### 4123:1-3-08 Ropes, chains and slings.

- (A) Reserved.
- (B) Reserved.
- (C) General requirements.
  - (1) Working loads.

Ropes, chains and slings shall not be used for loads in excess of the working loads specified in "Tables 8-1 through 8-20." in excess of their safe working load.

(2) Factor of safety - component parts.

All connections, fittings, fastenings, parts, etc., used in connection with manila ropes, wire ropes or chains shall be of such quality and strength and so attached, connected, fastened, etc., as to provide a factor of safety of no less than the carrying agent for which they are designed.

(3) Limitation on wire rope.

Haulage rope shall not be provided for use as a hoisting rope.

(4) Clearance.

The ratio between the rope diameter and the block, sheave or pulley tread diameter shall be such as to allow the rope strands to slide past each other and adjust themselves to the bend. In no case shall the sheave diameter be less than that recommended in the manufacturer's specifications for corresponding block, sheave and pulley diameters. Sheaves or pulleys with eccentric bores or with cracked hubs, spokes or flanges shall be repaired or removed from service.

(5) Protection.

Where manila rope or wire rope is used to support equipment and is brought over a sharp corner of steel, stone or other material liable to cut or cause undue abrasion to the manila rope or wire rope, it shall be protected at such points by the use of bagging, wooden blocks or other protective padding.

(6) Manila rope prohibited.

Manila rope slings shall not be used for handling known acid- or caustic-contaminated material or objects.

(7) Use of chain prohibited.

The use of chain as a sling or choker in erection of steel is prohibited.

(D) Alloy steel chains.

- (1) Welded alloy steel chain slings shall have permanently affixed durable identification stating size, grade, rated capacity, and sling manufacturer.
- (2) Hooks, rings, oblong links, pear-shaped links, welded or mechanical coupling links, or other attachments, when used with alloy steel chains, shall have a rated capacity at least equal to that of the chain.
- (3) Job or shop hooks and links, makeshift fasteners, made from bolts, rods, etc., or other such attachments shall not be used.
- (4) Rated capacity (working load limit) for alloy steel chain slings shall conform to the values shown in "Table 8-1."
- (5)(4) Whenever wear at any point of any chain link exceeds that shown in "Table-8-2, 8-1," the assembly shall be removed from service.

### **TABLE 8-1.**

### RATED CAPACITY (WORKING LOAD LIMIT), FOR ALLOY STEEL CHAIN SLINGS\* RATED CAPACITY (WORKING LOAD LIMIT), POUNDS

Ch <b>a</b> in	Single Branch	v	Double Sling ertical Angle		-	and Quadrup ertical Angle	0
Size,	Sling	30 degree	45 Degree	60 degree	30 degree	45 degree	60 degree
Inches	90 degree	Ho	rizontal Angle	e (2)	Ho	rizontal Angle	e (2)
	Loading	60 degree	45 degree	30 degree	60 degree	45 degree	30 degree
1⁄4	3,250	5,560	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	54,800	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	81,000	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	112,500	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.

(2) Rating of multileg slings adjusted for angle of loading between the inclined leg and the horizontal plane of the load.

\*Other grades of proof tested steel chain include Proof Coil, BBB Coil and Hi-Test Chain. These grades are not recommended for overhead lifting and therefore are not covered by this code.

### Rename TABLE 8-2 to TABLE 8-1

### **TABLE 8-2.**

### MAXIMUM ALLOWABLE WEAR AT ANY POINT OF LINK

Chai size (inche	Maximum allowable wear (inch)	Chain size (inches	Maximum allowable )wear (inch)
1⁄4	 3/64	1	3/16
3/8	 5/64	11/8	
1/2	 7/64	11/4	1/4
5/8	 9/64	13/8	
3/4	 5/32	11/2	
7∕8		13⁄4	11/32

(E) Wire rope.

- (1) "Tables 8-3 through 8-14" shall be used to determine the safe working loads of various sizes and classifications of improved plow steel wire rope and wire rope slings with various types of terminals. For sizes, classifications, and grades not included in these tables, the safe working load recommended by the manufacturer for specific, identifiable products shall be followed, provided that a factor of safety of no less than five is maintained. Employers must not use improved plow-steel wire rope and wire-rope slings with loads in excess of the rated capacities (i.e., working load limits) indicated on the sling by permanently affixed and legible identification markings prescribed by the manufacturer.
- (2) Protruding ends of strands in splices on slings and bridles shall be covered or blunted.
- (3) Wire rope shall not be secured by knots, except on haul-back lines of scrapers.
- (4) The following limitations shall apply to the use of wire rope:
  - (a) An eye splice made in any wire rope shall have no less than three full tucks. However, this requirement shall not operate to preclude the use of another form of splice or connection which can be shown to be as safe and which is not otherwise prohibited.
  - (b) Except for eye splices in the ends of wires and for endless rope slings, each wire rope used in hoisting or lowering, or in pulling loads, shall consist of one continuous piece without knot or splice.
  - (c) Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire rope clips or knots.
  - (d) Wire rope shall not be used if, in any length of eight diameters, the total number of visible broken wires exceeds ten per cent of the total number of wires, or if the rope shows other signs of excessive wear, corrosion or defect.

### Delete TABLE 8-3.

### **TABLE 8-3.**

### RATED CAPACITIES FOR SINGLE LEG SLINGS 6x19 & 6x37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE WITH FIBER CORE (FC)

Re	o <b>pe</b>			Rated	d Capaci	ties, To	ns (2,000	lb)		
Dia (Inches)	Constr	HT	Vertical MS	S	нт	Choker MS	S	Verti HT	cal Basi MS	cet* S
1/4 5/16 3/8	6 x 19 6 x 19 6 x 19 6 x 19	0.49 0.76 1.1	0.51 0.79 1.1	0.55 0.85 1.2	0.37 0.57 0.80	0.38 0.59 0.85	0.41 0.64 0.91	0.99 1.5 2.1	1.0 1.6 2.2	1.1 1.7 2.4
7/16	6 x 19	1.4	1.5	1.6	1.1	1.1	1.2	2.9	3.0	3.3
1/2	6 x 19	1.8	2.0	2.1	1.4	1.5	1.6	3.7	3.9	4.3
9/16	6 x 19	2.3	2.5	2.7	1.7	1.9	2.0	4.6	5.0	5.4
5/8	6 x 19	2.8	3.1	3.3	2.1	2.3	2.5	5.6	6.2	6.7
3/4	6 x 19	3.9	<u>4.4</u>	4.8	2.9	<u>3.3</u>	3.6	7.8	<u>8.8</u>	<u>9.5</u>
7/8	6 x 19	5.1	5.9	6.4	3.9	4.5	4.8	10.0	12.0	13.0
1	6 x 19	6.7	7.7	8.4	5.0	5.8	6.3	13.0	15.0	17.0
1-1/8	6 x 19	8.4	9.5	10.0	6.3	7.1	7.9	17.0	19.0	21.0
1-1/4	6 x 37	9.8	11.0	12.0	7.4	8.3	9.2	20.0	22.0	25.0
1-3/8	6 x 37	12.0	13.0	15.0	8.9	10.0	11.0	24.0	27.0	30.0
1-1/2	6 x 37	14.0	16.0	17.0	10.0	12.0	13.0	28.0	32.0	35.0
1-5/8	6 x 37	16.0	18.0	21.0	12.0	14.0	15.0	33.0	37.0	41.0
1-3/4	6 x 37	19.0	21.0	24.0	14.0	16.0	18.0	38.0	<b>43</b> .0	<b>48</b> .0
2	6 x 37	25.0	28.0	31.0	18.0	21.0	23.0	49.0	55.0	62.0

 $HT \approx$  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
  - \* 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.

### Delete TABLE 8-4.

### TABLE 8-4.

### RATED CAPACITIES FOR SINGLE LEG SLINGS 6x19 & 6x37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE WITH INDEPENDENT WIRE ROPE CORE (IWRC)

Ro	pe			Rated	l Capaci	ties, Tor	as (2.000 )	ь)		
Dia			Vertical			Choker		Verti	cal Bask	cet*
(Inches)	Constr	HT	MS	S	HT	MS	S	HT	MS	S
1/4	6 x 19	0.53	0.56	0.59	0.40	0.42	0.44	1.0	1.1	1.2
5/16	6 x 19	0.81	0.87	0.92	0.61	0.65	0.69	1.6	1.7	1.8
3/8	6 x 19	1.1	1.2	1.3	0.86	0.93	0.98	2.3	2.5	2.6
7/16	6 x 19	1.5	1.7	1.8	1.2	1.3	1.3	3.1	3.4	3.5
1/2	6 x 19	2.0	2.2	2.3	1.5	1.6	1.7	3.9	4.4	4.6
9/16	6 x 19	2.5	2.7	2.9	1.8	2.1	2.2	4.9	5.5	5.8
5/8	6 x 19	3.0	3.4	3.6	2.2	2.5	2.7	6.0	6.8	7.2
3/4	6 x 19	4.2	4.9	5.1	3.1	3.6	3.8	8.4	9.7	10.0
7/8	6 x 19	5.5	6.6	6.9	4.1	4.9	5.2	11.0	13.0	14.0
1	6 x 19	7.2	8.5	9.0	5.4	6.4	6.7	14.0	17.0	18.0
1-1/8	6 x 19	9.0	10.0	11.0	6.8	7.8	8.5	18.0	21.0	23.0
1-1/4	6 x 37	10.0	12.0	13.0	7.9	9.2	9.9	21.0	24.0	26.0
1-3/8	6 x 37	13.0	15.0	16.0	9.6	11.0	12.0	25.0	29.0	32.0
1-1/2	6 x 37	15.0	17.0	19.0	11.0	13.0	14.0	30.0	35.0	38.0
1-5/8	6 x 37	18.0	20.0	22.0	13.0	15.0	17.0	35.0	41.0	44.0
1-3/4	6 x 37	20.0	24.0	26.0	15.0	18.0	19.0	41.0	47.0	51.0
2	6 x 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 8-3 values in HT column.

MS = Mechanical Splice.

S = Swaged or Zinc Poured Socket.

S = These

values

D = Diameter of curvature around which the body of the sling is bent.

d = Diameter of rope.

### Delete TABLE 8-5.

### **TABLE 8-5.**

### RATED CAPACITIES FOR SINGLE LEG SLINGS CABLE LAID ROPE — MECHANICAL SPLICE ONLY 7x7x7 & 7x7x19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE 7x6x19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

	Rope	Rate	d Capacities, T	ons (2,000 lb)
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
1/4 3/8 1/2	7x7x7 7x7x7 7x7x7 7x7x7	0.5 1.1 1.8	0.38 0.81 1.4	1.0 2.0 3.7
5/8 3/4	7x7x7 7x7x7	2.8 3.8	2.1 2.9	5.5 7.6
5/8 3/4 7/8	7x7x19 7x7x19 7x7x19 7x7x19	2.9 4.1 5.4	2.2 3.0 4.0	5.8 8.1 11.0
1 1-1/8 1-1/4	7x7x19 7x7x19 7x7x19 7x7x19	6.9 8.2 9.9	5.1 6.2 7.4	14.0 16.0 20.0
3/4 7/8 1	7x6x19 IWRC 7x6x19 IWRC 7x6x19 IWRC 7x6x19 IWRC	3.8 5.0 6.4	2.8 3.8 4.8	7.6 10.0 13.0
1-1/8 1-1/4 1-5/16	7x6x19 IWRC 7x6x19 IWRC 7x6x19 IWRC	7.7 9.2 10.0	5.8 6.9 7.5	15.0 18.0 20.0
1-3/8 1-1/2	7x6x19 IWRC 7x6x19 IWRC	11.0 13.0	8.2 9.6	22.0 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.

### -Delete TABLE 8-6.

### **TABLE 8-6.**

### RATED CAPACITIES FOR SINGLE LEG SLINGS 8-PART AND 6-PART BRAIDED ROPE 6x7 & 6x19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE 7 x 7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

Compone	ent Ropes		Rate	d Capacitie	s, Tons (2,0	00 lb)	
		Ver	tical	Che	oker		Vertical legree*
Dia (Inches)	Constr	8-Part	6-Part	8-Part	6-Part	8-Part	6-Part
3/32	6 x 7	0.42	0.32	0.32	0.24	0.74	0.55
1/8	6 x 7	0.76	0.57	0.57	0.42	1.3	0.98
3/16	6 x 7	1.7	1.3	1.3	0.94	2.9	2.2
3/32 1/8	7 x 7 7 x 7	0.51 0.95	0.39 0.71	0.38	0.29 0.53	0.89	0.67 1.2
3/16	7 x 7	2.1	1.5	1.5	1.2	3.6	2.7
3/16	6 x 19	1.7	1.3	1.3	0.98	3.0	2.2
1/4	6 x 19	3.1	2.3	2.3	1.7	5.3	4.0
5/16	6 x 19	4.8	3.6	3.6	2.7	8.3	6.2
3/8	6 x 19	6.8	5.1	5.1	3.8	12.0	8.9
7/16	6 x 19	9.3	6.9	6.9	5.2	16.0	12.0
1/2	6 x 19	12.0	9.0	9.0	6.7	21.0	15.0
9/16	6 x 19	15.0	11.0	11.0	8.5	26.0	20.0
5/6	6 x 19	19.0	14.0	14.0	10.0	32.0	24.0
3/4	6 x 19	27.0	20.0	20.0	15.0	46.0	35.0
7/8	6 x 19	36.0	27.0	27.0	20.0	62.0	47.0
1	6 x 19	47.0	35.0	35.0	26.0	81.0	61.0

\*These 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 8-7.

# RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS 6x19 & 6x37 CLASSIFICATION IMPROVED PLOW STEEL GRADE

ROPE WITH FIBER CORE (FC)

Rope	g					Rate	Rated Capacities, Tons (2,000 lb)	s. Tons (2,1	(위 000				
			2	-Leg Bric	2-Leg Bridle Slings				e	3-Leg Bridle Slings	lle Sling		
Diα (Inches)	Constr	Vert 30 degree Horz 60 degree	30 degree 60 degree	45 de An	45 degree Angle	Vert 6 Horr 3	Vert 60 degree Horr 30 degree	Vert 30 Horz 60	Vert 30 degree Horz 60 degree	45 degree Angle	gree gle	Vert 60 Horz 30	Vert 60 degree Horz 30 degree
		нт	MS	НТ	MS	HT	WS	НТ	WS	H	MS	HT	WS
1/4		0.85	0.88	0.70	0.72	0.49	0.51	1.3	1.3	1.0	1.1	0.74	0.76
5/16	6 x 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		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	×	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 x 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	×	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		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 x 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
2/8		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 x 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		14.0	16.0	12.0	13.0	8.4	9.5	22.0	24.0	18.0	20.0	13.0	14.0
1-1/4	×	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	$6 \times 37$	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	×	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	×	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 x 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	×	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 1	Hand Tucked Splice.	o,										×	

MS = Mechanical Splice. 2

### -Delete TABLE 8-7.

<b>3-Leg Bridle Slings</b> Vert 30 degree         45 degree         Vert 30 degree         45 degree         Kndle Slings           HT         MS         HE         MS         HE         MS         HE         MS         HE         MS <th>Constr.         2-Lag Bridle Slings         3-Lag Bridle Slings           Vert 30 degree         45 degree         Mage         HT         MS         MS         MS         MS         MS         MS         MS</th> <th>Bo</th> <th>2</th> <th></th> <th></th> <th></th> <th></th> <th>Rcrte</th> <th>Rated Capacities, Tons (2,000 lb)</th> <th>s, Tons (2,0</th> <th>(역1 00</th> <th></th> <th></th> <th></th> <th></th>	Constr.         2-Lag Bridle Slings         3-Lag Bridle Slings           Vert 30 degree         45 degree         Mage         HT         MS         MS         MS         MS         MS         MS         MS	Bo	2					Rcrte	Rated Capacities, Tons (2,000 lb)	s, Tons (2,0	(역1 00					
Vert 30 degree         45 degree         Vert 80 degree         45 degree         Vert 30 degree         45 degree         Kaple         Hor 80 degree         Ko 46gree         Ko 46gree <th 46gree<="" th="" th<=""><th>Vert 30 degree         Vert 30</th><th></th><th>2</th><th></th><th>2</th><th>-Leg Brid</th><th>lle Slings</th><th>_</th><th></th><th></th><th>¢</th><th>-Leg Brid</th><th>lle Slingi</th><th></th><th></th></th>	<th>Vert 30 degree         Vert 30</th> <th></th> <th>2</th> <th></th> <th>2</th> <th>-Leg Brid</th> <th>lle Slings</th> <th>_</th> <th></th> <th></th> <th>¢</th> <th>-Leg Brid</th> <th>lle Slingi</th> <th></th> <th></th>	Vert 30 degree         Vert 30		2		2	-Leg Brid	lle Slings	_			¢	-Leg Brid	lle Slingi		
HT         MS	HTMSHTHTMS <th>Dia (Inches)</th> <th>Constr</th> <th>Vert 30 Horz 60</th> <th>degree degree</th> <th>45 de An</th> <th>egree gle</th> <th>Vert ( Horz (</th> <th>30 degree 30 degree</th> <th>Vert 30 Horz 60</th> <th>degree degree</th> <th>45 de Ang</th> <th>gree gle</th> <th>Vert 60 Horz 30</th> <th>degree degree</th>	Dia (Inches)	Constr	Vert 30 Horz 60	degree degree	45 de An	egree gle	Vert ( Horz (	30 degree 30 degree	Vert 30 Horz 60	degree degree	45 de Ang	gree gle	Vert 60 Horz 30	degree degree	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	6x19 $0.92$ $0.97$ $0.75$ $0.79$ $0.63$ $0.56$ $1.4$ $1.4$ $1.1$ $1.2$ $0.79$ $6x19$ $1.4$ $1.5$ $1.1$ $1.2$ $0.81$ $0.87$ $2.1$ $2.3$ $1.7$ $1.8$ $1.2$ $6x19$ $2.7$ $2.9$ $2.1$ $1.6$ $1.8$ $1.1$ $1.2$ $0.81$ $0.87$ $2.1$ $2.3$ $1.7$ $1.8$ $1.7$ $6x19$ $2.7$ $2.9$ $2.2$ $2.4$ $1.5$ $1.7$ $4.0$ $4.4$ $3.3$ $3.6$ $2.3$ $6x19$ $2.7$ $2.9$ $2.2$ $2.4$ $1.5$ $1.7$ $4.8$ $3.2$ $2.4$ $2.6$ $1.7$ $6x19$ $5.2$ $5.9$ $4.2$ $4.8$ $3.0$ $3.4$ $7.8$ $8.8$ $6.4$ $7.2$ $4.5$ $6x19$ $5.2$ $5.9$ $4.2$ $4.9$ $11.0$ $13.0$ $13.0$ $12.0$ $14.0$ $8.3$ $6x19$ $12.0$ $110$ $12.0$ $12.0$ $12.0$ $12.0$ $14.0$ $8.3$ $10.0$ $6x37$ $18.0$ $11.0$ $12.0$ $13.0$ $13.0$ $15.0$ $13.0$ $12.0$ $13.0$ $12.0$ $6x137$ $28.0$ $21.0$ $23.0$ $27.0$ $23.0$ $27.0$ $23.0$ $21.0$ $23.0$ $6x137$ $28.0$ $21.0$ $23.0$ $27.0$ $23.0$ $27.0$ $23.0$ $27.0$ $23.0$ $6x37$ $28.0$ $21.0$ $23.0$ $21.0$ $23.0$ <t< th=""><th></th><th></th><th>뷺</th><th>WS</th><th>Ħ</th><th>MS</th><th>HT</th><th>WS</th><th>H</th><th>WS</th><th>뮾</th><th>WS</th><th>нт</th><th>WS</th></t<>			뷺	WS	Ħ	MS	HT	WS	H	WS	뮾	WS	нт	WS	
6         6x19         1.4         1.5         1.1         1.2         0.81         0.87         2.1         2.3         1.7         1.8           6         6x19         2.0         2.1         1.6         1.8         1.1         1.2         0.81         3.2         2.4         2.6         5.7         4.9         3.2         2.4         2.6         5.7         4.2         4.6         5.7         4.2         4.6         5.7         4.2         4.6         5.7         4.2         4.6         5.7         4.2         4.6         5.7         4.2         4.6         5.7         4.2         4.6         5.7         4.2         4.6         5.7         4.2         4.6         5.7         4.6         5.7         4.6         5.7         4.6         5.7         4.6         5.7         4.6         5.7         4.6         5.7         4.6         5.7         4.6         5.7         4.6         5.7         4.6         5.7         4.6         5.7         4.6         5.7         5.8         6.6         11.0         17.0         17.0         17.0         17.0         17.0         17.0         18.0         18.0         13.0         13.0         13.0	6x191.41.51.11.20.810.872.12.31.71.81.16x192.02.11.61.81.11.20.810.872.12.31.71.81.76x192.72.92.22.41.51.74.04.43.33.62.36x192.72.92.22.41.51.74.04.43.33.62.36x194.34.83.12.02.25.15.15.74.24.63.06x195.25.94.24.83.03.47.15.25.83.16x195.25.94.24.93.03.47.15.25.83.06x1912.011.07.89.611.07.28.56.611.013.06.36x1912.018.013.015.017.013.012.022.015.011.013.06x3728.018.021.018.021.013.012.022.025.018.011.013.06x3725.018.021.018.021.013.013.012.022.023.	1/4	6x19	0.92	0.97	0.75	0.79	0.53	0.56	1.4	1.4	1.1	1.2	0.79	0.84	
6x19         2.0         2.1         1.6         1.8         1.1         1.2         3.0         3.2         2.4         2.6           6         6x19         2.7         2.9         2.2         2.4         1.5         1.7         4.0         4.4         3.3         3.6           6         6x19         3.4         3.8         2.8         3.1         2.0         2.2         5.4         1.5         1.7         4.0         4.4         3.3         3.6           6         5x19         5.2         5.9         4.2         4.8         3.0         3.4         7.8         8.8         6.4         7.2         5.2         5.8         6.6         11.0         13.0         8.9         10.0           6x19         12.0         15.0         10.0         12.0         13.0         13.0         13.0         13.0         13.0         13.0         14.0         17.0         12.0         18.0         14.0         17.0         12.0         18.0         18.0         13.0         13.0         13.0         14.0         14.0         17.0         12.0         18.0         14.0         17.0         12.0         14.0         14.0         14.0         1	6x192.02.11.61.81.11.23.03.22.42.61.76x192.72.92.22.41.51.74.04.43.33.62.36x193.43.33.53.32.22.41.51.74.04.43.33.62.36x193.43.85.25.92.22.41.51.74.04.43.33.62.36x195.25.94.24.83.03.47.15.74.63.06x195.25.94.24.83.03.47.15.74.63.06x195.25.94.24.83.03.47.15.74.54.56x1912.015.010.012.07.28.511.017.018.06x1912.015.010.012.07.28.514.04.43.36x3722.015.010.012.027.018.027.018.06x3725.018.017.010.012.027.031.018.023.06x3725.018.021.013.015.027.033.027.031.023.06x3725.025.018.027.033.027.033.027.031.023.027.031.06x3725.025.018.020.018.0 <td>5/16</td> <td>6x19</td> <td>1.4</td> <td>1.5</td> <td>1.1</td> <td>1.2</td> <td>0.81</td> <td>0.87</td> <td>2.1</td> <td>2.3</td> <td>1.7</td> <td>1.8</td> <td>1.2</td> <td>1.3</td>	5/16	6x19	1.4	1.5	1.1	1.2	0.81	0.87	2.1	2.3	1.7	1.8	1.2	1.3	
6         6x19         2.7         2.9         2.2         2.4         1.5         1.7         4.0         4.4         3.3         3.6           6         6x19         3.4         3.8         2.8         3.1         2.0         2.2         5.1         5.7         4.2         4.6           6         6x19         5.2         5.9         4.2         4.8         3.0         3.4         7.8         8.8         6.4         7.2           6x19         5.2         5.9         4.2         4.8         3.0         3.4         7.8         8.8         6.4         7.2           6x19         7.3         8.4         5.9         6.9         4.2         4.9         11.0         13.0         8.9         10.0           6x19         12.0         15.0         10.0         12.0         13.0         13.0         13.0         13.0         14.0         17.0         12.0         14.0           6x37         18.0         13.0         15.0         10.0         12.0         13.0         12.0         18.0         27.0         19.0         27.0         19.0         27.0         19.0         27.0         19.0         27.0         27.0 <td>6x19<math>2.7</math><math>2.9</math><math>2.2</math><math>2.4</math><math>1.5</math><math>1.7</math><math>4.0</math><math>4.4</math><math>3.3</math><math>3.6</math><math>2.3</math><math>6x19</math><math>3.4</math><math>3.8</math><math>2.8</math><math>3.1</math><math>2.0</math><math>2.2</math><math>5.1</math><math>5.7</math><math>4.2</math><math>4.6</math><math>3.0</math><math>6x19</math><math>5.2</math><math>5.9</math><math>4.2</math><math>4.8</math><math>3.0</math><math>3.4</math><math>7.1</math><math>5.2</math><math>5.8</math><math>3.7</math><math>6x19</math><math>5.2</math><math>5.9</math><math>4.2</math><math>4.8</math><math>3.0</math><math>3.4</math><math>7.1</math><math>5.2</math><math>5.8</math><math>3.7</math><math>6x19</math><math>5.2</math><math>5.9</math><math>4.2</math><math>4.8</math><math>3.0</math><math>3.4</math><math>7.8</math><math>8.8</math><math>6.4</math><math>7.2</math><math>4.5</math><math>6x19</math><math>9.6</math><math>11.0</math><math>7.8</math><math>9.3</math><math>5.5</math><math>6.6</math><math>14.0</math><math>17.0</math><math>12.0</math><math>14.0</math><math>8.3</math><math>6x19</math><math>12.0</math><math>15.0</math><math>10.0</math><math>12.0</math><math>12.0</math><math>13.0</math><math>15.0</math><math>17.0</math><math>12.0</math><math>14.0</math><math>8.3</math><math>6x37</math><math>18.0</math><math>21.0</math><math>13.0</math><math>15.0</math><math>17.0</math><math>12.0</math><math>14.0</math><math>8.3</math><math>6x37</math><math>18.0</math><math>21.0</math><math>17.0</math><math>12.0</math><math>22.0</math><math>18.0</math><math>22.0</math><math>18.0</math><math>6x37</math><math>35.0</math><math>25.0</math><math>18.0</math><math>25.0</math><math>18.0</math><math>22.0</math><math>19.0</math><math>22.0</math><math>11.0</math><math>6x37</math><math>35.0</math><math>23.0</math><math>22.0</math><math>18.0</math><math>22.0</math><math>18.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math><math>22.0</math></td> <td>3/8</td> <td>6x19</td> <td>2.0</td> <td>2.1</td> <td>1.6</td> <td>1.8</td> <td>1.1</td> <td>1.2</td> <td>3.0</td> <td>3.2</td> <td>2.4</td> <td>2.6</td> <td>1.7</td> <td>1.9</td>	6x19 $2.7$ $2.9$ $2.2$ $2.4$ $1.5$ $1.7$ $4.0$ $4.4$ $3.3$ $3.6$ $2.3$ $6x19$ $3.4$ $3.8$ $2.8$ $3.1$ $2.0$ $2.2$ $5.1$ $5.7$ $4.2$ $4.6$ $3.0$ $6x19$ $5.2$ $5.9$ $4.2$ $4.8$ $3.0$ $3.4$ $7.1$ $5.2$ $5.8$ $3.7$ $6x19$ $5.2$ $5.9$ $4.2$ $4.8$ $3.0$ $3.4$ $7.1$ $5.2$ $5.8$ $3.7$ $6x19$ $5.2$ $5.9$ $4.2$ $4.8$ $3.0$ $3.4$ $7.8$ $8.8$ $6.4$ $7.2$ $4.5$ $6x19$ $9.6$ $11.0$ $7.8$ $9.3$ $5.5$ $6.6$ $14.0$ $17.0$ $12.0$ $14.0$ $8.3$ $6x19$ $12.0$ $15.0$ $10.0$ $12.0$ $12.0$ $13.0$ $15.0$ $17.0$ $12.0$ $14.0$ $8.3$ $6x37$ $18.0$ $21.0$ $13.0$ $15.0$ $17.0$ $12.0$ $14.0$ $8.3$ $6x37$ $18.0$ $21.0$ $17.0$ $12.0$ $22.0$ $18.0$ $22.0$ $18.0$ $6x37$ $35.0$ $25.0$ $18.0$ $25.0$ $18.0$ $22.0$ $19.0$ $22.0$ $11.0$ $6x37$ $35.0$ $23.0$ $22.0$ $18.0$ $22.0$ $18.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$	3/8	6x19	2.0	2.1	1.6	1.8	1.1	1.2	3.0	3.2	2.4	2.6	1.7	1.9	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	6x19 $3.4$ $3.8$ $2.8$ $3.1$ $2.0$ $2.2$ $5.1$ $5.7$ $4.2$ $4.6$ $3.7$ $6x19$ $5.2$ $5.9$ $4.2$ $4.8$ $3.5$ $3.9$ $2.5$ $2.5$ $5.9$ $4.2$ $4.6$ $3.7$ $6x19$ $5.2$ $5.9$ $4.2$ $4.8$ $3.0$ $3.4$ $7.1$ $5.2$ $5.8$ $3.7$ $6x19$ $5.2$ $5.9$ $4.2$ $4.8$ $3.0$ $3.4$ $7.8$ $8.8$ $6.4$ $7.2$ $4.5$ $6x19$ $9.6$ $11.0$ $7.8$ $9.3$ $5.5$ $6.6$ $14.0$ $17.0$ $13.0$ $6.3$ $6x19$ $12.0$ $15.0$ $10.0$ $12.0$ $7.2$ $8.5$ $19.0$ $22.0$ $14.0$ $8.3$ $6x37$ $18.0$ $21.0$ $15.0$ $17.0$ $12.0$ $22.0$ $18.0$ $12.0$ $22.0$ $6x37$ $22.0$ $18.0$ $21.0$ $10.0$ $12.0$ $22.0$ $18.0$ $22.0$ $18.0$ $6x37$ $22.0$ $18.0$ $21.0$ $10.0$ $12.0$ $22.0$ $22.0$ $18.0$ $22.0$ $6x37$ $22.0$ $18.0$ $22.0$ $18.0$ $27.0$ $22.0$ $26.0$ $37.0$ $22.0$ $6x37$ $22.0$ $28.0$ $22.0$ $18.0$ $22.0$ $22.0$ $22.0$ $22.0$ $22.0$ $6x37$ $33.0$ $23.0$ $23.0$ $23.0$ $23.0$ $23.0$ $23.0$ $23.0$ $23.0$ $6x37$ $35.0$ <td>7/16</td> <td>6x19</td> <td>2.7</td> <td>2.9</td> <td>2.2</td> <td>2.4</td> <td>1.5</td> <td>1.7</td> <td>4.0</td> <td>4.4</td> <td>3.3</td> <td>3.6</td> <td>2.3</td> <td>2.5</td>	7/16	6x19	2.7	2.9	2.2	2.4	1.5	1.7	4.0	4.4	3.3	3.6	2.3	2.5	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	6x19 $4.3$ $4.8$ $3.5$ $3.9$ $2.5$ $2.7$ $6.4$ $7.1$ $5.2$ $5.8$ $3.7$ $6x19$ $5.2$ $5.9$ $4.2$ $4.8$ $3.0$ $3.4$ $7.8$ $8.8$ $6.4$ $7.2$ $4.5$ $6x19$ $7.3$ $8.4$ $5.9$ $6.9$ $4.2$ $4.8$ $3.0$ $3.4$ $7.8$ $8.9$ $10.0$ $6.3$ $6x19$ $9.6$ $11.0$ $7.8$ $9.3$ $5.5$ $6.6$ $11.0$ $17.0$ $12.0$ $14.0$ $17.0$ $8.9$ $10.0$ $6x19$ $12.0$ $18.0$ $11.0$ $7.2$ $8.5$ $19.0$ $22.0$ $18.0$ $11.0$ $1$ $6x37$ $18.0$ $21.0$ $18.0$ $17.0$ $10.0$ $12.0$ $23.0$ $27.0$ $31.0$ $19.0$ $6x37$ $25.0$ $18.0$ $21.0$ $13.0$ $15.0$ $18.0$ $27.0$ $31.0$ $19.0$ $23.0$ $6x37$ $25.0$ $21.0$ $18.0$ $21.0$ $18.0$ $27.0$ $31.0$ $19.0$ $23.0$ $6x37$ $35.0$ $21.0$ $23.0$ $38.0$ $43.0$ $50.0$ $31.0$ $30.0$ $6x37$ $35.0$ $21.0$ $23.0$ $38.0$ $43.0$ $50.0$ $31.0$ $30.0$ $6x37$ $35.0$ $37.0$ $23.0$ $38.0$ $43.0$ $50.0$ $31.0$ $31.0$ $6x37$ $35.0$ $37.0$ $23.0$ $38.0$ $43.0$ $50.0$ $31.0$ $31.0$ $6x37$	1/2	6x19	3.4	3.8	2.8	3.1	2.0	2.2	5.1	5.7	4.2	4.6	3.0	3.3	
6x19 $5.2$ $5.9$ $4.2$ $4.8$ $3.0$ $3.4$ $7.8$ $8.8$ $6.4$ $7.2$ $6x19$ $7.3$ $8.4$ $5.9$ $6.9$ $4.2$ $4.8$ $3.0$ $3.4$ $7.8$ $8.9$ $10.0$ $6x19$ $9.6$ $11.0$ $7.8$ $9.3$ $5.5$ $6.6$ $14.0$ $17.0$ $12.0$ $14.0$ $6x19$ $12.0$ $15.0$ $10.0$ $12.0$ $7.2$ $8.5$ $19.0$ $22.0$ $14.0$ $6x19$ $16.0$ $18.0$ $13.0$ $12.0$ $17.0$ $12.0$ $18.0$ $22.0$ $18.0$ $6x37$ $18.0$ $21.0$ $15.0$ $17.0$ $12.0$ $27.0$ $22.0$ $18.0$ $6x37$ $22.0$ $25.0$ $18.0$ $21.0$ $15.0$ $18.0$ $27.0$ $31.0$ $6x37$ $22.0$ $25.0$ $18.0$ $21.0$ $15.0$ $18.0$ $27.0$ $31.0$ $6x37$ $22.0$ $25.0$ $18.0$ $21.0$ $15.0$ $18.0$ $27.0$ $31.0$ $6x37$ $31.0$ $35.0$ $21.0$ $18.0$ $20.0$ $46.0$ $53.0$ $38.0$ $43.0$ $6x37$ $35.0$ $25.0$ $18.0$ $29.0$ $29.0$ $38.0$ $43.0$ $6x37$ $32.0$ $25.0$ $29.0$ $17.0$ $32.0$ $27.0$ $38.0$ $43.0$ $6x37$ $35.0$ $25.0$ $29.0$ $29.0$ $29.0$ $29.0$ $29.0$ $29.0$ $6x37$ $35.0$ $29.0$ $29.$	6x19 $5.2$ $5.9$ $4.2$ $4.8$ $3.0$ $3.4$ $7.8$ $8.8$ $6.4$ $7.2$ $4.5$ $6x19$ $7.3$ $8.4$ $5.9$ $6.9$ $4.2$ $4.9$ $1110$ $13.0$ $8.9$ $10.0$ $6.3$ $6x19$ $9.6$ $11.0$ $7.8$ $9.3$ $5.5$ $6.6$ $1440$ $17.0$ $12.0$ $140$ $8.9$ $6x19$ $12.0$ $15.0$ $10.0$ $12.0$ $7.2$ $8.5$ $19.0$ $22.0$ $18.0$ $11.0$ $6x37$ $18.0$ $21.0$ $13.0$ $15.0$ $9.0$ $10.0$ $22.0$ $18.0$ $11.0$ $6x37$ $22.0$ $25.0$ $18.0$ $21.0$ $13.0$ $15.0$ $33.0$ $27.0$ $31.0$ $19.0$ $6x37$ $22.0$ $21.0$ $18.0$ $21.0$ $18.0$ $27.0$ $31.0$ $19.0$ $22.0$ $16.0$ $6x37$ $22.0$ $25.0$ $29.0$ $18.0$ $20.0$ $46.0$ $53.0$ $45.0$ $27.0$ $31.0$ $6x37$ $35.0$ $25.0$ $29.0$ $18.0$ $20.0$ $46.0$ $53.0$ $37.0$ $27.0$ $6x37$ $35.0$ $27.0$ $38.0$ $43.0$ $27.0$ $31.0$ $19.0$ $6x37$ $35.0$ $53.0$ $89.0$ $79.0$ $37.0$ $27.0$ $31.0$ $6x37$ $35.0$ $53.0$ $61.0$ $65.0$ $43.0$ $50.0$ $31.0$ $6x37$ $35.0$ $53.0$ $59.0$ $59.0$ $50.0$	9/16	6 <b>x</b> 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	
	6x19 $7.3$ $8.4$ $5.9$ $6.9$ $4.2$ $4.9$ $11.0$ $13.0$ $8.9$ $10.0$ $6.3$ $6x19$ $9.6$ $11.0$ $7.8$ $9.3$ $5.5$ $6.6$ $14.0$ $17.0$ $12.0$ $14.0$ $8.3$ $6x19$ $12.0$ $15.0$ $10.0$ $12.0$ $7.2$ $8.5$ $19.0$ $22.0$ $18.0$ $11.0$ $6x19$ $12.0$ $18.0$ $13.0$ $15.0$ $9.0$ $10.0$ $22.0$ $18.0$ $11.0$ $6x37$ $22.0$ $21.0$ $15.0$ $17.0$ $12.0$ $22.0$ $28.0$ $18.0$ $6x37$ $22.0$ $21.0$ $13.0$ $12.0$ $27.0$ $31.0$ $22.0$ $18.0$ $6x37$ $22.0$ $21.0$ $18.0$ $21.0$ $13.0$ $15.0$ $37.0$ $27.0$ $31.0$ $23.0$ $6x37$ $22.0$ $25.0$ $29.0$ $18.0$ $20.0$ $46.0$ $53.0$ $43.0$ $27.0$ $6x37$ $35.0$ $21.0$ $18.0$ $20.0$ $46.0$ $53.0$ $38.0$ $43.0$ $27.0$ $6x37$ $35.0$ $23.0$ $33.0$ $29.0$ $38.0$ $43.0$ $27.0$ $31.0$ $6x37$ $35.0$ $53.0$ $38.0$ $43.0$ $50.0$ $31.0$ $6x37$ $35.0$ $53.0$ $59.0$ $50.0$ $31.0$ $6x37$ $35.0$ $53.0$ $56.0$ $56.0$ $50.0$ $31.0$ $6x37$ $35.0$ $53.0$ $56.0$ $56.0$ $50.0$ <td>5/8</td> <td>6x19</td> <td>5.2</td> <td>5.9</td> <td>4.2</td> <td>4.8</td> <td>3.0</td> <td>3.4</td> <td>7.8</td> <td>8.8</td> <td>6.4</td> <td>7.2</td> <td>4.5</td> <td>5.1</td>	5/8	6x19	5.2	5.9	4.2	4.8	3.0	3.4	7.8	8.8	6.4	7.2	4.5	5.1	
6x19         9.6         11.0         7.8         9.3         5.5         6.6         14.0         17.0         12.0         14.0 $6x19$ 12.0         15.0         10.0         12.0         7.2         8.5         19.0         27.0         19.0         22.0         18.0 $6x19$ 16.0         18.0         13.0         15.0         9.0         10.0         23.0         27.0         19.0         22.0         18.0 $6x37$ 18.0         21.0         15.0         17.0         10.0         12.0         27.0         32.0         27.0         32.0         27.0         31.0         25.0         56.0 $6x37$ 22.0         25.0         18.0         21.0         13.0         15.0         17.0         32.0         27.0         31.0         27.0         31.0 $6x37$ 22.0         25.0         18.0         27.0         18.0         27.0         31.0         37.0         37.0         37.0 $6x37$ 35.0         21.0         25.0         18.0         27.0         38.0         43.0         43.0 $6x37$ 35.0         25.0	6x199.611.07.89.35.56.614.017.012.014.08.3 $6x19$ 12.015.019.012.015.010.012.015.018.011.0 $6x19$ 12.015.018.017.012.022.018.011.0 $6x37$ 18.021.015.09.010.022.022.018.011.0 $6x37$ 22.025.018.017.010.012.027.031.019.0 $6x37$ 22.025.018.021.013.015.033.038.027.031.019.0 $6x37$ 22.025.018.021.013.015.017.039.045.037.023.027.0 $6x37$ 35.021.025.018.020.018.020.046.053.031.019.0 $6x37$ 35.025.029.033.020.024.053.061.043.027.0 $6x37$ 35.053.037.029.030.026.030.056.067.031.0 $6x37$ 35.053.053.061.048.050.031.056.067.0 $6x37$ 35.053.056.053.065.067.056.067.0 $6x37$ 35.053.061.048.079.056.067.031.0 $6x37$ 35.053.056.053.065.040.0 </td <td>3/4</td> <td><b>6x19</b></td> <td>7.3</td> <td>8.4</td> <td>5.9</td> <td>6.9</td> <td>4.2</td> <td>4.9</td> <td>11.0</td> <td>13.0</td> <td>8.9</td> <td>10.0</td> <td>6.3</td> <td>7.3</td>	3/4	<b>6x19</b>	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	6x19	9.6	11.0	7.8	9.3	5.5	6.6	14.0	17.0	12.0	14.0	8.3	9.9	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		1	6x19	12.0	15.0	10.0	12.0	7.2	8.5	19.0	22.0	15.0	18.0	11.0	13.0	
6x37         18.0         21.0         15.0         17.0         10.0         12.0         27.0         32.0         26.0           6x37         22.0         25.0         18.0         21.0         13.0         15.0         33.0         38.0         27.0         31.0           6x37         22.0         25.0         18.0         21.0         13.0         15.0         33.0         38.0         27.0         31.0           6x37         26.0         30.0         21.0         25.0         15.0         17.0         39.0         45.0         32.0         37.0           6x37         31.0         25.0         29.0         18.0         20.0         46.0         53.0         43.0           6x37         35.0         41.0         29.0         29.0         53.0         61.0         43.0           6x37         35.0         41.0         29.0         33.0         20.0         53.0         61.0         43.0	6x37       18.0 $21.0$ 15.0       17.0       10.0       12.0 $27.0$ $32.0$ $26.0$ 16.0 $6x37$ $22.0$ $25.0$ 18.0 $21.0$ 13.0       15.0 $33.0$ $38.0$ $27.0$ $31.0$ $19.0$ $6x37$ $22.0$ $25.0$ $18.0$ $21.0$ $13.0$ $15.0$ $37.0$ $38.0$ $27.0$ $31.0$ $19.0$ $6x37$ $26.0$ $30.0$ $21.0$ $13.0$ $15.0$ $17.0$ $39.0$ $45.0$ $37.0$ $23.0$ $37.0$ $23.0$ $37.0$ $23.0$ $37.0$ $23.0$ $37.0$ $23.0$ $43.0$ $27.0$ $31.0$ $19.0$ $6x37$ $35.0$ $41.0$ $25.0$ $29.0$ $18.0$ $20.0$ $68.0$ $79.0$ $43.0$ $27.0$ $31.0$ $6x37$ $35.0$ $53.0$ $56.0$ $56.0$ $56.0$ $56.0$ $40.0$ $6x37$ $35.0$ $57.0$ $37.0$ $27.0$ $31.0$ $56.0$ $50.0$ $31.0$	1-1/8	6x19	16.0	18.0	13.0	15.0	9.0	10.0	23.0	27.0	19.0	22.0	13.0	16.0	
6x37         22.0         25.0         18.0         21.0         13.0         15.0         33.0         38.0         27.0         31.0           6x37         26.0         30.0         21.0         25.0         15.0         17.0         39.0         45.0         32.0         37.0           6x37         31.0         35.0         21.0         25.0         18.0         20.0         46.0         53.0         38.0         43.0           6x37         35.0         41.0         29.0         33.0         24.0         53.0         61.0         43.0           6x37         35.0         29.0         33.0         20.0         24.0         53.0         61.0         43.0		1-1/4	6x37	18.0	21.0	15.0	17.0	10.0	12.0	27.0	32.0	22.0	26.0	16.0	18.0	
6x37         26.0         30.0         21.0         25.0         15.0         17.0         39.0         45.0         32.0         37.0           6x37         31.0         35.0         25.0         29.0         18.0         20.0         46.0         53.0         38.0         43.0           6x37         35.0         41.0         29.0         33.0         20.0         24.0         53.0         61.0         43.0         50.0	6x37 $26.0$ $30.0$ $21.0$ $25.0$ $15.0$ $17.0$ $39.0$ $45.0$ $32.0$ $37.0$ $23.0$ $6x37$ $31.0$ $35.0$ $25.0$ $29.0$ $18.0$ $20.0$ $46.0$ $53.0$ $38.0$ $43.0$ $27.0$ $6x37$ $35.0$ $41.0$ $29.0$ $33.0$ $20.0$ $24.0$ $53.0$ $61.0$ $43.0$ $50.0$ $31.0$ $6x37$ $46.0$ $53.0$ $37.0$ $43.0$ $20.0$ $24.0$ $53.0$ $61.0$ $43.0$ $50.0$ $6x37$ $46.0$ $53.0$ $37.0$ $43.0$ $20.0$ $20.0$ $24.0$ $56.0$ $65.0$ $40.0$ $6x37$ $46.0$ $53.0$ $37.0$ $43.0$ $26.0$ $30.0$ $68.0$ $79.0$ $56.0$ $65.0$ $40.0$ tid Tucked Splice.	1-3/8	6 <b>x</b> 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	
6x37         31.0         35.0         25.0         29.0         18.0         20.0         46.0         53.0         38.0         43.0           6x37         35.0         41.0         29.0         33.0         20.0         24.0         53.0         61.0         43.0         50.0	6x37 $31.0$ $35.0$ $25.0$ $29.0$ $18.0$ $20.0$ $46.0$ $53.0$ $38.0$ $43.0$ $27.0$ $6x37$ $35.0$ $41.0$ $29.0$ $33.0$ $20.0$ $24.0$ $53.0$ $61.0$ $43.0$ $50.0$ $31.0$ $6x37$ $46.0$ $53.0$ $43.0$ $20.0$ $24.0$ $53.0$ $61.0$ $43.0$ $50.0$ $31.0$ $6x37$ $46.0$ $53.0$ $43.0$ $20.0$ $20.0$ $30.0$ $68.0$ $79.0$ $65.0$ $40.0$ id Tucked Splice. $10.0$ $10.0$ $10.0$ $10.0$ $10.0$ $10.0$ $10.0$	1-1/2	$6 \times 37$	26.0	30.0	21.0	25.0	15.0	17.0	39.0	45.0	32.0	37.0	23.0	26.0	
6x37 35.0 41.0 29.0 33.0 20.0 24.0 53.0 61.0 43.0 50.0	6x37         35.0         41.0         29.0         33.0         20.0         24.0         53.0         61.0         43.0         50.0         31.0           6x37         46.0         53.0         47.0         26.0         30.0         68.0         79.0         56.0         40.0           id Tucked Splice.         68.0         79.0         56.0         65.0         40.0	1-5/8	6x37	31.0	35.0	25.0	29.0	18.0	20.0	46.0	53.0	38.0	43.0	27.0	31.0	
	6x37 46.0 53.0 37.0 43.0 26.0 30.0 68.0 79.0 56.0 65.0 40.0 d Tucked Splice.	1-3/4	6x37	35.0	41.0	29.0	33.0	20.0	24.0	53.0	61.0	43.0	50.0	31.0	35.0	
46.0 33.0 37.0 43.0 26.0 30.0 68.0 79.0 56.0 55.0	T = Hand Tucked Splice.	2	6x37	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 ' Mochenicel	Tucked Spiic	e.												

-Delete TABLE 8-8.

Delete TABLE 8-9.

TABLE 8-8.

### RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS 6x19 & 6x37 CLASSIFICATION IMPROVED PLOW STEEL GRADE ROPE

	7x7 7xf	RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS CABLE LAID ROPE — MECHANICAL SPLICE ONLY 7x7x7 & 7x7x19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE ROPE 7x6x19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE	ALD ROPE – ALD ROPE – NSTRUCTIC NSTRUCTIO	8 2-LEG & 3-LH - MECHANICA )NS GALVANI ROPE N IMPROVED ROPE ROPE	RATED CAPACITIES FOR 2-LEG & 3-LEG BRIDLE SLINGS CABLE LAID ROPE — MECHANICAL SPLICE ONLY CT & 7x7x19 CONSTRUCTIONS GALVANIZED AIRCRAFT GR/ ROPE 19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GR/ ROPE	INGS JY T GRADE L GRADE	
	Rope			Rated Capacities, Tons (2,000 lb)	s, Tons (2,000 lb)		1
		3	2-Leg Bridle Sling			<b>3-Leg Bridle Sling</b>	
Dia (Inches)	Constr	Vert 30 degree Horz 60 degree	45 degree Angle	Vert 60 degree Hora 30 degree	Vert 30 Degree Horz 60 degree	45 degree Angle	Vert 60 degree Horz 30 degree
1/4	7x7x7	0.87	0.71	0.50	1.3	1.1	0.75
3/8 1/2	7x7x7	1.9 3.2	1.5 2.6	1.1	2.8 4.8	3.9	2.8
5/8 3/4	TxTxT TxTxT	4.8 6.6	3.9 5.4	2.8 3.8	7.2 9.9	5.9 8.1	4.2
5/8	7x7x19	5.0	4.1	2.9	7.5	6.1 8.6	4.3
5/4 7/8	7x7x19	9.3	7.6	<b>5.4</b>	14.0	11.0	8.1
1 1-1/8	7x7x19 7x7x19	12.0 14.0	9.7 12.0	6.9 8.2	18.0 21.0	14.0 17.0	10.0
1-1/4	7x7x19	17.0	14.0	9.9	26.0	21.0	15.0
3/4 7/8	7x6x19 IWRC 7x6x19 IWRC	6.6 8.7	5.4 7.1	3.8 5.0	9.9 13.0	8.0	5.7 7.5
1	7x6x19 IWRC	11.0	9.0	6.4	17.0	13.0	9.6
1-1/8	7x6x19 IWRC	13.0	11.0	7.7	20.0	16.0 20.0	11.0
1-1/3	7x6x19 IWRC	17.0	14.0	10.0	26.0	21.0	15.0
1-3/8 1-1/2	7x6x19 IWRC 7x6x19 IWRC	19.0 22.0	15.0 18.0	11.0 13.0	28.0 33.0	23.0 27.0	16.0 19.0

Delete TABLE 8-10.

TABLE 8-9.

38-10.	ITES FOR 2-LEG AND 3-LEG BRIDLE	
TABLE 8-10.	TES FOR 2-LE	

## 8-PART AND 6-PART BRAIDED ROPE 6x7 & 6x19 CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE 7x7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE SJUIJS RATED CAPACITI

	nent					Rate	Rated Capacities. Tons (2,000 lb)	s. Tons (2,(	(वा 00				
Rope	œ		2	Leg Brid	2-Leg Bridle Slings				3	-Leg Bric	<b>3-Leg Bridle Slings</b>	_	
Dia (Inches)	Constr	Vert 30 Horz 60	30 degree 60 degree	45 degree Angle	gree gle	Vert 6 Horz 3	Vert 80 degree Horz 30 degree	Vert 30 Horz 60	Vert 30 degree Horz 60 degree	45 de Any	45 degree Angle	Vert 60 degree Horz 30 degree	degree degree
		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	6x7	0.74	0.55	0.60	0.45	0.42	0.32	1.1	0.83	06.0	0.68	0.64	0.48
1/8	6x7	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	6x7	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	7x7	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	7x7	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	7x7	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	6x19	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	6x19	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	<b>6x</b> 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	6x19	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	6x19	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	<b>6x</b> 19	21.0	15.0	17.0	13.0	12.0	0.0	31.0	23.0	25.0	19.0	18.0	13.0
9/16	6x19	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	6x19	32.0	24.0	26.0	20.0	19.0	14.0	48.0	36.0	40.0	30.0	28.0	21.0
3/4	<b>6x</b> 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
8/L	6x19	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	6x19	81.0	61.0	66.0	50.0	47.0	35.0	122.0	91.0	99.0	74.0	70.0	53.0

### -Delete TABLE 8-11.

### **TABLE 8-11.**

### RATED CAPACITIES FOR STRAND LAID GROMMET – HAND TUCKED IMPROVED PLOW STEEL GRADE ROPE

ROP	EBODY	RATED CA	PACITIES, TOP	IS (2,000 lb)
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
1/4	7x19	0.85	0.64	1.7
5/16	7x19	1.3	1.0	2.6
3/8	7x19	1.9	1.4	3.8
7/16	7x19	2.6	1.9	5.2
1/2	7x19	3.3	2.5	6.7
9/16	7x19	4.2	3.1	8.4
5/8	7x19	5.2	3.9	10.0
3/4	7x19	7.4	5.6	15.0
7/8	7x19	10.0	7.5	20.0
1	7x19	13.0	9.7	26.0
1-1/8	7x19	16.0	12.0	32.0
1-1/4	7x37	18.0	14.0	37.0
1-3/8	7x37	22.0	16.0	44.0
1-1/2	7x37	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 the rope is bent.

d = Diameter of rope body.

### Delete TABLE 8-12.

### **TABLE 8-12.**

### RATED CAPACITIES FOR CABLE LAID GROMMET — HAND TUCKED 7x6x7 & 7x6x19 CONSTRUCTIONS IMPORVED PLOW STEEL GRADE ROPE

### 7x7x7 CONSTRUCTION GALVANIZED AIRCRAFT GRADE ROPE

CABL	E BODY	RATED CA	PACITIES, TON	IS (2.000 lb)
Dia (Inches)	Constr	() Vertical	Choker	Vertical Basket*
3/8	7x6x7	1.3	0.95	2.5
9/16	7x6x7	2.8	2.1	5.6
5/8	7x6x7	3.8	2.8	7.6
3/8	7x7x7	1.6	1.2	3.2
9/16	7x7x7	3.5	2.6	6.9
5/8	7x7x7	4.5	3.4	9.0
5/8	7x6x19	3.9	3.0	7.9
3/4	7x6x19	5.1	3.8	10.0
15/16	7x6x19	7.9	5.9	16.0
1- 1/8	7x6x19	11.0	8.4	22.0
1- 5/16	7x6x19	15.0	11.0	30.0
1- 1/2	7x6x19	19.0	14.0	39.0
1-11/16	7x6x19	24.0	18.0	49.0
1- 7/8	7x6x19	30.0	22.0	60.0
2- 1/4	7x6x19	42.0	31.0	84.0
2- 5/8	7x6x19	56.0	42.0	112.0

\*These values only apply when the D/d value is 5 or greater where:

 $D \approx$  Diameter of curvature around which cable body is bent.

d = Diameter of cable body.

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### -Delete TABLE 8-13.

### **TABLE 8-13.**

### RATED CAPACITIES FOR STRAND LAID ENDLESS SLINGS-MECHANICAL JOINT IMPROVED PLOW STEEL GRADE ROPE

ROI	PE BODY	RATED CA	PACITIES, TON	S (2,000 lb)
Dia (Inches)	Constr	0	Ø	U
		Vertical	Choker	Vertical Basket*
1/4	6x19 IWRC	0.92	0.69	1.8
3/8 1/2	6x19 IWRC 6x19 IWRC	2.0 3.6	$\frac{1.5}{2.7}$	4.1 7.2
5/8 3/4	6x19 IWRC 6x19 IWRC	5.6 8.0	4.2 6.0	$\begin{array}{c} 11.0\\ 16.0\end{array}$
7/8 1	6x19 IWRC 6x19 IWRC	11.0 14.0	8.1 10.0	$\begin{array}{c} 21.0\\ 28.0\end{array}$
1-1/8	6x19 IWRC	14.0	13.0	28.0 35.0
1-1/4	6x37 IWRC	21.0	15.0	41.0
1-3/8 1-1/2	6x37 IWRC 6x37 IWRC	$\begin{array}{c} 25.0 \\ 29.0 \end{array}$	$\begin{array}{c} 19.0\\ 22.0\end{array}$	50.0 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.

### Delete TABLE 8-14.

### **TABLE 8-14.**

### RATED CAPACITIES FOR CABLE LAID ENDLESS SLINGS-MECHANICAL JOINT 7x7x7 & 7x7x19 CONSTRUCTIONS GALVANIZED AIRCRAFT GRADE

### ROPE

### 7x6x19 IWRC CONSTRUCTION IMPROVED PLOW STEEL GRADE ROPE

CA	BLE BODY	RATED CA	PACITIES, TON	IS (2,000 lb)
Dia (Inches)	Constr	Vertical	Choker	Vertical Basket*
1/4	7x7x7	0.83	0.62	1.6
3/8	7x7x7	1.8	1.3	3.5
1/2	7x7x7	3.0	2.3	6.1
5/8	7x7x7	4.5	3.4	9.1
3/4	7x7x7	6.3	4.7	12.0
5/8	7x7x19	4.7	3.5	9.5
3/4	7x7x19	6.7	5.0	13.0
7/8	7x7x19	8.9	6.6	18.0
1	7x7x19	11.0	8.5	22.0
1-1/8	7x7x19	14.0	10.0	28.0
1-1/4	7x7x19	17.0	12.0	33.0
3/4	7x6x19 IWRC	6.2	4.7	12.0
7/8	7x6x19 IWRC	8.3	6.2	16.0
1	7x6x19 IWRC	10.0	7.9	21.0
1-1/8	7x6x19 IWRC	13.0	9.7	26.0
1-1/4	7x6x19 IWRC	16.0	12.0	31.0
1-3/8	7x6x19 IWRC	18.0	14.0	37.0
1-1/2	7x6x19 IWRC	22.0	16.0	43.0

\*These values only apply when the D/d ratio is 5 or greater where:

D = Diameter of curvature around which cable body is bent.

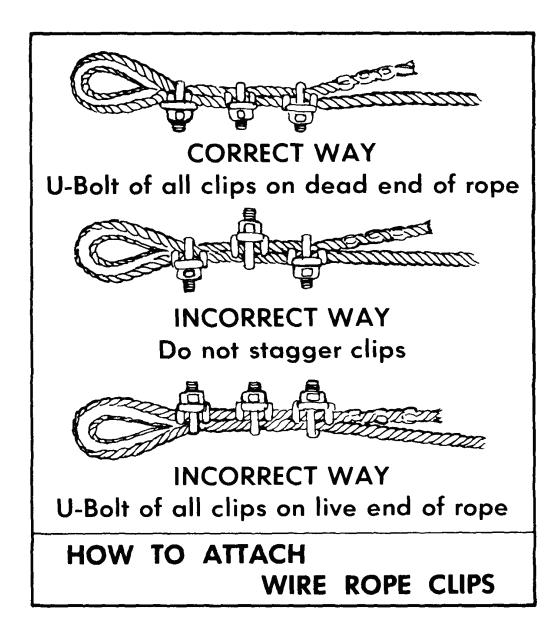
d = Diameter of cable body.

(5) When U-bolt wire rope clips are used to form eyes, "Table <u>8-15</u> <u>8-2</u>" shall be used to determine the number of clips and the amount of rope to turn back. Spacing of clips shall be uniform between the loop and the dead end. When used for eye splices, the U-bolt shall be applied so that the "U" section is in contact with the dead end of the rope.

<del>Clip size</del>	Minimum number of clips	Amount of rope to turn
-	-	back
<del>1/8</del>	2	<del>3-1/4</del>
<del>3/16</del>	-2	<del>3-3/4</del>
1/4	2	-4-3/4
<del>5/16</del>	-2	5-1/4
<del>3/8</del>	2	<u>6-1/2</u>
<del>7/16</del>	2	7
<del>1/2</del>	3	<del>11-1/2</del>
<del>9/16</del>	3	<del>12</del>
<del>5/8</del>	3	<del>12</del>
<del>3/4</del>	4	<del>18</del>
<del>7/8</del>	4	<del>19</del>
+	5	<del>26</del>
<del>1-1/8</del>	6	<del>34</del>
<del>1-1/4</del>	7	44
<del>1-3/8</del>	7	44
$\frac{1-1}{2}$	8	<del>54</del>
<del>1-5/8</del>	8	<del>58</del>
<del>1-3/4</del>	8	<del>61</del>
2	8	71
2-1/4	8	73
<del>2-1/2</del>	9	<del>84</del>
<del>2-3/4</del>	<del>10</del>	<del>100</del>
3	<del>10</del>	<del>106</del>

### TABLE 8-15. WIRE ROPE CLIPS.

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- (F) Natural rope, and synthetic fiber.
  - (1) General.

When using natural or synthetic fiber rope slings, "Tables 8-16, 8-17, 8-18, and 8-19" shall apply. Employers must not use natural-fiber and synthetic-fiber rope slings with loads in excess of the rated capacities (i.e., working load limits) indicated on the sling by permanently affixed and legible identification markings prescribed by the manufacturer.

- (2) All splices in rope slings provided by the employer shall be made in accordance with fiber rope manufacturers' recommendations.
  - (a) In manila rope, eye splices shall contain no less than three full tucks, and short splices shall contain no less than six full tucks (three on each side of the centerline of the splice).
  - (b) In layed synthetic fiber rope, eye splices shall contain no less than four full tucks, and short splices shall contain no less than eight full tucks (four on each side of the centerline of the splice).
  - (c) Strand end tails shall not be trimmed short (flush with the surface of the rope) immediately adjacent to the full tucks. This precaution applies to both eye and short splices and all types of fiber rope. For fiber ropes under one-inch diameter, the tails shall project no less than six rope diameters beyond the last full tuck. For fiber ropes one-inch diameter and larger, the tails shall project no less than six 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 no less than two additional tucks (which will require a tail length of approximately six rope diameters beyond the last full tuck).
  - (d) For all eye splices, the eye shall be sufficiently large to provide an included angle of no greater than sixty degrees at the splice when the eye is placed over the load or support.
  - (e) Knots shall not be used in lieu of splices. Delete TABLE 8-16.

TABLE 8-16. MANILA ROPE SLINGS

											í			
						RATED (	APAC	RATED CAPACITY IN POUNDS (Safety Factor =	S) SUNDS (S	afety Fac	tor = 5)			
ROPE				ЕҮ	E AND F	EYE AND EYE SLING	G				ENDLESS SLING	S SLING		
DIA-	Nominal					<b>BASKET HITCH</b>	HITCH	F	,			<b>BASKET HITCH</b>	HITCH	
METEK	Per	Breaking			Angle	Angle of Rope to Horizontal	to Hori	izontal			Angle	Angle of Rope to Horizontal	to Horize	ontal
Nominal	100 ft	Strength	DITS DTI	LCH ЭКЕ	90 deg	60 deg	45 deg	30 deg	NTS OTI	TCF JKE	90 deg	60 deg	45 deg	30 deg
Inches	In Pounds	In Pounds			Ang	Angle of Rope to Vertical	s to Vel	rtical			Ang	Angle of Rope to Vertical	e to Vert	ical
				•	0 deg	30 deg	45 deg	ge0 deg			0 deg	30 deg	45 deg	60 deg
1/2	7.5	2,650	550	250	1,100	906	750	550	950	500	1,900	1,700	1,400	950
9/16	10.4	3,450	100	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	006	450	1,800	1,500	1,200	006 (	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
2/8	22.5	7,700	1,500	750	3,100	2,700	2,200	0 1,500	2,800	1,400	5,600	4,800	3,900	2,800
1	27.0	9,000	1,800	006	3,600	3,100	2,600		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	0 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	8,000
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	00,500	18,500	9,500	37,500	32,500	26,500	18,500

TABLE 8-17. NYLON ROPE SLINGS

					5			CONTRA TION NOT IN	2					
						RATED (	CAPAC	RATED CAPACITY IN POUNDS (Safety Factor =	S) SUNDS (S	afety Fac	tor $= 9$ )			
ROPE				EY	E AND F	EYE AND EYE SLING	U U			H	NDLES	ENDLESS SLING		
DIA-	Nominal					<b>BASKET HITCH</b>	HITCE	F				<b>BASKET HITCH</b>	<b>HITCH</b>	
METER	Weight Per	Minimum Breaking			Angle	Angle of Rope to Horizontal	to Hori	izontal	H CVF		Angle	Angle of Rope to Horizontal	to Horiz	ontal
Nominal	100 ft	Strength	DITS DTI	TCH DKE	90 deg	60 deg	45 deg	30 deg	erre ITC	TCI DKF	90 deg	60 deg	45 deg	30 deg
Inches	In Pounds	In Pounds	H IJA	HL CHC	Ang	Angle of Rope to Vertical	e to Vei	rtical			Ang	Angle of Rope to Vertical	e to Vert	ical
					0 deg	30 deg	45 deg	60 deg			0 deg	30 deg	45 deg	60 deg
1/2	6.5	6,080	100	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	006	3,600	3,100	2,600	1,800	3,200	1,600	6,400	5,600	4,600	3,200
2/8	20.0	19,000	2,100	1,100	4,200	3,700	3,000		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		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		7,100	3,600	14,500	12,500	10,000	7,100
1-3/16	45.0	40,850	4,500	2,300	9,100	7,900	6,400	4,500	8,200	4,100	16,500	14,000	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	27,500	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	26,300	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	29,300	25,500	21,000		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

### Delete TABLE 8-17.

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## TABLE 8-18. POLYESTER ROPE

						RATED (	CAPAC	RATED CAPACITY IN POUNDS (Safety Factor	S) SUNDS (S	afety Fac	tor = 9			
ROPE				ΕY	EYE AND E	<b>EYE SLING</b>	G			H	SUDLES	ENDLESS SLING		
DIA- Meted	Nominal	Minimum	,			<b>BASKET HITCH</b>	HITCH		,			<b>BASKET HITCH</b>	HITCH	
MEIER	Per	Breaking			Angle	Angle of Rope to H <mark>o</mark> rizontal	to Hori	zontal			Angle	Angle of Rope to Horizontal	to Horiz	ontal
Nominal	100 ft	Strength	erte STIC	тсі Эке	90 deg	60 deg	45 deg	30 deg	ATIC ITC	TCF JKF	90 deg	60 deg	45 deg	30 deg
In Inches	In Pounds	Pounds		HI CHC	Ang	Angle of Rope to Vertical	e to Ver	tical			Ang	Angle of Rope to Vertical	e to Vert	ical
					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
-	30.5	20,900	2,300	1,200	4,600	4,000	3,300		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		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		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		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

### Delete TABLE 8-17.

				<b>-</b>	JA TO	POLYPROPYLENE ROPE SLINGS	ENI,	E ROP	E SL	NGS N					
						RATED CAPACITY IN POUNDS (Safety Factor =	CAPA	CITY IN	N POUN	VDS (Sa	fety Fact	or = 6)			
ROPE				ЕҮ	E AND F	EYE AND EYE SLING	16				Ξ	NDLES	ENDLESS SLING		
DIA-						<b>BASKET HITCH</b>	, HIT	CH					BASKET	<b>BASKET HITCH</b>	
METER	Weight Per	Minimum Breaking	H TV:		Angl	Angle of Rope to Horizontal	to Ho	rizontal			-	Angle	Angle of Rope to Horizontal	to Horiz	ontal
Nominal	100 ft	Strength	OIT. IOT	LCH DKE	90 deg	60 deg	45 deg	eg 30 deg		DITI DTI	тсн Эке	90 deg	60 deg	45 deg	30 deg
Inches	In Pounde	In Pounde	ін ИЭ/		Ang	Angle of Rope to Vertical	e to V	rtical				Ang	Angle of Rope to Vertical	e to Vert	ical
TICKES	enuno I		<u>۱</u>	)	0 deg	30 deg	45 de	deg 60 deg				0 deg	30 deg	45 deg	60 deg
1/2	4.7	3.990	650	350	1,300	1,200	36	950 6	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	00 1,000		1,800	006	3,500	3,100	2,500	1,800
3/4	10.7	8,075	1,300	200	2,700	2,300	1,900			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		10.925	1,800	006	3,600	3,200	2,600	00 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	00 2,200		4,000	2,000	8,000	6,900	5,600	4,000
1-1/16	20.4	15,200	2,500	1,300	5,100	4,400	3,600			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	00 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			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	00 3,700		6,700	3,400	13,500	11,500	9,500	6,700
1-1/2	38.5		4,700	2,400	9,400	8,100	6,700	00 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 1	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	009'6		6,800 1	12,500		24,500	21,000	17,500	12,500
2	69.0	49,400	8,200	4,100	16,500	14,300	11,500			15,000		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 1	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	00 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	00 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			25,300	13,000	51,500	44,500	36,500	25,500
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TABLE 8-19.

POLYPROPYLENE ROPE SLINGS

### Delete TABLE 8-19.

- (G) Synthetic webbing (nylon, polyester and polypropylene).
  - (1) The employer shall have each synthetic web sling marked or coded to show:
    - (a) Name or trademark of manufacturer.
    - (b) Rated capacities for the type of hitch.
    - (c) Type of material.
  - (2) Rated capacity shall not be exceeded.
- (H) Shackles and hooks.
  - (1) "Table 8-20" shall be used to determine the safe working loads of various sizes of shackles, except that higher safe working loads are permissible when recommended by the manufacturer for specific, identifiable products, provided that a factor of safety of no less than five is maintained. Employers must not use shackles with loads in excess of the rated capacities (i.e., working load limits) indicated on the shackle by permanently affixed and legible identification markings prescribed by the manufacturer.
  - (2) The manufacturer's recommendations shall be followed in determining the safe working loads of the various sizes and types of specific and identifiable hooks. All hooks for which no applicable manufacturer's recommendations are available shall be tested to twice the intended safe working load before they are initially put into use.

### Delete TABLE 8-20.

Material size (inches)		Pin diameter (inches)	Safe working load
1/2		5/8	1.4
5/8		3/4	2.2
3/4		7/8	3.2
7/8		1	4.3
1		1-1/8	5.6
1-1/8		1-1/4	6.7
1-1/4		1-3/8	8.2
1-3/8		1-1/2	10.0
1-1/2	• • • • • • • • • • • • • • • • • • • •	1-5/8	11.9
1-3/4		2	16.2
2		2-1/4	21.2

### Table 8-20.SAFE WORKING LOADS FOR SHACKLES<br/>[In tons of 2000 pounds]

Effective:

10/12/2014

Five Year Review (FYR) Dates:

07/28/2014 and 10/01/2019

### CERTIFIED ELECTRONICALLY

Certification

10/02/2014

Date

Promulgated Under: Statutory Authority:	119.03 4121.12, 4121.121, 4121.13, Ohio Const. Art. II, Sec. 35
Rule Amplifies:	4121.13
Prior Effective Dates:	11/1/79, 1/1/11