0	42.0	40.0	84.0	60.0	60.0	60.0	84.0	60.0
1	62.0	47.0	51.0	38.0	36.0	94.0	70.0	76.0	57.0	54.0	112.0	80.0	80.0	80.0	112.0	80.0
1-1/8	81.0	61.0	66.0	50.0	50.0	122.0	91.0	99.0	74.0	70.0	145.0	105.0	105.0	105.0	145.0	105.0

TABLE N-190-11
RATED CAPACITIES FOR STRAND LAID GROMMET - HAND TUCKED
IMPROVED PLOW STEEL GRADE ROPE

ROPE BODY		RATED CAPACITIES, TONS (2,000 lb)			
Die (Inches)	Constr	Vertical		Choker	Vertical Basket*
		6 x 19	6 x 37		
1/4	7 x 19	0.85	0.64		1.7
3/8	7 x 19	1.3	1.0		2.6
1/2	7 x 19	1.9	1.4		3.8
5/8	7 x 19	2.6	1.9		5.2
3/4	7 x 19	3.3	2.5		6.7
7/8	7 x 19	4.2	3.1		8.4
1	7 x 19	5.2	3.9		10.0
1-1/8	7 x 19	7.4	5.6		15.0
1-1/4	7 x 19	10.0	7.5		20.0
1-3/8	7 x 19	13.0	9.7		26.0
1-1/2	7 x 19	16.0	12.0		32.0
1-3/4	7 x 37	18.0	14.0		37.0
1-7/8	7 x 37	22.0	16.0		44.0
1-1/2	7 x 37	26.0	19.0		52.0

* 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.

(iii) Kinking, crushing, bird caging or any other damage resulting in distortion of the wire rope structure.
 (iv) Evidence of possible 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.

(f) *Metal mesh sling.* (1) *Metal mesh* are classified in accordance with Table N-190-15. Only metal mesh slings that are manufactured in accordance with the provisions of this paragraph shall be used.

TABLE N-190-15

Type	Classification	Designation
Heavy Duty	Carbon Steel Stainless Steel	35-CS 35-SS
Medium Duty	Carbon Steel Stainless Steel	43-CS 43-SS
Light Duty	Carbon Steel Stainless Steel	59-CS 59-SS

TABLE N-190-14
 RATED CAPACITIES FOR CABLE LAID ENDLESS SLINGS-MECHANICAL JOINT
 7 X 7 X 7 AND 7 X 7 X 19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE
 7 X 6 X 19 IWRC CONSTRUCTION IMPROVED FLOW STEEL GRADE ROPE

Cable Body	RATED CAPACITIES, TONS (2,000 lb)		
	Vertical	Choker	Vertical Basket*
1/4	7 X 7 X 7	0.62	1.6
	7 X 7 X 7	1.3	3.5
	7 X 7 X 7	2.3	6.1
	7 X 7 X 7	3.4	9.1
3/8	7 X 7 X 7	4.7	12.0
	7 X 7 X 19	3.5	9.5
	7 X 7 X 19	5.0	13.0
	7 X 7 X 19	6.6	18.0
1/2	7 X 7 X 19	8.5	22.0
	7 X 7 X 19	10.0	28.0
	7 X 7 X 19	12.0	33.0
	7 X 6 X 19 IWRC	4.7	12.0
3/4	7 X 6 X 19 IWRC	6.2	16.0
	7 X 6 X 19 IWRC	8.3	21.0
	7 X 6 X 19 IWRC	10.0	26.0
	7 X 6 X 19 IWRC	12.0	31.0
1-1/8	7 X 6 X 19 IWRC	14.0	37.0
	7 X 6 X 19 IWRC	16.0	43.0
	7 X 6 X 19 IWRC	18.0	
	7 X 6 X 19 IWRC	22.0	

* 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.

(3) *Proof test.*—Slings of all grades terminated by mechanical splices, sockets, and pressed or swaged terminals shall be proof tested by the sling manufacturer or an equivalent entity prior to initial use. The employer shall retain a certificate of this proof test.

(i) The proof load for single leg slings and endless slings shall be two times the vertical rated capacity.
 (ii) The proof load for multiple leg bridle slings shall be applied to the individual legs and shall be two times the vertical rated capacity of a single leg sling of the same size, grade, and the construction of rope.

(4) Minimum sling lengths. (1) Cable laid and 6 x 19 and 6 x 37 slings shall have a minimum clear length of wire rope 10 times the rope diameter between splices, sleeves or end fittings.
 (ii) Braided slings shall have a minimum clear length or wire rope 40 times the component rope diameter between the loops or end fittings.

(5) *End attachments.*—(1) All components welded prior to assembly in the sling shall be proof tested by the sling manufacturer or an equivalent entity prior to initial use. The employer shall retain a certificate of the proof test.
 (ii) Welding of handles or of any other accessories to end attachments shall be performed prior to the assembly of the sling.
 (6) *Removal from service.*—A wire rope sling that exhibits any of the following conditions shall be immediately removed from service:
 (i) Six randomly distributed broken wires in one rope lay, or three broken wires in one strand in one rope lay.
 (ii) Wear or scraping of one-third the original diameter of outside individual wires.

TABLE N-190-16
 FABRIC CONSTRUCTION

	HEAVY DUTY	MEDIUM DUTY	LIGHT DUTY
Nominal Spiral Turns per Foot of Sling Width	35	43	59
Spiral Wire Size USSWG	10 Ga. (0.135 in.)	12 Ga. (0.105 in.)	14 Ga. (0.080 in.)
Nominal Cross Rods per Foot of Fabric Length	21	30	38
Size of Cross Rods USSWG	8 Ga. (0.162 in.)	10 Ga. (0.135 in.)	14 Ga. (0.080 in.)
Nominal Fabric Thickness	1/2 in.	3/8 in.	5/16 in.

PROPOSED RULES

(2) *Construction.* (i) *Fabric construction.*—Fabric shall be constructed in accordance with the provisions in Table N-190-16.

(ii) *Handle construction.*—The handle shall have a rated capacity at least equal to the metal fabric and exhibit no deformation after proof testing.

(iii) *Attachment of handles to fabric.*—The fabric and handles shall be joined so that:

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

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

(C) Sharp edges do not damage the fabric.







(iv) *Sling coatings.*—Slings may be painted, plated, impregnated with elastomers such as neoprene or polyvinyl chloride, or otherwise suitably coated. Coatings which diminish the rated capacity of a sling shall not be applied.

(3) *Sling testing.*—All new and repaired metal mesh slings shall be proof tested at a minimum of 1½ times their rated capacity. Elastomer impregnated slings shall be proof tested before coating.

(4) *Sling marking.*—All metal mesh slings shall have permanently affixed durable identification stating the manufacturer's name or trademark and the rated capacity for vertical basket hitch and choker hitch loadings.

(5) *Proper use of metal mesh slings.*—Metal mesh slings shall not be used to lift loads in excess of those prescribed in Table N-190-17 which applies a safety factor of five (5). The sling manufacturer's specifications shall be complied with for slings which differ in width, materials, or design from those shown in Table N-190-17.

TABLE N-190-17
RATED CAPACITIES
(lb)

SLING WIDTH IN INCHES	VERTICAL OR CHOKER		VERTICAL BASKET	EFFECT OF ANGLE ON RATED CAPACITIES IN BASKET HITCH		
						
				30 deg Vertical 60 deg Horizontal	45 deg Vertical 45 deg Horizontal	60 deg Vertical 30 deg Horizontal
35-CS and 35-S5						
2	1,800	3,600	3,600	2,600	2,100	1,500
3	2,700	5,400	5,400	4,700	3,800	2,700
4	4,000	8,000	8,000	6,900	5,600	4,000
6	6,000	12,000	12,000	10,400	8,400	6,000
8	8,000	16,000	16,000	13,800	11,300	8,000
10	10,000	20,000	20,000	17,000	14,100	10,000
12	12,000	24,000	24,000	20,700	16,900	12,000
14	14,000	28,000	28,000	24,300	19,700	14,000
16	16,000	32,000	32,000	27,700	22,600	16,000
18	18,000	36,000	36,000	31,100	25,400	18,000
20	20,000	40,000	40,000	34,500	28,300	20,000
45-CS and 45-S5						
2	1,350	2,700	2,700	2,300	1,900	1,400
3	2,000	4,000	4,000	3,500	2,800	2,000
4	2,700	5,400	5,400	4,700	3,800	2,700
6	4,300	8,600	8,600	7,800	6,400	4,500
8	6,000	12,000	12,000	10,400	8,500	6,000
10	7,500	15,000	15,000	13,000	10,600	7,500
12	9,000	18,000	18,000	15,600	12,700	9,000
14	10,500	21,000	21,000	18,200	14,800	10,500
16	12,000	24,000	24,000	20,800	17,000	12,000
18	13,500	27,000	27,000	23,400	19,100	13,500
20	15,000	30,000	30,000	26,000	21,200	15,000
55-CS and 55-S5						
2	900	1,800	1,800	1,400	1,300	900
3	1,400	2,800	2,800	2,400	2,000	1,400
4	2,000	4,000	4,000	3,300	2,800	2,000
6	3,000	6,000	6,000	5,300	4,200	3,000
8	4,000	8,000	8,000	6,900	5,700	4,000
10	5,000	10,000	10,000	8,500	7,100	5,000
12	6,000	12,000	12,000	10,400	8,500	6,000
14	7,000	14,000	14,000	12,300	9,900	7,000
16	8,000	16,000	16,000	13,900	11,300	8,000
18	9,000	18,000	18,000	15,500	12,700	9,000
20	10,000	20,000	20,000	17,300	14,100	10,000

(6) *Repairs.* (i) Metal mesh slings shall be repaired only by a metal mesh sling manufacturer or an equivalent entity.

(ii) The sling shall be permanently marked to identify the repairing agency and the date of repair.

(g) *Rope slings: Natural and synthetic fiber.* (1) *Type of fiber & safety factor.*—The following safety factors shall be used for the four basic fiber types covered by this paragraph:

Fiber type	Safety factor
Manila -----	5 minimum
Nylon -----	9 minimum
Polyester -----	9 minimum
Polypropylene -----	6 minimum

(2) *Rope: Grade, size, construction.*—This paragraph covers sling made from

conventional three-strand construction fiber rope. For each fiber type, essential descriptive data (diameter, weight, and strength) is given in Tables N-190-18 through N-190-21.

(3) *Rated load capacities.*—Rope slings shall not be used to lift loads in excess of those prescribed in Tables N-190-18 through N-190-21 which apply the appropriate safety factor.

(4) *Sling configurations.*—(explanation of Fig. N-190-4 and N-190-5) The several sling configurations encompassed here are identified in Fig. N-190-4 & 5. For both Figures, the following symbols are used to indicate the minimum contact surface which shall be provided between a portion of the sling and a load or support:

TABLE N-190-18
MANILA ROPE SLINGS

ROPE DIA-METER Nominal In Inches	Nominal Weight Per 100 ft In Pounds	Minimum Breaking Strength In Pounds	RATED CAPACITY IN POUNDS (Safety Factor = 5)												
			EYE AND EYE SLING						ENDLESS SLING						
			VERTICAL HITCH	CHOKER HITCH	BASKET HITCH				VERTICAL HITCH	CHOKER HITCH	BASKET HITCH				
					Angle of Rope to Horizontal						Angle of Rope to Vertical				
					90 deg	60 deg	45 deg	30 deg			90 deg	60 deg	45 deg	30 deg	
				Angle of Rope to Vertical											
				0 deg	30 deg	45 deg	60 deg					0 deg	30 deg	45 deg	60 deg
1/2	7.5	2,650	550	250	1,100	900	750	550	950	500	1,900	1,700	1,400	950	
9/16	10.4	3,450	700	350	1,400	1,200	1,000	700	1,200	600	2,500	2,200	1,800	1,200	
5/8	13.3	4,400	900	450	1,800	1,500	1,200	900	1,600	800	3,200	2,700	2,200	1,600	
3/4	16.7	5,400	1,100	550	2,200	1,900	1,500	1,100	2,000	950	3,900	3,400	2,800	2,000	
13/16	19.5	6,500	1,300	650	2,600	2,300	1,800	1,300	2,300	1,200	4,700	4,100	3,300	2,300	
7/8	22.5	7,700	1,500	750	3,100	2,700	2,200	1,500	2,800	1,400	5,600	4,800	3,900	2,800	
1	27.0	9,000	1,800	900	3,600	3,100	2,600	1,800	3,200	1,600	6,500	5,600	4,600	3,200	
1 1/16	31.3	10,500	2,100	1,100	4,200	3,600	3,000	2,100	3,800	1,900	7,600	6,600	5,400	3,800	
1 1/8	36.0	12,000	2,400	1,200	4,800	4,200	3,400	2,400	4,300	2,200	8,600	7,500	6,100	4,300	
1 1/4	41.7	13,500	2,700	1,400	5,400	4,700	3,800	2,700	4,900	2,400	9,700	8,400	6,900	4,900	
1 5/16	47.9	15,000	3,000	1,500	6,000	5,200	4,300	3,000	5,400	2,700	11,000	9,400	7,700	5,400	
1 1/2	59.9	18,500	3,700	1,850	7,400	6,400	5,200	3,700	6,700	3,300	13,500	11,500	9,400	6,700	
1 5/8	74.6	22,500	4,500	2,300	9,000	7,800	6,400	4,500	8,100	4,100	16,000	14,000	11,500	8,100	
1 3/4	89.3	26,500	5,300	2,700	10,500	9,200	7,500	5,300	9,500	4,800	19,000	16,500	13,500	9,500	
2	107.5	31,000	6,200	3,100	12,500	10,500	8,800	6,200	11,000	5,600	22,500	19,500	16,000	11,000	
2 1/8	125.0	36,000	7,200	3,600	14,500	12,500	10,000	7,200	13,000	6,500	26,000	22,500	18,500	13,000	
2 1/4	146.0	41,000	8,200	4,100	16,500	14,000	11,500	8,200	15,000	7,400	29,500	25,500	21,000	15,000	
2 1/2	166.7	46,500	9,300	4,700	18,500	16,000	13,000	9,300	16,500	8,400	33,500	29,000	23,500	16,500	
2 5/8	190.8	52,000	10,500	5,200	21,000	18,000	14,500	10,500	18,500	9,500	37,500	32,500	26,500	18,500	

See Figs. 4 & 5 for Sling Description

PROPOSED RULES

TABLE N-190-19
NYLON ROPE SLINGS

ROPE DIA-METER	Nominal Weight Per 100 ft In Pounds	Minimum Breaking Strength In Pounds	RATED CAPACITY IN POUNDS (Safety Factor = 9)											
			EYE AND EYE SLING						ENDLESS SLING					
			VERTICAL HITCH	CHOKER HITCH	BASKET HITCH				VERTICAL HITCH	CHOKER HITCH	BASKET HITCH			
					Angle of Rope to Horizontal						Angle of Rope to Horizontal			
					90 deg	60 deg	45 deg	30 deg			90 deg	60 deg	45 deg	30 deg
Angle of Rope to Vertical				Angle of Rope to Vertical				Angle of Rope to Vertical						
0 deg	30 deg	45 deg	60 deg	0 deg	30 deg	45 deg	60 deg	0 deg	30 deg	45 deg	60 deg			
1/2	6.5	6,080	700	350	1,400	1,200	950	700	1,200	600	2,400	2,100	1,700	1,200
9/16	8.3	7,600	850	400	1,700	1,500	1,200	850	1,500	750	3,000	2,600	2,200	1,500
5/8	10.5	9,880	1,100	550	2,200	1,900	1,600	1,100	2,000	1,000	4,000	3,400	2,800	2,000
3/4	14.5	13,490	1,500	750	3,000	2,600	2,100	1,500	2,700	1,400	5,400	4,700	3,800	2,700
13/16	17.0	16,150	1,800	900	3,600	3,100	2,600	1,800	3,200	1,600	6,400	5,600	4,600	3,200
7/8	20.0	19,000	2,100	1,100	4,200	3,700	3,000	2,100	3,800	1,900	7,600	6,600	5,400	3,800
1	26.0	23,750	2,600	1,300	5,300	4,600	3,700	2,600	4,800	2,400	9,500	8,200	6,700	4,800
1 1/16	29.0	27,360	3,000	1,500	6,100	5,300	4,300	3,000	5,500	2,700	11,000	9,500	7,700	5,500
1 1/8	34.0	31,350	3,500	1,700	7,000	6,000	5,000	3,500	6,300	3,100	12,500	11,000	8,900	6,300
1 1/4	40.0	35,625	4,000	2,000	7,900	6,900	5,600	4,000	7,100	3,600	14,500	12,500	10,000	7,100
1 5/16	45.0	40,850	4,500	2,300	9,100	7,900	6,400	4,500	8,200	4,100	16,500	14,500	12,000	8,200
1 1/2	55.0	50,350	5,600	2,800	11,000	9,700	7,900	5,600	10,000	5,000	20,000	17,500	14,000	10,000
1 5/8	68.0	61,750	6,900	3,400	13,500	12,000	9,700	6,900	12,500	6,200	24,500	21,500	17,500	12,500
1 3/4	83.0	74,100	8,200	4,100	16,500	14,500	11,500	8,200	15,000	7,400	29,500	25,500	21,000	15,000
2	95.0	87,400	9,700	4,900	19,500	17,000	13,500	9,700	17,500	8,700	35,000	30,500	24,500	17,500
2 1/8	109.0	100,700	11,000	5,600	22,500	19,500	16,000	11,000	20,000	10,000	40,500	35,000	28,500	20,000
2 1/4	129.0	118,750	13,000	6,600	26,500	23,000	18,500	13,000	24,000	12,000	47,500	41,000	33,500	24,000
2 1/2	149.0	133,000	15,000	7,400	29,500	25,500	21,000	15,000	26,500	13,500	53,000	46,000	37,500	26,500
2 5/8	168.0	153,900	17,100	8,600	34,000	29,500	24,000	17,000	31,000	15,500	61,500	53,500	43,500	31,000

See Figs. 4 & 5 for Sling Description

TABLE N-190-20
POLYESTER ROPE SLINGS

ROPE DIA-METER	Nominal Weight Per 100 ft In Pounds	Minimum Breaking Strength In Pounds	RATED CAPACITY IN POUNDS (Safety Factor = 9)											
			EYE AND EYE SLING						ENDLESS SLING					
			VERTICAL HITCH	CHOKER HITCH	BASKET HITCH				VERTICAL HITCH	CHOKER HITCH	BASKET HITCH			
					Angle of Rope to Horizontal						Angle of Rope to Horizontal			
					90 deg	60 deg	45 deg	30 deg			90 deg	60 deg	45 deg	30 deg
Angle of Rope to Vertical				Angle of Rope to Vertical				Angle of Rope to Vertical						
0 deg	30 deg	45 deg	60 deg	0 deg	30 deg	45 deg	60 deg	0 deg	30 deg	45 deg	60 deg			
1/2	8.0	6,080	700	350	1,400	1,200	950	700	1,200	600	2,400	2,100	1,700	1,200
9/16	10.2	7,600	850	400	1,700	1,500	1,200	850	1,500	750	3,000	2,600	2,200	1,500
5/8	13.0	9,500	1,100	550	2,100	1,800	1,500	1,100	1,900	950	3,800	3,300	2,700	1,900
3/4	17.5	11,875	1,300	650	2,600	2,300	1,900	1,300	2,400	1,200	4,800	4,100	3,400	2,400
13/16	21.0	14,725	1,600	800	3,300	2,800	2,300	1,600	2,900	1,500	5,900	5,100	4,200	2,900
7/8	25.0	17,100	1,900	950	3,800	3,300	2,700	1,900	3,400	1,700	6,800	5,900	4,800	3,400
1	30.5	20,900	2,300	1,200	4,600	4,000	3,300	2,300	4,200	2,100	8,400	7,200	5,900	4,200
1 1/16	34.5	24,225	2,700	1,300	5,400	4,700	3,800	2,700	4,800	2,400	9,700	8,400	6,900	4,800
1 1/8	40.0	28,025	3,100	1,600	6,200	5,400	4,400	3,100	5,600	2,800	11,000	9,700	7,900	5,600
1 1/4	46.3	31,540	3,500	1,800	7,000	6,100	5,000	3,500	6,300	3,200	12,500	11,000	8,900	6,300
1 5/16	52.5	35,625	4,000	2,000	7,900	6,900	5,600	4,000	7,100	3,600	14,500	12,500	10,000	7,100
1 1/2	66.8	44,460	4,900	2,500	9,900	8,600	7,000	4,900	8,900	4,400	18,000	15,500	12,500	8,900
1 5/8	82.0	54,150	6,000	3,000	12,000	10,400	8,500	6,000	11,000	5,400	21,500	19,000	15,500	11,000
1 3/4	98.0	64,410	7,200	3,600	14,500	12,500	10,000	7,200	13,000	6,400	26,000	22,500	18,000	13,000
2	118.0	76,000	8,400	4,200	17,000	14,500	12,000	8,400	15,000	7,600	30,500	26,500	21,500	15,000
2 1/8	135.0	87,400	9,700	4,900	19,500	17,000	13,500	9,700	17,500	8,700	35,000	30,500	24,500	17,500
2 1/4	157.0	101,650	11,500	5,700	22,500	19,500	16,000	11,500	20,500	10,000	40,500	35,000	29,000	20,500
2 1/2	181.0	115,900	13,000	6,400	26,000	22,500	18,000	13,000	23,000	11,500	46,500	40,000	33,000	23,000
2 5/8	205.0	130,150	14,500	7,200	29,000	25,000	20,500	14,500	26,000	13,000	52,000	45,000	37,000	26,000

See Figs. 4 & 5 for Sling Description

TABLE N-190-21
POLYPROPYLENE ROPE SLINGS

ROPE DIA-METER Nominal In Inches	Nominal Weight, Per 100 ft In Pounds	Minimum Breaking Strength In Pounds	RATED CAPACITY IN POUNDS (Safety Factor = 6)											
			EYE AND EYE SLING						ENDLESS SLING					
			VERTICAL HITCH	CHOKER HITCH	BASKET HITCH				VERTICAL HITCH	CHOKER HITCH	BASKET HITCH			
					Angle of Rope to Horizontal						Angle of Rope to Vertical			
					90 deg	60 deg	45 deg	30 deg			0 deg	30 deg	45 deg	60 deg
1/2	4.7	3,990	650	350	1,300	1,200	950	650	1,200	600	2,400	2,100	1,700	1,200
9/16	6.1	4,845	800	400	1,600	1,400	1,100	800	1,500	750	2,900	2,500	2,100	1,500
5/8	7.5	5,890	1,000	500	2,000	1,700	1,400	1,000	1,800	900	3,500	3,100	2,500	1,800
3/4	10.7	8,075	1,300	700	2,700	2,300	1,900	1,300	2,400	1,200	4,900	4,200	3,400	2,400
13/16	12.7	9,405	1,600	800	3,100	2,700	2,200	1,600	2,800	1,400	5,600	4,900	4,000	2,800
7/8	15.0	10,925	1,800	900	3,600	3,200	2,600	1,800	3,300	1,600	6,600	5,700	4,600	3,300
1	18.0	13,300	2,200	1,100	4,400	3,800	3,100	2,200	4,000	2,000	8,700	6,900	5,600	4,000
1 1/16	20.4	15,200	2,500	1,300	5,100	4,400	3,600	2,500	4,600	2,300	9,100	7,900	6,500	4,600
1 1/8	23.7	17,385	2,900	1,500	5,800	5,000	4,100	2,900	5,200	2,600	10,500	9,000	7,400	5,200
1 1/4	27.0	19,950	3,300	1,700	6,700	5,800	4,700	3,300	6,000	3,000	12,000	10,500	8,500	6,000
1 5/16	30.5	22,325	3,700	1,900	7,400	6,400	5,300	3,700	6,700	3,400	13,500	11,500	9,500	6,700
1 1/2	38.5	28,215	4,700	2,400	9,400	8,100	6,700	4,700	8,500	4,200	17,000	14,500	12,000	8,500
1 5/8	47.5	34,200	5,700	2,900	11,500	9,900	8,100	5,700	10,500	5,100	20,500	18,000	14,500	10,500
1 3/4	57.0	40,850	6,800	3,400	13,500	12,000	9,600	6,800	12,500	6,100	24,500	21,000	17,500	12,500
2	69.0	49,400	8,200	4,100	16,500	14,500	11,500	8,200	15,000	7,400	29,500	25,500	21,000	15,000
2 1/8	80.0	57,950	9,700	4,800	19,500	16,500	13,500	9,700	17,500	8,700	35,000	30,100	24,500	17,500
2 1/4	92.0	65,550	11,000	5,500	22,000	19,000	15,500	11,000	19,500	9,900	39,500	34,000	28,000	19,500
2 1/2	107.0	76,000	12,500	6,300	25,500	22,000	18,000	12,500	23,000	11,500	45,500	39,500	32,500	23,000
2 5/8	120.0	85,500	14,500	7,100	28,500	24,500	20,000	14,500	25,500	13,000	51,500	44,500	36,500	25,500

See Figs. 4 & 5 for Sling Description

(i) The symbol $\text{\textcircled{X}}$ 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.

(ii) The symbol $\text{\textcircled{O}}$ represents a contact surface which shall have a diameter of curvature at least 8 times the diameter of the rope.

(iii) The symbol $\text{\textcircled{C}}$ 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 the load surface shall be at least double the rope diameter.

(5) *Splicing*.—All splices shall be made in accordance with the fiber rope sling manufacturer's recommendations.

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

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

(iii) Strand end tails shall not be trimmed short (flush with the surface of the rope) immediately adjacent to the full tucks. The precaution applies to both eye and short splices and all types of fiber rope. For fiber ropes under one inch in diameter the tails shall project at least six rope diameters beyond the last full tuck. For fiber ropes one inch in diameter and larger, the tail shall project at least 6 inches beyond the last full tuck. In applications where the projecting tails may be objectionable the tails 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.)

BASIC SLING CONFIGURATIONS WITH VERTICAL LEGS

NOTE: Legs 5° or less from vertical may be considered vertical. For slings with legs more than 5° off vertical, the actual angle as shown, in Fig. 6 must be considered.

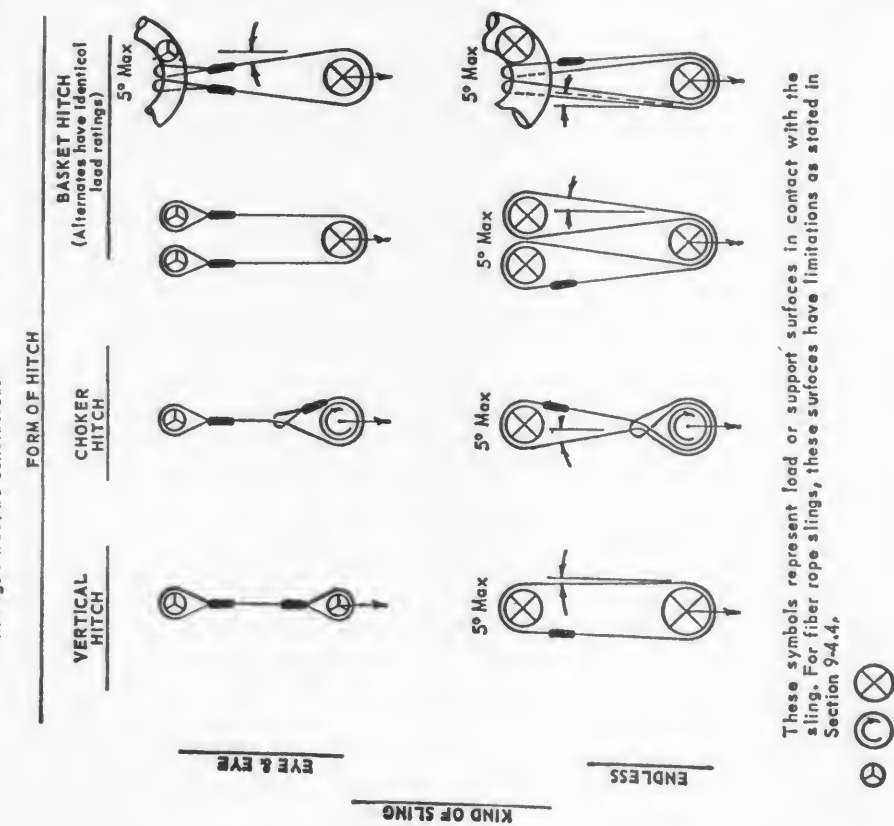


FIG. N-190-4

SLING CONFIGURATIONS WITH ANGLED LEGS

NOTE: For vertical angles of 5° or less, refer to Fig. 5 "Basic Sling Configurations with Vertical Legs." The use of slings with vertical angles more than 60° (horizontal angles less than 30°) is NOT RECOMMENDED.

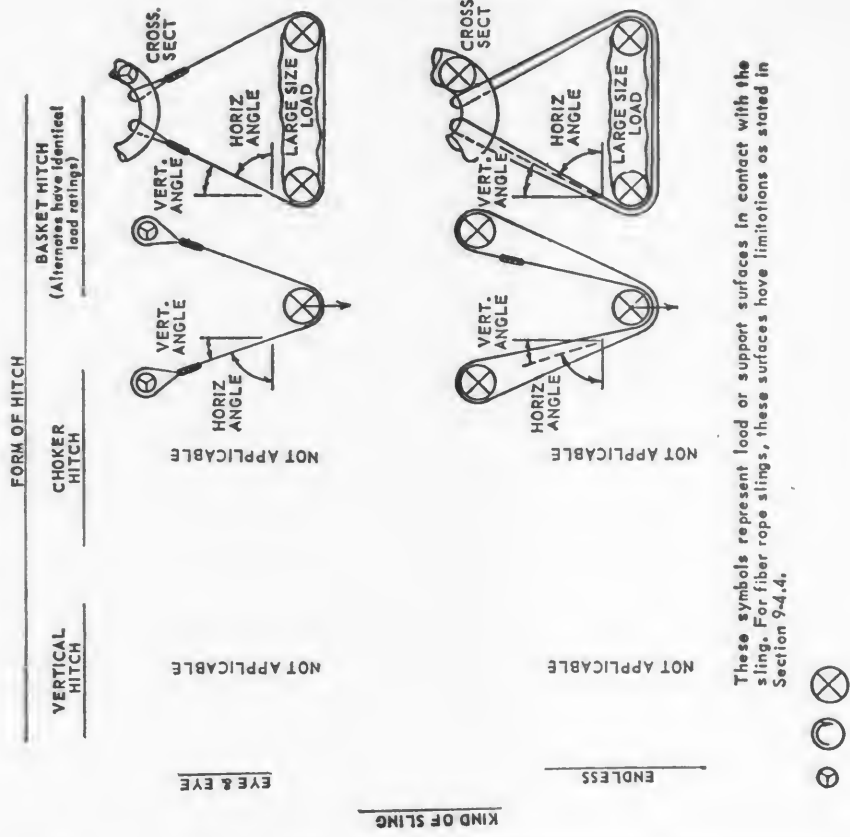


FIG. N-190-5

PROPOSED RULES

(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.

(vii) For all eye splices, the eye shall be sufficiently large to provide an included angle of not greater than 60 degrees at the splice when the eye is placed over the load or support. (See Fig. N-190-4)

(6) *End attachments.*—(i) End attachments in contact with the rope shall not have sharp edges, projections, etc. that might weaken the fiber rope.

(ii) Appropriately rated thimbles shall be used.

(h) *Synthetic webbing slings.* (1) *Construction.*—(i) Only synthetic webbing slings that are manufactured in accordance with the provisions of this paragraph shall be used.

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

(iii) *Thread.*—The thread used in the manufacture of sling shall be of the same type material as the webbing.

(iv) *Fittings.*—Fittings shall be:

(A) Of sufficient strength to sustain twice the rated capacity without permanent deformation;

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

(C) Free of all sharp edges that would in any way damage the webbing.

(v) *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.

(vi) *Coatings.*—Slings may be coated with elastomers or other suitable material that will impart desirable characteristics.

(2) *Safety factor.*—Factor of safety for synthetic web slings shall be a minimum of five (5).

(3) *Marking.*—Each sling shall be marked or coded to show:

(i) Name or trademark of manufacturer;

(ii) Rated capacities for the type of hitch; and

(iii) Type of material.

(4) *Environmental considerations.*—When slings made from synthetic webbing are to be used the following precautions shall be taken:

(A) Nylon slings shall not be used where acid conditions exist.

(B) Polyester and polypropylene slings shall not be used where caustic conditions exist.

(C) Polyester and nylon slings shall not be used at temperatures in excess of 180° F nor polypropylene in excess of 200° F.

(D) Aluminum fittings shall not be used where caustic conditions exist.

(5) *Repairs.*—(i) Synthetic web sling shall be repaired by a sling manufacturer or an equivalent entity.

(ii) All repaired slings shall be proof tested and certified by the sling manufacturer or an equivalent entity prior to their return to service.

(iii) Temporary repairs to either the webbing or the fittings shall not be permitted.

2. Subparagraph (2) of § 1910.179(j) would be amended by deleting the words "or load attachment" from subdivision (iv) and by revoking subdivision (v) as this material is the subject matter of the proposed new § 1910.190. The amended provisions of § 1910.179(j) (2) would read as follows:

§ 1910.179 Overhead and gantry cranes.

* * * * *

(j) *Inspection.* * * *

(2) *Frequent inspections.* * * *

(iv) Hoist chains, including end connections, for excessive wear, twist, distorted links interfering with proper function, or stretch beyond manufacturer's recommendations. Visual inspection daily; monthly inspection with signed report.

(v) [Revoked]

* * * * *

§§ 1910.182, 1910.183, 1910.184 [Redesignated]

3. The following section redesignations would be made in Subpart N:

<i>Old section number</i>	<i>New section number</i>
§ 1910.182	§ 1910.208
§ 1910.183	§ 1910.209
§ 1910.184	§ 1910.210

(Sec. 6, Pub. L. 91-596, 84 Stat. 1593 (29 U.S.C. 655))

Signed at Washington, D.C., this 18th day of August 1973.

JOHN STENDER,
Assistant Secretary of Labor.

[FR Doc.73-17909 Filed 8-29-73;8:45 am]

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