



Journeyman Rigger's Reference Card

Sling Capacities

MECHANICAL SPLICE IN POUNDS

DESIGN FACTOR 5:1

1

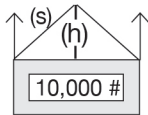
	Size in inches	 1.00 VERTICAL	 .75 CHOKER	 2 - Legs or Basket 90° 2.00	 60° 1.73	 45° 1.41	 30° 1.00	 3 - Legs Only if 1/3 each leg 2.60	Size in mm	
Wire Rope	EIPS IWRC	1/4	1,300	960	2,600	2,200	1,820	1,300	3,300	6.4
		5/16	2,000	1,480	4,000	3,400	2,800	2,000	5,100	8.0
		3/8	2,800	2,200	5,600	5,000	4,000	2,800	7,400	9.6
		7/16	3,800	2,800	7,600	6,800	5,400	3,800	10,000	11.0
		1/2	5,000	3,800	10,000	8,800	7,200	5,000	13,200	13.0
		9/16	6,400	4,800	12,800	11,000	9,000	6,400	16,500	14.0
		5/8	7,800	5,800	15,600	13,600	11,000	7,800	20,000	16.0
		3/4	11,200	8,200	22,400	19,400	15,800	11,200	29,100	19.0
		7/8	15,200	11,200	30,400	26,000	22,000	15,200	39,000	22.0
		1	19,600	14,400	39,200	34,000	28,000	19,600	51,000	25.4
		1-1/8	24,000	18,000	48,000	42,000	34,000	24,000	62,000	28.5
		1-1/4	30,000	22,500	60,000	52,000	42,000	30,000	76,000	32.0
			MULTIPLIER →	1.00	.75	.60	← MULTIPLIER			

Formula to find sling length Total distance between pick points x Multiplier = Sling Length

Load Factors & Weight Distribution

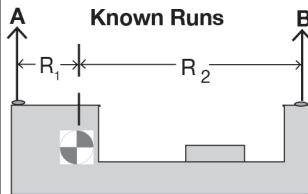
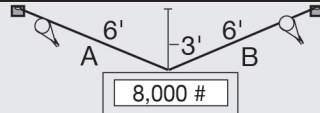
2

5,000 # 5,000 # Tension in s = $\frac{\text{length s}}{\text{length h}} \times \text{share of load wt.}$ $\frac{s}{h} = \text{Load Factor}$

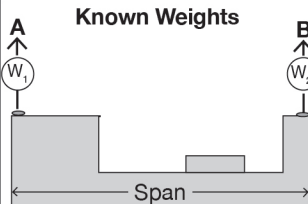


$$\text{Tension in A} = \frac{6}{3} \times 4,000$$

$$\text{Tension in A} = \underline{8,000 \#}$$



Share of Load Wt. @ A	Share of Load Wt. @ B	Legend
$R_1 + R_2 = TS$ $\frac{R_2}{TS} = P$ $P \times W = \text{Share of Load Wt @ A}$	$R_1 + R_2 = TS$ $\frac{R_1}{TS} = P$ $P \times W = \text{Share of Load Wt @ B}$	$R_1 = \text{Run, Side 1}$ $R_2 = \text{Run, Side 2}$ $TS = \text{Total Span}$ $P = \text{Percentage}$ $W = \text{Weight of Load}$



CG In Feet From A	CG In Feet From B	Legend
$W_1 + W_2 = TW$ $\frac{W_2}{TW} = P$ $P \times S = \text{CG in ft. from A}$	$W_1 + W_2 = TW$ $\frac{W_1}{TW} = P$ $P \times S = \text{CG in ft. from B}$	$W_1 = \text{Weight at A}$ $W_2 = \text{Weight at B}$ $TW = \text{Total Weight}$ $P = \text{Percentage}$ $S = \text{Span}$

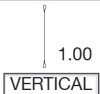
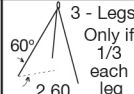
Sling Capacities

DESIGN FACTORS - CHAIN 4:1

WEB 5:1

ROUND 5:1

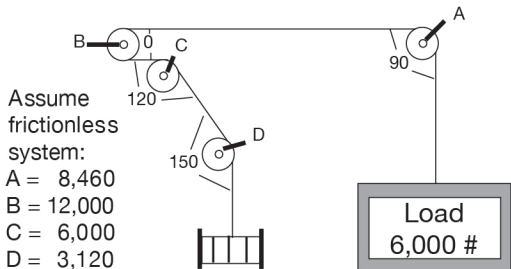
3

	Size or Code	 1.00 VERTICAL	 .80 CHOKER	 2 - Legs or Basket 90° 2.00	 60° 1.73	 45° 1.41	 30° 1.00	 3 - Legs Only if 1/3 each leg 2.60	Diameter or Width	
Chain G-8	9/32	3,500	2,800	7,000	6,100	4,900	3,500	9,150	7 mm	Chain G-8
	3/8	7,100	5,680	14,200	12,300	10,000	7,100	18,450	10 mm	
	1/2	12,000	9,600	24,000	20,800	17,000	12,000	31,200	13 mm	
	5/8	18,100	14,480	36,200	31,300	25,600	18,100	46,950	16 mm	
Web Eye & Eye	1-9-1	1,600	1,280	3,200	2,770	2,260	1,600	4,150	1"	Web Eye & Eye
	1-9-2	3,200	2,560	6,400	5,540	4,452	3,200	8,310	2"	
	1-9-3	4,800	3,840	9,600	8,320	6,780	4,800	12,480	3"	
	1-9-4	6,400	5,120	12,800	11,090	9,040	6,400	16,630	4"	
	2-9-3	8,880	7,100	17,760	15,390	12,540	8,880	23,080	3"	
	2-9-4	11,520	9,210	23,040	19,960	16,270	11,520	29,940	4"	
Polyester Round	EN30	2,600	2,100	5,200	4,500	3,600	2,600	6,750	1"	Polyester Round
	EN60	5,300	4,200	10,600	9,100	7,500	5,300	13,650	1"	
	EN90	8,400	6,700	16,800	14,500	11,800	8,400	21,750	1.5"	
	EN120	10,600	8,500	21,200	18,300	14,900	10,600	27,450	1.5"	
	EN150	13,200	10,600	26,400	22,800	18,600	13,200	34,200	2"	
	EN180	16,800	13,400	33,600	29,100	23,700	16,800	43,650	2"	

Block & Fairlead Loading

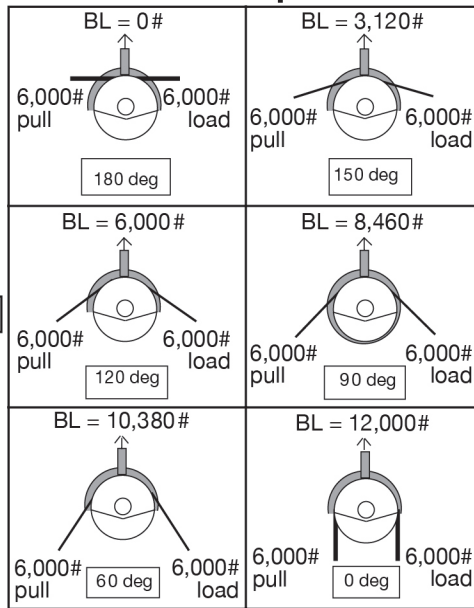
Angle full included	Block Factor	Line Pull in lbs.	Block Load in lbs.
180	0.00	6,000	0
150	0.52	6,000	3,120
120	1.00	6,000	6,000
90	1.41	6,000	8,460
60	1.73	6,000	10,380
0	2.00	6,000	12,000

Formula: Block Factor x Line Pull = Block Load



Example

4



Rigging Hardware Capacities

FORGED STEEL

5

Size in inches	Shldr Eye Bolt		Turnbuckle 5:1 Eye or Jaw	Master Link 5:1	Shackle 6:1 SPAnchor	Wire Rope Clip			Flat Shackle 5:1	Web Eye Width Inches
	Vertical	5:1 45 deg.				Min.# clips	Turnback in inches	Torque in ft. lbs.		
1/4	500	125	500	-----	1,000	2	4.75	15	6,500	1-2
5/16	800	200	800	-----	1,500	2	5.25	30	9,000	3
3/8	1,200	300	1,200	-----	2,000	2	6.50	45	12,500	4
7/16	-----	-----	-----	-----	3,000	2	7.00	65	17,000	5
1/2	2,200	550	2,200	4,920	4,000	3	11.50	65	Swivel Hoist Rings	
9/16	-----	-----	-----	-----	-----	3	12.00	95		
5/8	3,500	875	3,500	6,600	6,500	3	12.00	95		
3/4	5,200	1,300	5,200	10,320	9,500	4	18.00	130		
7/8	7,200	1,800	7,200	-----	13,000	4	19.00	225		
1	10,000	2,500	10,000	24,360	17,000	5	26.00	225	Swivel Hoist Rings	
1-1/8	-----	-----	-----	-----	19,000	6	34.00	225		
1-1/4	15,200	3,800	15,200	35,160	24,000	7	44.00	360		

Coefficients of Friction

Concrete on concrete	.65	Continuous lubricated
Metal on concrete	.60	surface
Wood on concrete	.45	Steel on steel
Wood on metal	.30	Load on wheels

D/d Ratios

30:1 = .94	8:1 = .83
20:1 = .92	5:1 = .77
15:1 = .89	2:1 = .65
10:1 = .86	1:1 = .50

Load Weights - Calculating

6

Materials and Liquids - Pounds / cu. ft.			
Aluminum	165	Iron Casting	450
Asbestos	153	Lead	708
Asphalt	81	Lumber - Fir	32
Brass	524	Lumber - Oak	62
Brick	120	Lumber - RR Ties	50
Bronze	534	Oil, Motor	58
Coal	56	Paper	58
Concrete, Reinf.	150	Portland Cement	94
Crushed Rock	95	River Sand	120
Diesel	52	Rubber	94
Dry Earth, Loose	75	Steel	480
Gasoline	45	Water	63
Glass	162	Zinc	437

Pounds / sq. ft.	
Steel plate	
• 1/8"	5
• 1/4"	10
• 1/2"	20
• 1"	40
Aluminum plate	
• 1/8"	1.75
• 1/4"	3.50
Lumber	
• 3/4" Fir	2
• 3/4" Oak	4

Pounds / gal.	
Gas	6.0
Diesel	7.0
Water	8.3

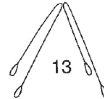
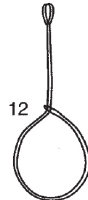
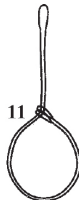
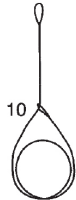
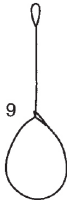
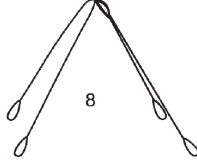
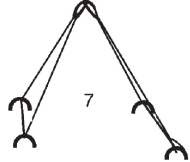
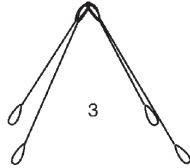
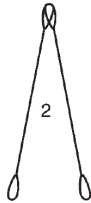
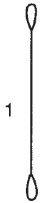
• 7.5 gallons of liquid to a cubic foot
• 27 cubic feet to a cubic yard
• 2,000 lbs = 1 U.S. ton

Formulas and Information

- H = Height • W = Width • L = Length • d = diameter • r = 1/2 diameter • π = 3.2 (approx.)
- Area of square or rectangle = LW • Vol. of cube = HWL • Area of circle = πr^2 • Circumference = πd
- The area of a circle is approx. 80% of its diameter squared (diameter x diameter)
- Load Weight (to estimate) $\longrightarrow$ Volume in cu. ft. x 500 lbs. x density factor .02, .05, .10, .20, .30 etc.

Hitch Types

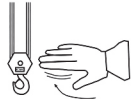
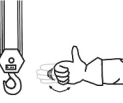
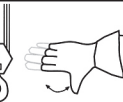
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#	Hitch Type	↑/CG	Leg Loading	Load Control	#
1	Single Vertical	Above	One	Poor	1
2	2-Leg Bridle	Above	Two	Average	2
3	4-Leg Bridle	Both	Two	Excellent	3
4	3-Leg Bridle	Both	Three	Excellent	4
5	Single Wrap Basket	Both*	Two	Average	5
6	Double Wrap Basket	Both*	Two	Good	6
7	Two Single Baskets	Both**	Four	Poor	7
8	Inverted Basket & 2-Leg Br	Both	Four	Excellent	8
9	Single Wrap Choker	Both*	Single	Average	9
10	Double Wrap Choker	Both*	Single	Good	10
11	Double Choker Bight -up	Both*	Two	Good	11
12	Double Choker Eyes-up	Both*	Two	Poor	12
13	Double Inverted Baskets	Above	Four	Poor	13
14	Single Inverted Basket	Above	Two	Poor	14
* [never use as single hitch below CG]		**[compounds loading at pick points]			

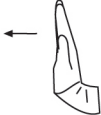
Mobile Crane Hand Signals

9

 Main Hoist	 Auxiliary Hoist	 Hoist Load	 Hoist Load Slowly	 Stop
 Raise Boom	 Raise Boom & Lower Load	 Lower Load	 Lower Load Slowly	 Emergency Stop
 Lower Boom	 Lower Boom & Raise Load	 Swing Boom	 Swing Boom Slowly	 Travel (mobile eqpt)
 Retract Boom 2 hands	 Retract Boom 1 hand	 Extend Boom 2 hands	 Extend Boom 1 hand	 Dog Everything

Checklists

10

Rigger's Checklist	Overhead Crane Op. Hand Signals		
• Wind, temperature & visibility • Crane & load foundations • Load weight, height, width & length • Load's CG, pick points above or below • Attach. point: positive or freely rigged • Crane capacity at maximum radius • Head height, hoist ht., horizontal travel • Power lines, obstructions, load flexing • Hitch: Single vertical, choker, basket • Bridle: 2, 3 or 4-leg, rated spreader bar • Slings: wire rope, web, chain, mtl. mesh • All equipment inspected, slings protected • Tailboard meeting, communications • Signaller, tag lines, spotters • Sketch & outline procedure	 Hoist	 Lower	 Bridge Travel
	 Trolley Travel	 Emergency Stop	 Stop
	 Move Slowly	 Multiple Trolleys	 Magnet Disconnect
 WARNING: Refer to hoist & rigging equipment manufacturers' specifications for proper applications and limitations.			
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