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RIGGING GUIDE

A HANDBOOK FOR RIGGING AND HOISTING APPLICATIONS



COLUMBUS MCKINNON CORPORATION



RIGGING GUIDE

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DISCLAIMER:

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SLING INFORMATION

All sling working load limits are based on items being in acceptable condition for use per ASME B30.9, OSHA 1910.184 and the manufacturer's recommendations.

Rigging equipment is subject to misuse and wear. It is required by ASME and OSHA that rigging equipment be inspected on a regular basis by a competent person designated by the employer. Columbus McKinnon Corporation recommends a rigger inspect rigging equipment before each use. **Do not use slings or rigging equipment that is damaged or worn beyond the manufactures recommendations. Refer to OSHA and applicable ASME standards for rejection criteria.**

WLL's are based on the following factors:

- | | |
|----------------------|--------------------------------|
| 1. Type of hitch | 4. Angle of loading |
| 2. Material strength | 5. Diameter of curvature (D/d) |
| 3. Design factor | 6. Fabrication efficiency |

ASME B30.9-1.7.1 Identification Requirements

All slings shall be marked to show:

- | | |
|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 1. Sling size | 5. Number of branches |
| 2. Sling reach | 6. Rated load for at least one hitch type and the angle upon which it is based |
| 3. Working load limit (all slings must be rated by their weakest component) | |
| 4. Manufacturer name (CM) and grade of sling | |

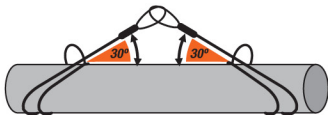
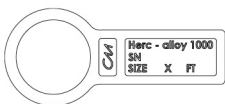
Additional marking requirements for:

Wire Rope: diameter or size

Web Slings: synthetic web material used

Chains: grade, chain size, number of legs, length/reach, serial number

Permanently affixed sling ID tags are required per ASME B30.9-1.10.1 (i) and OSHA 1910.184.



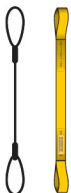
"Horizontal sling angles less than 30° shall not be used except as recommended by the sling manufacturer or a qualified person."

BASIC HITCHES

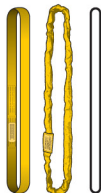
VERTICAL



Chain Sling



**Wire Rope/
Web Sling**
(eye & eye)



**Web/
Round Sling**
(endless)

CHOKER

Sling tags and chart working load limits are based on the angle of choke to be 120° or higher

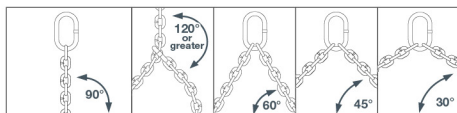


BASKET

Working load limit is based on both legs being within 5° of vertical.



CHAIN SLINGS (GRADE 80)



Chain Size (in.)	Working Load Limit (lbs.)				
	Single (1 Leg) Vertical Single Endless	Choker	Double (2 Legs) or Basket		
			60°	45°	30°
7/32	2,100	1,700	3,600*	3,000	2,100
9/32	3,500	2,800	6,100*	4,900	3,500
5/16	4,500	3,600	7,800*	6,400	4,500
3/8	7,100	5,700	12,300*	10,000	7,100
1/2	12,000	9,600	20,800*	17,000	12,000
5/8	18,100	14,500	31,300*	25,600	18,100
3/4	28,300	22,600	49,000*	40,000	28,300
7/8	34,200	27,400	59,200*	48,400	34,200
1	47,700	38,200	82,600*	67,400	47,700
1-1/4	72,300	57,800	125,200*	102,200	72,300

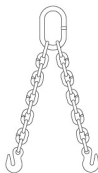
* Also applies to Double Endless Slings at 60°. Do not use Double Endless Slings at angles less than 60°. Based on OSHA and ASME B30.9 standards - Always use the sling tag for the Working Load Limits. Factory assembled HERC-ALLOY 800 or HERC-ALLOY 1000 chain slings have the "HERC-ALLOY 800" or "HERC-ALLOY 1000" trademark on serial number tags and on the sling hooks. On chain sizes 9/32" through 1-1/4" (9/32" through 3/4" for HA1000), links are embossed with grade symbol "HA-800" or "HA-1000". This data applies to Herc-Alloy 800 & Herc-Alloy 1000 Chain only. Ratings apply to both factory assembled slings and slings assembled with Hammerlok coupling links, Clevlok hooks, or Lodelok hooks.



Single Leg (Vertical) Sling



Choker Sling



Double Leg Sling



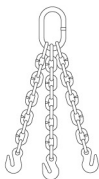
Basket Sling

CHAIN SLINGS (GRADE 80)

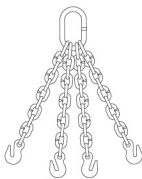


Chain Size (in.)	Working Load Limit (lbs.)		
	Triple or Quadruple (3 or 4 Legs) Bridle Sling or Double Basket Sling		
	60°	45°	30°
7/32	5,500	4,400	3,200
9/32	9,100	7,400	5,200
5/16	11,700	9,500	6,800
3/8	18,400	15,100	10,600
1/2	31,200	25,500	18,000
5/8	47,000	38,400	27,100
3/4	73,500	60,000	42,400
7/8	88,900	72,500	51,300
1	123,900	101,200	71,500
1-1/4	187,800	153,400	108,400

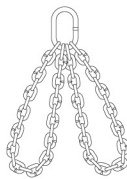
Based on OSHA and ASME B30.9 standards - Always use the sling tag for the Working Load Limits. Factory assembled HERC-ALLOY 800 or HERC-ALLOY 1000 chain slings have the "HERC-ALLOY 800" or "HERC-ALLOY 1000" trademark on serial number tags and on the sling hooks. On chain sizes 9/32" through 1-1/4" (9/32" through 3/4" for HA1000), links are embossed with grade symbol "HA-800" or "HA-1000". This data applies to Herc-Alloy 800 & Herc-Alloy 1000 Chain only. Ratings apply to both factory assembled slings and slings assembled with Hammerlok coupling links, Clevlok hooks, or Lodelok hooks.



**Triple Leg
Bridle Sling**

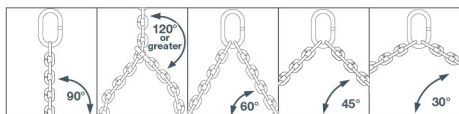


**Quadruple Leg
Bridle Sling**



**Double Basket
Sling**

CHAIN SLINGS (GRADE 100)



Chain Size (in.)	Working Load Limit (lbs.)				
	Single (1 Leg) Vertical Single Endless	Choker	Double (2 Legs) or Basket		
			60°	45°	30°
7/32	2,700	2,100	4,700*	3,800	2,700
9/32	4,300	3,500	7,400*	6,100	4,300
5/16	5,700	4,500	9,900*	8,100	5,700
3/8	8,800	7,100	15,200*	12,400	8,800
1/2	15,000	12,000	26,000*	21,200	15,000
5/8	22,600	18,100	39,100*	32,000	22,600
3/4	35,300	28,300	61,100*	49,900	35,300
7/8	42,700	34,200	74,000*	60,400	42,700

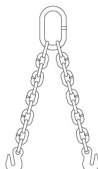
* Also applies to Double Endless Slings at 60°. Do not use Double Endless Slings at angles less than 60°. Based on OSHA and ASME B30.9 standards - Always use the sling tag for the Working Load Limits. Factory assembled HERC-ALLOY 800 or HERC-ALLOY 1000 chain slings have the "HERC-ALLOY 800" or "HERC-ALLOY 1000" trademark on serial number tags and on the sling hooks. On chain sizes 9/32" through 1-1/4" (9/32" through 3/4" for HA1000), links are embossed with grade symbol "HA-800" or "HA-1000". This data applies to Herc-Alloy 800 & Herc-Alloy 1000 Chain only. Ratings apply to both factory assembled slings and slings assembled with Hammerlok coupling links, Clevlok hooks, or Lodelok hooks.



Single Leg (Vertical) Sling



Choker Sling



Double Leg Sling



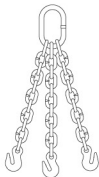
Basket Sling

CHAIN SLINGS (GRADE 100)

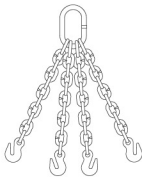


Chain Size (in.)	Working Load Limit (lbs.)		
	Tripe or Quadruple (3 or 4 Legs) Bridle Sling or Double Basket Sling		
	60°	45°	30°
7/32	7,000	5,700	4,000
9/32	11,200	9,100	6,400
5/16	14,800	12,100	8,500
3/8	22,900	18,700	13,200
1/2	39,000	31,800	22,500
5/8	58,700	47,900	33,900
3/4	91,700	74,900	53,000
7/8	110,900	90,600	64,000

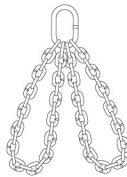
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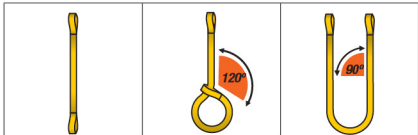
**Triple Leg
Bridle Sling**



**Quadruple Leg
Bridle Sling**



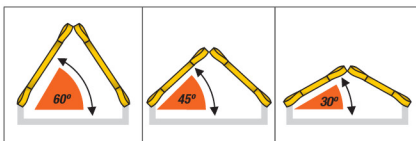
**Double Basket
Sling**

WEB SLINGS EYE-AND-EYE SLING**EE LIGHT DUTY (CLASS 5) (1-PLY & 2-PLY)**

Synthetic Sling Size (in.)	Working Load Limit (lbs.)		
	Vertical (1 Leg)	Choker	Vertical Basket 90°
1-PLY, CLASS 5, EE LIGHT DUTY			
1	1,100	880	2,200
1-1/2	1,600	1,280	3,200
1-3/4	1,900	1,520	3,800
2	2,200	1,760	4,400
3	3,300	2,640	6,600
4	4,400	3,520	8,800
5	5,500	4,400	11,000
6	6,600	5,280	13,200
2-PLY, CLASS 5, EE LIGHT DUTY			
1	2,200	1,760	4,400
1-1/2	3,300	2,640	6,600
1-3/4	3,800	3,040	7,600
2	4,400	3,520	8,800
3	6,600	5,280	13,200
4	8,200	6,560	16,400
5	10,200	8,160	20,400
6	12,300	9,840	24,600

Always verify information on sling tag

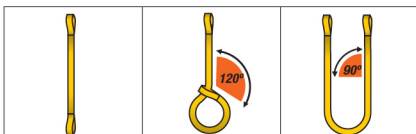
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WEB SLINGS EYE-AND-EYE SLING**EE LIGHT DUTY (CLASS 5) (1-PLY & 2-PLY)**

Synthetic Sling Size (in.)	Working Load Limit (lbs.)		
	Double (2 Legs)		
	60°	45°	30°
1-PLY, CLASS 5, EE LIGHT DUTY			
1	1,905	1,555	1,100
1-1/2	2,771	2,262	1,600
1-3/4	3,291	2,687	1,900
2	3,810	3,111	2,200
3	5,716	4,666	3,300
4	7,621	6,222	4,400
5	9,526	7,777	5,500
6	11,431	9,332	6,600
2-PLY, CLASS 5, EE LIGHT DUTY			
1	3,810	3,111	2,200
1-1/2	5,716	4,666	3,300
1-3/4	6,582	5,373	3,800
2	7,621	6,222	4,400
3	11,431	9,332	6,600
4	14,202	11,595	8,200
5	17,666	14,423	10,200
6	21,304	17,392	12,300

Always verify information on sling tag

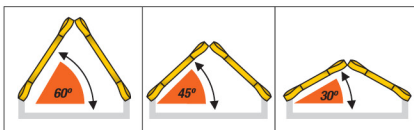
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WEB SLINGS EYE-AND-EYE SLING**EE HEAVY DUTY (CLASS 7) (1-PLY & 2-PLY)**

Synthetic Sling Size (in.)	Working Load Limit (lbs.)		
	Vertical (1 Leg)	Choker	Vertical Basket 90°
1-PLY, CLASS 7, EE HEAVY DUTY			
1	1,600	1,280	3,200
1-1/2	2,300	1,840	4,600
1-3/4	2,700	2,160	5,400
2	3,100	2,480	6,200
3	4,700	3,760	9,400
4	6,200	4,960	12,400
5	7,800	6,240	15,600
6	9,300	7,440	18,600
8	11,800	9,440	23,600
10	14,700	11,760	29,400
12	17,600	14,080	35,200
2-PLY, CLASS 7, EE HEAVY DUTY			
1	3,100	2,480	6,200
1-1/2	4,700	3,760	9,400
1-3/4	5,400	4,320	10,800
2	6,200	4,960	12,400
3	8,800	7,040	17,600
4	11,000	8,800	22,000
5	13,700	10,960	27,400
6	16,500	13,200	33,000
8	22,700	18,160	45,400
10	28,400	22,720	56,800
12	34,100	27,280	68,200

Always verify information on sling tag

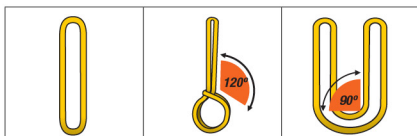
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WEB SLINGS EYE-AND-EYE SLING**EE HEAVY DUTY (CLASS 7) (1-PLY & 2-PLY)**

Synthetic Sling Size (in.)	Working Load Limit (lbs.)		
	Double (2 Legs)		
	60°	45°	30°
1-PLY, CLASS 7, EE HEAVY DUTY			
1	2,771	2,262	1,600
1-1/2	3,984	3,252	2,300
1-3/4	4,676	3,818	2,700
2	5,369	4,383	3,100
3	8,140	6,646	4,700
4	10,738	8,767	6,200
5	13,510	11,029	7,800
6	16,108	13,150	9,300
8	20,438	16,685	11,800
10	25,460	20,786	14,700
12	30,483	24,886	17,600
2-PLY, CLASS 7, EE HEAVY DUTY			
1	5,369	4,383	3,100
1-1/2	8,140	6,646	4,700
1-3/4	9,353	7,636	5,400
2	10,738	8,767	6,200
3	15,242	12,443	8,800
4	19,052	15,554	11,000
5	23,728	19,372	13,700
6	28,578	23,331	16,500
8	39,316	32,098	22,700
10	49,189	40,158	28,400
12	59,061	48,217	34,100

Always verify information on sling tag

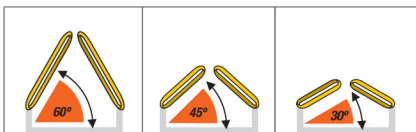
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WEB SLINGS ENDLESS SLING**EN LIGHT DUTY (CLASS 5) (1-PLY & 2-PLY)**

Synthetic Sling Size (in.)	Working Load Limit (lbs.)		
	Endless Vertical	Choker	Vertical Basket 90°
1-PLY, CLASS 5, EN LIGHT DUTY			
1	2,200	1,760	4,400
1-1/2	3,200	2,560	6,400
1-3/4	3,800	3,040	7,600
2	4,400	3,520	8,800
3	6,600	5,280	13,200
4	8,800	7,040	17,600
5	11,000	8,800	22,000
6	13,200	10,560	26,400
2-PLY, CLASS 5, EN LIGHT DUTY			
1	4,400	3,520	8,800
1-1/2	6,600	5,280	13,200
1-3/4	7,600	6,080	15,200
2	8,800	7,040	17,600
3	13,200	10,560	26,400
4	16,400	13,120	32,800
5	20,400	16,320	40,800
6	24,600	19,680	49,200

Always verify information on sling tag

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WEB SLINGS ENDLESS SLING**EN LIGHT DUTY (CLASS 5) (1-PLY & 2-PLY) (TYPE V)**

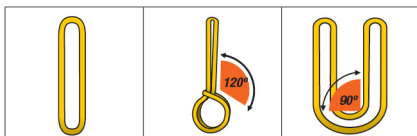
Synthetic Sling Size (in.)	Working Load Limit (lbs.)		
	Two Leg or Single Basket		
	60°	45°	30°
1-PLY, CLASS 5, EN LIGHT DUTY			
1	3,810	3,111	2,200
1-1/2	5,542	4,525	3,200
1-3/4	6,582	5,373	3,800
2	7,621	6,222	4,400
3	11,431	9,332	6,600
4	15,242	12,443	8,800
5	19,052	15,554	11,000
6	22,862	18,665	13,200
2-PLY, CLASS 5, EN LIGHT DUTY			
1	7,621	6,222	4,400
1-1/2	11,431	9,332	6,600
1-3/4	13,163	10,746	7,600
2	15,242	12,443	8,800
3	22,862	18,665	13,200
4	28,405	23,190	16,400
5	35,333	28,846	20,400
6	42,607	34,784	24,600

Always verify information on sling tag

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WEB SLINGS ENDLESS SLING

EN HEAVY DUTY (CLASS 7) (2-PLY)



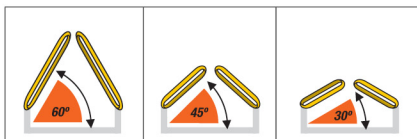
Synthetic Sling Size (in.)	Working Load Limit (lbs.)		
	Endless Vertical	Single Choker	Vertical Basket 90°
1	6,200	4,960	12,400
1-1/2	9,400	7,520	18,800
1-3/4	10,800	8,640	21,600
2	12,400	9,920	24,800
3	17,600	14,080	35,200
4	22,000	17,600	44,000
5	27,400	21,920	54,800
6	33,000	26,400	66,000
8	42,350	33,880	84,600
10	52,900	42,320	105,800
12	63,500	50,800	127,000

Always verify information on sling tag

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WEB SLINGS ENDLESS SLING

EN HEAVY DUTY (CLASS 7) (2-PLY) (TYPE V)



Synthetic Sling Size (in.)	Working Load Limit (lbs.)		
	Two Leg or Single Basket		
	60°	45°	30°
1	10,738	8,767	6,200
1-1/2	16,281	13,262	9,400
1-3/4	18,706	15,271	10,800
2	21,477	17,534	12,400
3	30,483	24,886	17,600
4	38,104	31,108	22,000
5	47,457	38,744	27,400
6	57,156	46,662	33,000
8	74,801	59,812	42,300
10	91,623	74,801	52,900
12	109,982	89,789	63,500

Always verify information on sling tag

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ROUNDSLINGS

FOR VERTICAL & CHOKER HITCHES



Size	Working Load Limit (lbs.)		Minimum Diameter	
	Vertical	Choker	Decimals (in.)	Fractions (in.)
1	2,600	2,100	.5	1/2
2	5,300	4,200	.625	5/8
3	8,400	6,700	.75	3/4
4	10,600	8,500	.875	7/8
5	13,200	10,600	1	1
6	16,800	13,400	1.125	1-1/8
7	21,200	17,000	1.375	1-3/16
8	25,000	20,000	1.25	1-1/4
9	31,000	24,800	1.5	1-1/2
10	40,000	32,000	1.625	1-5/8
11	53,000	42,400	2	2
12	66,000	52,800	2.125	2-1/8
13	90,000	72,000	2.5	2-1/2

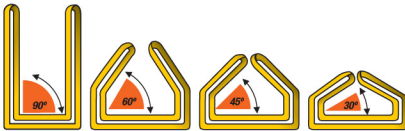
Always verify information on sling tag

Never choke into the eye of hooks, bows of shackles and shackle pins and/or other rigging hardware.

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ROUNDSLINGS

FOR BASKET HITCHES



Size	Working Load Limit (lbs.)				Minimum Diameter	
	Basket				Decimals (in.)	Fractions (in.)
	90°	60°	45°	30°		
1	5,200	4,500	3,700	2,600	.625	5/8
2	10,600	9,200	7,500	5,300	.875	7/8
3	16,800	14,500	11,900	8,400	1.0625	1-1/16
4	21,200	18,400	15,000	10,600	1.25	1-1/4
5	26,400	22,900	18,700	13,200	1.375	1-3/8
6	33,600	29,100	23,800	16,800	1.625	1-5/8
7	42,400	36,700	30,000	21,200	1.625	1-5/8
8	50,000	43,300	35,400	25,000	1.875	1-7/8
9	62,000	53,700	43,800	31,000	2	2
10	80,000	69,300	56,600	40,000	2.375	2-3/8
11	106,000	91,800	74,900	53,000	2.75	2-3/4
12	132,000	114,300	93,300	66,000	3	3
13	180,000	155,900	127,300	90,000	3.5	3-1/2

Always verify information on sling tag

Never choke into the eye of hooks, bows of shackles and shackle pins and/or other rigging hardware.

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WIRE ROPE SLINGS 6x19 and 6x36 Class

EIPS – MS – IWRC

(extra improved plow steel, mechanical splice, independent wire rope core)



Wire Rope Size (in.)	Working Load Limit (tons)		
	Vertical (1 Leg)	Single Choker	Basket 90°
1/4	0.65	0.48	1.30
5/16	1.00	0.74	2.00
3/8	1.40	1.10	2.90
7/16	1.90	1.40	3.90
1/2	2.50	1.90	5.10
9/16	3.20	2.40	6.40
5/8	3.90	2.90	7.80
3/4	5.60	4.10	11.00
7/8	7.60	5.60	15.00
1	9.80	7.20	20.00
1-1/8	12.00	9.10	24.00
1-1/4	15.00	11.00	30.00
1-3/8	18.00	13.00	36.00
1-1/2	21.00	16.00	42.00
1-5/8	24.00	18.00	49.00
1-3/4	28.00	21.00	57.00
1-7/8	32.00	24.00	64.00
2	37.00	28.00	73.00

Based on OSHA standards - Always use the sling tag for the working load limits or consult sling manufacturer.

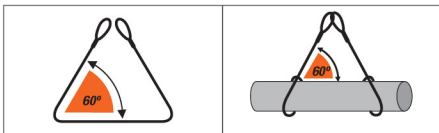
Note: Rated loads based on a minimum D/d of 25:1

Values listed in US tons.

WIRE ROPE SLINGS 6x19 and 6x36 Class

EIPS – MS – IWRC

(extra improved plow steel, mechanical splice, independent wire rope core)



Wire Rope Size (in.)	Working Load Limit (tons)			
	Basket 60°	Basket 30°	Two Chokers	
			60°	30°
1/4	1.10	0.65	0.82	0.48
5/16	1.70	1.00	1.30	0.74
3/8	2.50	1.40	1.80	1.10
7/16	3.40	1.90	2.50	1.40
1/2	4.40	2.50	3.20	1.90
9/16	5.50	3.20	4.10	2.40
5/8	6.80	3.90	5.00	2.90
3/4	9.70	5.60	7.10	4.10
7/8	13.00	7.60	9.70	5.60
1	17.00	9.80	13.00	7.20
1-1/8	21.00	12.00	16.00	9.10
1-1/4	26.00	15.00	19.00	11.00
1-3/8	31.00	18.00	23.00	13.00
1-1/2	37.00	21.00	28.00	16.00
1-5/8	42.00	24.00	32.00	18.00
1-3/4	49.00	28.00	37.00	21.00
1-7/8	56.00	32.00	42.00	24.00
2	63.00	37.00	48.00	28.00

Based on OSHA standards - Always use the sling tag for the working load limits or consult sling manufacturer.

Note: Rated loads based on a minimum D/d of 25:1

Values listed in US tons.

3 - LEG BRIDLE 6x19 and 6x36 Class

EIPS – MS – IWRC

(extra improved plow steel, mechanical splice, independent wire rope core)



Wire Rope Size (in.)	Working Load Limit (tons)			
	Vertical	60°	45°	30°
1/4	1.90	1.70	1.40	0.97
5/16	3.00	2.60	2.10	1.50
3/8	4.30	3.70	3.00	2.20
7/16	5.80	5.00	4.10	2.90
1/2	7.60	6.60	5.40	3.80
9/16	9.60	8.30	6.80	4.80
5/8	12.00	10.00	8.30	5.90
3/4	17.00	15.00	12.00	8.40
7/8	23.00	20.00	16.00	11.00
1	29.00	26.00	21.00	15.00
1-1/8	36.00	31.00	26.00	18.00
1-1/4	44.00	38.00	31.00	22.00
1-3/8	53.00	46.00	38.00	27.00
1-1/2	63.00	55.00	45.00	32.00
1-5/8	73.00	63.00	52.00	37.00
1-3/4	85.00	74.00	60.00	42.00
1-7/8	97.00	84.00	68.00	48.00
2	110.00	95.00	78.00	55.00

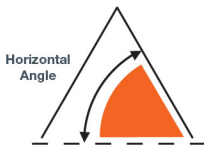
Based on OSHA standards - Always use the sling tag for the working load limits or consult sling manufacturer.

Values listed in US tons.

4 - LEG BRIDLE 6x19 and 6x36 Class

EIPS – MS – IWRC

(extra improved plow steel, mechanical splice, independent wire rope core)



Wire Rope Size (in.)	Working Load Limit (tons)			
	Vertical	60°	45°	30°
1/4	2.6	2.2	1.8	1.3
5/16	4.0	3.5	2.8	2.0
3/8	5.7	5.0	4.1	2.9
7/16	7.8	6.7	5.5	3.9
1/2	10.0	8.8	7.1	5.1
9/16	13.0	11.0	9.0	6.4
5/8	16.0	14.0	11.0	7.8
3/4	22.0	19.0	16.0	11.0
7/8	30.0	26.0	21.0	15.0
1	39.0	34.0	28.0	20.0
1-1/8	48.0	42.0	34.0	24.0
1-1/4	59.0	51.0	42.0	30.0
1-3/8	71.0	62.0	50.0	36.0
1-1/2	84.0	73.0	60.0	42.0
1-5/8	98.0	85.0	69.0	49.0
1-3/4	113.0	98.0	80.0	57.0
1-7/8	129.0	112.0	91.0	64.0
2	147.0	127.0	104.0	73.0

Based on OSHA standards - Always use the sling tag for the working load limits or consult sling manufacturer.

Values listed in US tons.

WIRE ROPE SLINGS 6x19 and 6x36 Class

EEIPS – MS – IWRC

(extra extra improved plow steel, mechanical splice, independent wire rope core)



Wire Rope Size (in.)	Working Load Limit (tons)		
	Vertical (1 Leg)	Single Choker	Basket 90°
1/4	0.71	0.52	1.40
5/16	1.10	0.81	2.20
3/8	1.60	1.20	3.20
7/16	2.10	1.60	4.30
1/2	2.80	2.00	5.50
9/16	3.50	2.60	7.00
5/8	4.30	3.20	8.60
3/4	6.20	4.50	12.00
7/8	8.30	6.10	17.00
1	11.00	8.00	22.00

Based on OSHA standards - Always use the sling tag for the working load limits or consult sling manufacturer.

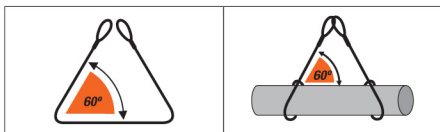
Note: Rated loads based on a minimum D/d of 25:1

Values listed in US tons.

WIRE ROPE SLINGS 6x19 and 6x36 Class

EEIPS – MS – IWRC

(extra extra improved plow steel, mechanical splice, independent wire rope core)



Wire Rope Size (in.)	Working Load Limit (tons)			
	Basket 60°	Basket 30°	Two Chokers	
			60°	30°
1/4	1.20	0.71	0.90	0.52
5/16	1.90	1.10	1.40	0.81
3/8	2.70	1.60	2.00	1.20
7/16	3.70	2.10	2.70	1.60
1/2	4.80	2.80	3.50	2.00
9/16	6.10	3.50	4.50	2.60
5/8	7.50	4.30	5.50	3.20
3/4	11.00	6.20	7.90	4.50
7/8	14.00	8.30	11.00	6.10
1	19.00	11.00	14.00	8.00

Based on OSHA standards - Always use the sling tag for the working load limits or consult sling manufacturer.

Note: Rated loads based on a minimum D/d of 25:1

Values listed in US tons.

WIRE ROPE SLINGS 6x19 and 6x36 Class

EIPS – MS – Fiber Core

(extra improved plow steel, mechanical splice, fiber core)



Wire Rope Size (in.)	Working Load Limit (tons)		
	Vertical (1 Leg)	Single Choker	Basket 90°
1/4	0.56	0.42	1.10
5/16	0.87	0.66	1.70
3/8	1.20	0.94	2.50
7/16	1.70	1.30	3.40
1/2	2.20	1.60	4.40
9/16	2.70	2.10	5.50
5/8	3.40	2.60	6.80
3/4	4.80	3.70	9.70
7/8	6.60	5.00	13.00
1	8.30	6.40	17.00
1-1/8	10.00	8.10	21.00
1-1/4	13.00	9.90	26.00

Based on OSHA standards - Always use the sling tag for the working load limits or consult sling manufacturer.

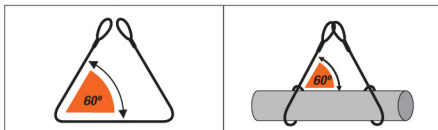
Note: Rated loads based on a minimum D/d of 25:1

Values listed in US tons.

WIRE ROPE SLINGS 6x19 and 6x36 Class

EIPS – MS – Fiber Core

(extra improved plow steel, mechanical splice, fiber core)



Wire Rope Size (in.)	Working Load Limit (tons)			
	Basket 60°	Basket 30°	Two Chokers	
			60°	30°
1/4	0.97	0.56	0.73	0.42
5/16	1.50	0.87	1.10	0.66
3/8	2.20	1.20	1.60	0.94
7/16	2.90	1.70	2.20	1.30
1/2	3.80	2.20	2.90	1.60
9/16	4.80	2.70	3.60	2.10
5/8	5.90	3.40	4.50	2.60
3/4	8.40	4.80	6.30	3.70
7/8	11.00	6.60	8.60	5.00
1	14.00	8.30	11.00	6.40
1-1/8	18.00	10.00	14.00	8.10
1-1/4	22.00	13.00	17.00	9.90

Based on OSHA standards - Always use the sling tag for the working load limits or consult sling manufacturer.

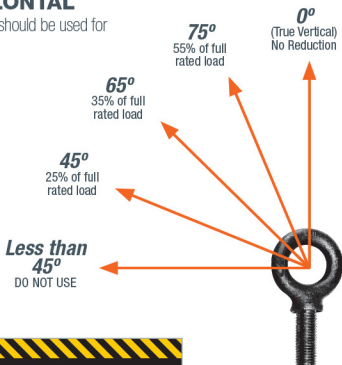
Note: Rated loads based on a minimum D/d of 25:1

Values listed in US tons.

HOIST RING & EYE BOLT USE

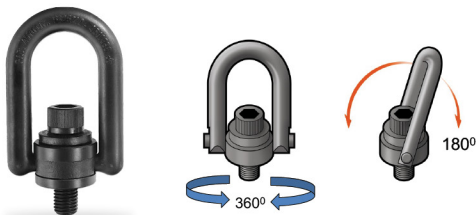
SHOULDER EYE BOLTS WORKING LOAD LIMIT ANGLE TO HORIZONTAL

Note: Non-shouldered eye bolt should be used for vertical pull only.



Always consult manufacturer's loads charts before using eye bolts.

HEAVY DUTY® HOIST RINGS*



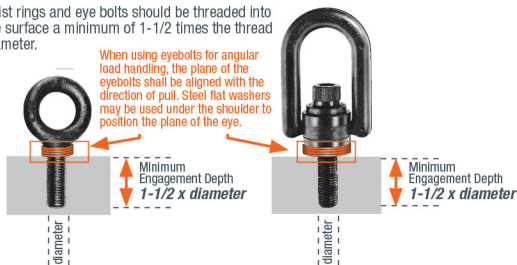
Hoist rings will not yield to heavy side pulling within their rated capacity.

Hoist Rings pivot 180 and swivel 360 to compensate for pitch, roll and sway when lifting loads.

HOIST RING & EYE BOLT USE

MINIMUM ENGAGEMENT DEPTH

Hoist rings and eye bolts should be threaded into the surface a minimum of 1-1/2 times the thread diameter.



Example:

The minimum engagement depth for an eye bolt with a 1/2" diameter would be 3/4"

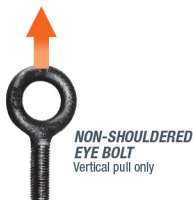
ALWAYS PULL LOAD IN THE PLANE OF THE EYE

Never go below 45° side pull



SIDE LOADING

Vertical pull should be used whenever possible. **Only shoulder eye bolts may be side loaded.**



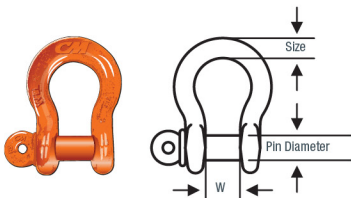
* per ASME B30.26-2.9.4.2 "when used in a tapped blind hole, the effective thread length shall be at least 1-1/2 times the diameter of the bolt for engagement in steel... For other thread engagements or in other materials, contact the eye bolt manufacturer or a qualified person"

Always verify manufacturer's information prior to use.

SHACKLES

CARBON

Shackles are designed and rated for in-line applied tension. You can attach multiple slings in the body of a shackle without reducing the capacity, provided that the shackle is symmetrically loaded and the included angle does not exceed 120°.



Size (in.)	WLL (tons)	WLL (lbs.)	Pin Dia. (in.)	W dim. (in.)
3/16	1/3	667	0.25	0.38
1/4	1/2	1,000	0.31	0.47
5/16	3/4	1,500	0.38	0.53
3/8	1	2,000	0.44	0.66
7/16	1-1/2	3,000	0.50	0.72
1/2	2	4,000	0.63	0.84
5/8	3-1/4	6,500	0.75	1.06
3/4	4-3/4	9,500	0.88	1.28
7/8	6-1/2	13,000	1.00	1.44
1	8-1/2	17,000	1.13	1.72
1-1/8	9-1/2	19,000	1.25	1.84
1-1/4	12	24,000	1.38	2.03
1-3/8	13-1/2	27,000	1.50	2.25
1-1/2	17	34,000	1.63	2.41
1-5/8	20	40,000	1.75	2.66
1-3/4	25	50,000	2.00	2.94
2	35	70,000	2.25	3.28

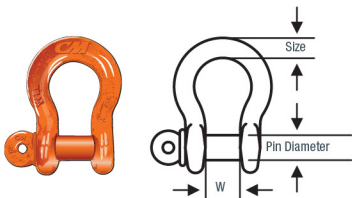
Always verify manufacturer's information prior to use.

SHACKLES

SUPER STRONG CARBON

Higher WLL than Standard Carbon

Shackles are designed and rated for in-line applied tension. You can attach multiple slings in the body of a shackle without reducing the capacity, provided that the shackle is symmetrically loaded and the included angle does not exceed 120°.



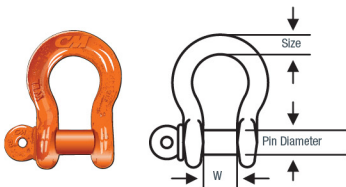
Size (in.)	WLL (tons)	WLL (lbs.)	Pin Dia. (in.)	W dim. (in.)
3/16	1/2	1,000	0.25	0.38
1/4	3/4	1,500	0.31	0.47
5/16	1	2,000	0.38	0.53
3/8	1-1/2	3,000	0.44	0.66
7/16	2	4,000	0.50	0.72
1/2	3	6,000	0.63	0.84
5/8	4-1/2	9,000	0.75	1.06
3/4	6-1/2	13,000	0.88	1.28
7/8	8-1/2	17,000	1.00	1.44
1	10	20,000	1.13	1.72
1-1/8	12	24,000	1.25	1.84
1-1/4	14	28,000	1.38	2.03
1-3/8	17	34,000	1.50	2.25
1-1/2	20	40,000	1.63	2.41
1-5/8	24	48,000	1.75	2.66
1-3/4	30	60,000	2.00	2.94
2	35	70,000	2.25	3.28

Always verify manufacturer's information prior to use.

SHACKLES

ALLOY

Shackles are designed and rated for in-line applied tension. You can attach multiple slings in the body of a shackle without reducing the capacity, provided that the shackle is symmetrically loaded and the included angle does not exceed 120°.



Size (in.)	WLL (tons)	WLL (lbs.)	Pin Dia. (in.)	W dim. (in.)
3/8	2	4,000	0.44	0.66
7/16	2.6	5,200	0.50	0.72
1/2	3.3	6,600	0.63	0.84
5/8	5	10,000	0.75	1.06
3/4	7	14,000	0.88	1.28
7/8	9.5	19,000	1.00	1.44
1	12.5	25,000	1.13	1.72
1-1/8	15	30,000	1.25	1.84
1-1/4	18	36,000	1.38	2.03
1-3/8	21	42,000	1.50	2.25
1-1/2*	25	50,000	1.63	2.41
1-1/2**	30	60,000	1.63	2.41
1-5/8*	29	58,000	1.75	2.66
1-5/8**	35	70,000	1.75	2.66
1-3/4*	34	68,000	2.00	2.94
1-3/4**	40	80,000	2.00	2.94
2*	43	86,000	2.25	3.28

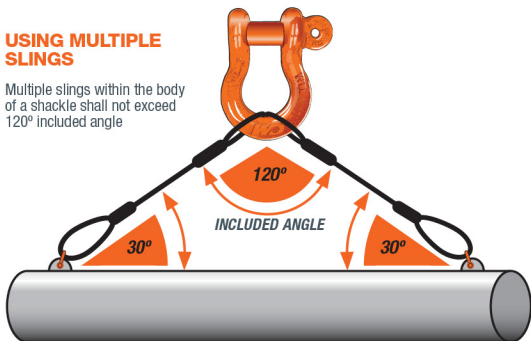
* Screw Pin & Round Pin style only

Always verify manufacturer's information prior to use.

SHACKLE AND SLING USE

USING MULTIPLE SLINGS

Multiple slings within the body of a shackle shall not exceed 120° included angle



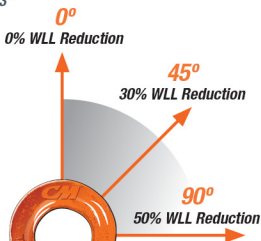
SIDE LOADING

When side loading a shackle with a single sling, the rated WLL will be reduced in accordance with the manufacturer's recommendation or a qualified person. ASME B30.26 recommends reducing the capacity of a side loaded shackle from 30% to 50% as shown below.

WLL REDUCTIONS

FOR ALL SHACKLE STYLES SIZES 3/16" TO 3"

Angles in Degrees	Working Load Limit Reduction
0° to 10°	0%
11° to 20°	15%
21° to 30°	25%
31° to 45°	30%
46° to 55°	40%
56° to 70°	45%
71° to 90°	50%



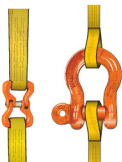
**NEVER SIDE LOAD
ROUND PIN SHACKLES**

Always verify manufacturer's information prior to use.

SHACKLE AND SLING USE

CONNECTING SLINGS TOGETHER

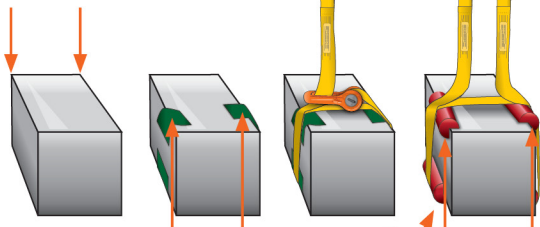
A shackle may be used to connect slings together. Synthetic-to-synthetic webbloks are an acceptable way to connect slings.



PROTECT YOUR SLING FROM CORNERS & SHARP EDGES

These safe practices apply to all types of slings

Sharp corners can cut into slings resulting in high risk of failure and permanent damage to the sling.



To protect the sling, sharp edges and corners that come in contact with the sling should be padded with material of sufficient strength.



Change the profile of a corner in contact with a sling to a radius with padding.

SHACKLE USE



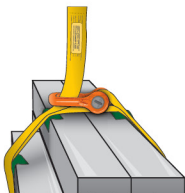
Attach multiple sling legs to the bow, not to the pin. This can damage and weaken the sling.



When point loading shackle to shackle, connect: **Bow to Bow** or **Bow to Pin**



Loading should stay centered and/or in line.



The bow of shackle should be put into the bit of a choke.



1" shackle with 3/4" wire rope

The shackle must be equal to or larger than the wire rope diameter.



To avoid pinching and binding of synthetic slings, shackle must be large enough.



1) **Effective Width** = Shackle Width x .75

BEARING STRESS (REF. WSTDA 4.7.1.1 – 4.7.1.3)

Recommended Bearing Stress Value of 7,000 Lbs. / sq.in. or less

2) **Load Bearing Area** = Hardware diameter x Effective Contact Width

3) **Bearing Stress at Hardware connection**

$$\frac{\text{Sling Load (IN POUNDS)}}{\text{Load Bearing Area}}$$



WEBLOK™ ASSEMBLY

For use with round slings, web slings and high-performance synthetics. Simply connect a sling to the synthetic sling attachment of the Weblok and a master link or other rigging attachment to the Hammerlok portion to efficiently and safely lift your load. For synthetic-to-synthetic Webloks, simply attach a sling to both ends.



SYNTHETIC TO ATTACHMENT
WITH DOUBLE RETENTION



SYNTHETIC TO ATTACHMENT
WITH SINGLE RETENTION

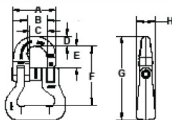


SYNTHETIC TO SYNTHETIC
WITH SINGLE RETENTION

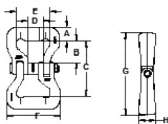


SYNTHETIC TO SYNTHETIC
WITH DOUBLE RETENTION

SYNTHETIC TO ATTACHMENT



SYNTHETIC TO SYNTHETIC



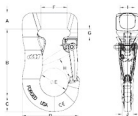
SPECIFICATIONS

Size (in.)	Working Load Limit (lbs.)		Product Code		Double Retention Load Pin Kit	Dimensions (in.)								Weight (lbs.)
	Design Factor		Single Retention	Double Retention		A	B	C	D	E	F	G	H	
	5:1	4:1												
Synthetic to Attachment														
3/8	6,250	7,800	867010-2	867010-4	R867010-4	2.33	1.05	0.93	0.53	1.16	3.15	4.48	1.00	1.49
3/8	12,500	15,600	867020-2	867020-4	R867020-4	3.57	1.55	1.35	0.88	1.74	4.32	6.19	1.25	3.96
3/4	18,750	23,400	867025-2	867025-4	R867025-4	4.31	1.78	1.25	1.04	2.02	5.47	7.61	1.38	6.62
7/8	30,000	37,200	867030-2	867030-4	R867030-4	5.00	2.25	1.92	1.05	1.83	5.15	7.60	1.75	8.96
1	40,000	50,000	N/A	867035-4	R867035-4	5.86	2.74	2.37	1.25	2.31	6.57	9.67	2.25	16.18
1-1/4	60,000	75,000	N/A	867040-4	R867040-4	7.04	3.00	2.70	1.53	2.63	7.41	10.92	2.31	25.35
Synthetic to Synthetic														
3/8	5,000	N/A	877010-2	877010-4	R867010-4	0.80	1.31	3.30	0.93	2.00	3.18	4.90	1.00	2.03
3/8	10,000	N/A	877020-2	877020-4	R867020-4	0.99	1.52	4.10	1.38	2.75	4.13	6.08	1.25	4.26
3/4	15,000	N/A	877025-2	877025-4	R867025-4	1.10	2.13	5.58	1.55	2.75	4.46	7.78	1.38	6.96
7/8	25,000	N/A	877030-2	877030-4	R867030-4	1.41	2.00	5.32	1.92	3.75	6.00	8.14	1.75	11.00
1	40,000	N/A	N/A	877035-4	R867035-4	1.85	2.89	7.15	2.37	4.74	7.45	10.84	2.25	22.79
1-1/4	60,000	N/A	N/A	877040-4	R867040-4	1.96	3.22	8.00	2.70	5.75	8.86	11.96	2.31	33.30

QUICK CONNECT HOOKS

Ideal for use with synthetic slings, CM Quick Connect Hooks are the quickest and easiest way to add hooks to any synthetic sling by eliminating the need for additional hardware or assembly tools. Designed with a large bearing surface, these hooks prevent the sling from bunching, allowing the sling to be used at full capacity. And, for easy selection, Quick Connect Hooks are color coded to match common industry synthetic sling capacities.

COLOR CODED TO MATCH COMMON SYNTHETIC SLING CAPACITIES



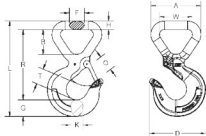
WLL: 2,600 LBS.

SPECIFICATIONS

Color	Working Load Limit (lbs.)	Product Code	Latch Kit	Dimensions (in.)										Weight (lbs.)
				A	B	C	D	E	F	G	H	I	J	
	2,600	M6000	4X65030	0.770	3.530	0.794	2.884	1.500	1.500	0.418	0.938	0.813	0.580	1.450
	5,300	M6000	4X65060	1.034	4.589	1.040	3.751	1.625	1.875	0.553	1.200	1.168	0.665	3.735
	8,400	M6000	4X455329	1.206	5.410	1.172	4.325	1.875	2.375	0.640	1.500	1.250	1.043	5.835
	13,200	M60120	4X455329	1.384	6.141	1.392	5.026	2.125	2.625	0.744	1.750	1.438	1.200	8.282

FLAT EYE RIGGING HOOKS

Designed specifically for use with synthetic slings, CM Flat Eye Rigging Hooks provide a wide, smooth, load-bearing surface that won't damage synthetic material, promoting longer sling life. The flat eye opening eliminates bunching and pinching of the synthetic sling, ensuring the sling can be used at full capacity.



SPECIFICATIONS

Working Load Limit (tons)	Product Code			Dimensions (in.)													Weight (lbs.)	
	With Latch	Without Latch	Latch Kit	A	B	D	F	G	K	L	O	R	T	W	without Latch	with Latch		
1-1/2	M6003	M6403	4X1303	2.38	1.20	3.37	0.75	0.94	0.71	5.36	0.97	3.98	0.97	1.50	1.16	1.25		
3	M6005	M6405	4X1305	3.79	1.88	4.25	1.13	1.26	0.94	7.21	1.21	5.31	1.21	2.50	2.82	3.00		
5	M6007	M6407	4X1307	5.53	2.84	5.11	1.63	1.44	1.38	9.27	1.47	7.06	1.47	4.00	5.50	5.90		

MASTER LINK

DUAL RATED FOR USE WITH HA800 OR HA1000

WORKING LOAD LIMIT: 5,400 TO 187,800 LBS.

BENEFITS & FEATURES

- Accepts both Herc-Alloy® 800 & 1000 chain and components
- Durable orange powder coated finish
- May be used for mechanical and welded sling assemblies
- 100% proof tested
- 4:1 design factor



Trade Size (in.)	Working Load Limit (lbs.)	Product Code	Nominal Dimensions (in.)			Weight (lbs.)	Type and Size of Grade 80 Chain Sling (in.)	
			Material Diameter A	Inside Length B	Inside Width C		Single	Double
Standard Sizes (DUAL RATED THROUGH 1-3/4" SIZE ONLY)								
13/32	5,400	555231	0.41	3.00	1.50	0.33	7/32 & 9/32	7/32
1/2	8,600	555232	0.56	5.00	2.50	1.02	3/8	9/32
3/4	17,600	555235	0.75	5.50	2.75	2.08	1/2	3/8
1	30,000	555238	1.00	7.00	3.50	4.59	5/8 & 3/4	1/2
1-1/4	45,200	555240	1.25	8.75	4.38	9.31	7/8	5/8
1-1/2	70,600	555243	1.50	10.50	5.25	15.60	1	3/4 & 7/8
1-3/4	105,900	555246	1.75	12.00	6.00	24.40	1-1/4	1
2*	88,900	554949	2.00	14.00	7.00	38.00	1-1/4	1
2-1/4*	125,200	554951	2.25	16.00	8.00	55.00	–	1-1/4
2-3/4*	187,800	554957	2.75	16.00	9.00	84.84	–	–
Special Sizes (NOT DUAL RATED)								
1	18,200	554969	1.00	8.00	4.00	5.25	N/A	N/A
1-1/4	22,800	554942	1.25	12.00	6.00	12.08		
1-1/2	36,700	554944	1.50	14.00	7.00	20.16		
1-1/2	42,900	554970	1.50	12.00	6.00	17.60		
1-3/4	57,100	554945	1.75	14.00	7.00	27.92		
2	77,800	554952	2.00	16.00	8.00	43.00		

NOTE: Standard sizes dual rated through 1-3/4" only. Special sizes not dual rated.

HOOK USE

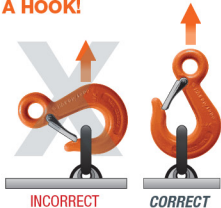
HOOK LATCHES



CORRECT **INCORRECT**

Hook latches (when required) must be in good working condition. If not, the hook should be removed from service.

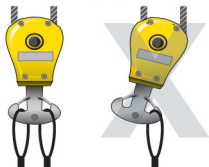
NEVER TIP LOAD A HOOK!



INCORRECT **CORRECT**

DUPLEX HOOKS

Must be loaded equally on both sides



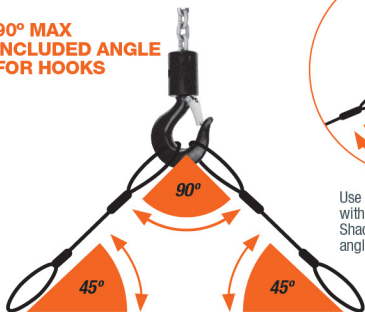
CORRECT **INCORRECT**

SELECTING THE RIGHT SIZE HOOK/SLING

Be sure the component is of adequate size and shape so that it can be properly seated in the saddle of hook or lifting device.



90° MAX INCLUDED ANGLE FOR HOOKS



Use a shackle when working with low horizontal angles. Shackles can be used with angles up to 120°.

Always verify manufacturer's information prior to use.

WIRE ROPE CLIPS

Rope Diameter (in.)	No. of Clips	Turnback (in.)	Torque (ft.-lbs.) (unlubed bolts)
1/8	2	3-1/4	4-1/2
3/16	2	3-3/4	7-1/2
1/4	2	4-3/4	15
5/16	2	5-1/4	30
3/8	2	6-1/2	45
7/16	2	7	65
1/2	3	11-1/2	65
9/16	3	12	95
5/8	3	12	95
3/4	4	18	130
7/8	4	20	225
1	5	26	225

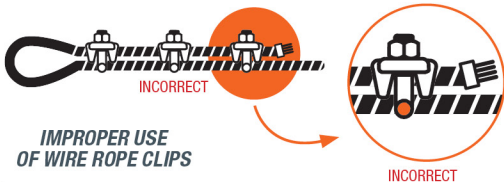
PROPER USE OF WIRE ROPE CLIPS



NOTE: Mechanical spliced or flemished eyes slings are the preferred method of wire rope sling construction. OSHA does not allow the use of clips to form the eyes of wire rope slings.

WARNING

NEVER INSTALL THE U-BOLT ON THE LIVE SIDE!



Always verify manufacturer's information prior to use.

TURNBUCKLES



Size (in.)	Working Load Limit (lbs.)	
	End Fitting Types	
	Hook & Eye Hook & Hook	Eye & Eye, Eye & Jaw, Jaw & Jaw
1/4	400	500
5/16	700	800
3/8	1,000	1,200
1/2	1,500	2,200
5/8	2,250	3,500
3/4	3,000	5,200
7/8	4,000	7,200
1	5,000	10,000
1-1/4	6,500	15,200
1-1/2	7,500	21,400

WARNING

**TURNBUCKLES TO BE USED FOR
IN-LINE LOADING ONLY**

Always verify manufacturer's information prior to use.

CLAMP USE & SAFETY

FACTORS TO CONSIDER WHEN SELECTING A CLAMP:

- Weight of material
- Hardness of material
- Type of material
- Orientation & position of material
- Can material be marked? Is a non-marking clamp required?

Max plate hardness is 300 Brinell (32HRc)

(For clamps with teeth – If hardness exceeds 300 brinell a non-marking clamp will be needed.)

VERTICAL PLATE CLAMPS

FOR LIFTING PLATES

- For lifting long plates, two clamps and a lifting beam must be used
- For lifting short plates, a single clamp can be used

Clamps have maximum and minimum loading.

Look for the manufacturer's marking for these thresholds. If minimum loading is not marked on clamp, never lift below 20% of the maximum WLL.

Never side load clamp that does not have a hinged hook ring.

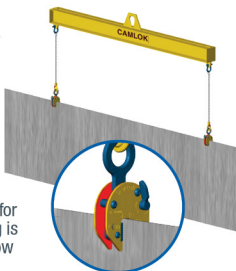


Plate at full depth and lever locked in position

VERTICAL PLATE CLAMPS

FOR TURNING OVER PLATES

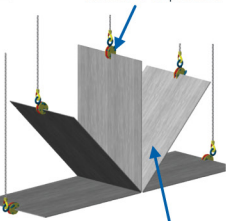
- Plate must be in contact with back of clamp

If locking lever is uppermost it is necessary to lift the clamp when sliding onto the plate to allow free movement of the jaw



Ensure full depth of grip with locking lever in locked position

Lifting sling must be vertical for all positions

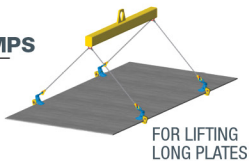


Take extra care when clamp takes least weight at "top dead center"

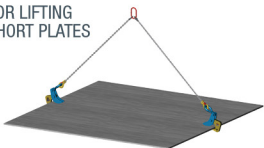
CLAMP USE & SAFETY

HORIZONTAL PLATE CLAMPS

- For lifting long plates, two clamps and a lifting or spreader beam must be used
- For lifting short plates, a single clamp can be used
- **DO NOT USE 4 LEG SLINGS**
- **DO NOT USE ENDLESS CHAIN SLINGS**



FOR LIFTING SHORT PLATES



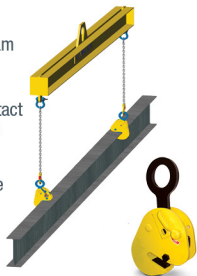
GIRDER/SECTION CLAMPS

- For long girders use 2 clamps and a lifting beam
- For short sections one clamp may be used



Jaw should be in contact with sufficient area to grip load safely

Front clamp should be in contact with load



- **DO NOT USE A VERTICAL CLAMP TO LIFT I-TYPE BEAMS**

SCREWLOK BEAM CLAMPS

- The tips of the side plates should touch the beam flange. The load is transmitted into the beam and away from the edge
- Used for attaching hoists to I-beams.
- **DO NOT USE AS A LIFTING DEVICE TO LIFT I-BEAMS**



CORRECT



INCORRECT

TENSION CALCULATOR

BY USING ANGLES

Here is how to calculate the tension on a sling when used at angles other than 90° vertical.

Step 1:

Identify the Load Angle Factor (L.A.F.) based on the horizontal angle.

Step 2:

Use the formula below

$$(\text{Weight} \div \text{No. of legs}) \times \text{L.A.F.}$$

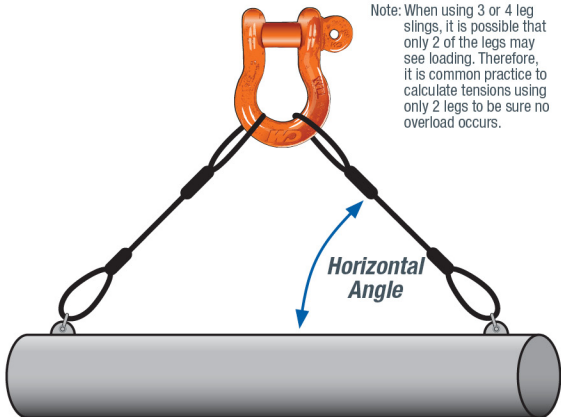
Example: If the load weight is 8,000 lbs. and three (3) slings are used at a 60° angle each:

$$(8,000 \div 3) \times 1.155 = 3,080 \text{ lbs.}$$

Therefore, each leg will have 3,080 lbs. of tension.

Horizontal Angle	L.A.F.
30°	2.00
35°	1.742
40°	1.555
45°	1.414
50°	1.305
55°	1.221
60°	1.155
65°	1.104
70°	1.064
75°	1.035
80°	1.015
85°	1.004
90°	1.00

Note: When using 3 or 4 leg slings, it is possible that only 2 of the legs may see loading. Therefore, it is common practice to calculate tensions using only 2 legs to be sure no overload occurs.



Always verify calculations with a qualified person.

TENSION CALCULATOR

BY USING MEASUREMENTS

When working in the field, determining the exact horizontal angles can be difficult.

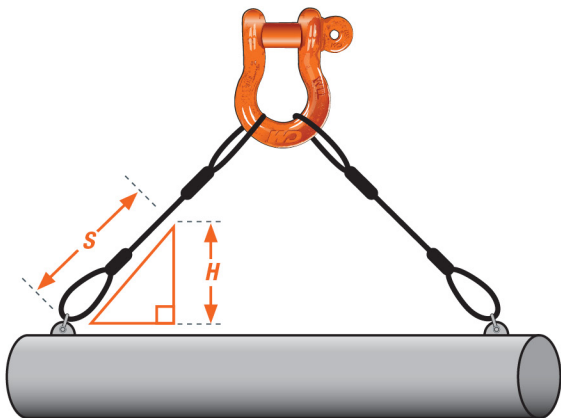
We can calculate the tension based on what information we do know, and apply this formula:

$$(\text{Weight} \div \text{Number of legs}) \times (\text{S} \div \text{H})$$

Example: The load weight is 12,000 lbs. and two (2) slings are used. You measure up the sling 48" (the "S" dimension) and then measure straight down and get a 30" measurement (the "H" dimension)

$$(12,000 \div 2) \times (48 \div 30) = 9,600 \text{ lbs. of tension per leg}$$
$$6,000 \times 1.6 = 9,600 \text{ lbs. of tension per leg (1.6 is the calculated L.A.F.)}$$

Therefore, each leg will have 9,600 lbs. of tension.



Note: When using 3 or 4 leg slings, it is possible that only 2 of the legs may see loading. Therefore, it is common practice to calculate tensions using only 2 legs to be sure no overload occurs.

Always verify calculations with a qualified person.

LOAD ANGLE TENSION CHART

Share of Load (lbs.)	Load on Each Leg (lbs.)				
	Sling Angle (Load Angle Factor)				
	30° (2)	45° (1.414)	60° (1.155)	75° (1.035)	90° (1)
100	200	141	116	104	100
200	400	283	231	207	200
300	600	424	347	311	300
400	800	566	462	414	400
500	1,000	707	578	518	500
600	1,200	848	693	621	600
700	1,400	990	809	725	700
800	1,600	1,131	924	828	800
900	1,800	1,273	1,040	932	900
1,000	2,000	1,414	1,155	1,035	1,000
1,100	2,200	1,555	1,271	1,139	1,100
1,200	2,400	1,697	1,386	1,242	1,200
1,300	2,600	1,838	1,502	1,346	1,300
1,400	2,800	1,980	1,617	1,449	1,400
1,500	3,000	2,121	1,733	1,553	1,500
1,600	3,200	2,262	1,848	1,656	1,600
1,700	3,400	2,404	1,964	1,760	1,700
1,800	3,600	2,545	2,079	1,863	1,800
1,900	3,800	2,687	2,195	1,967	1,900
2,000	4,000	2,828	2,310	2,070	2,000
2,100	4,200	2,969	2,426	2,174	2,100
2,200	4,400	3,111	2,541	2,277	2,200
2,300	4,600	3,252	2,657	2,381	2,300
2,400	4,800	3,394	2,772	2,484	2,400
2,500	5,000	3,535	2,888	2,588	2,500

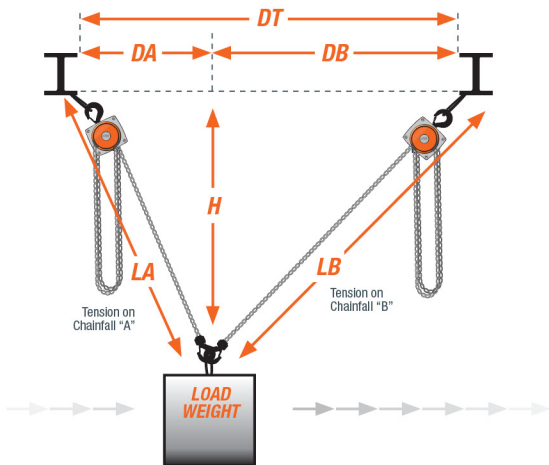
Always verify tension calculations with a qualified person.

DRIFTING LOADS

To calculate the amount of tension on chainfalls used in angular rigging applications, the following formula should be used:

TENSION ON CHAINFALL "A" =
 (Load Weight x DB x LA) ÷ (H x DT)

TENSION ON CHAINFALL "B" =
 (Load Weight x DA x LB) ÷ (H x DT)



The CM Hurricane 360° hand chain hoist is ideal for load drifting

NOTE: THIS FORMULA IS BASED ON BOTH CHAINFALLS POSITIONED AT THE SAME ELEVATION

Always verify calculations with a qualified person.

EXAMPLE OF A LOAD DRIFT WITH VALUES USED:

DA = 36"

DB = 60"

DT = 96"

LA = 96"

LB = 120"

H = 60"

Load Weight = 1,500 lbs.

EXAMPLE CALCULATIONS

Tension for CM Hurricane 360° Chainfall "A" =

$(\text{Load} \times \text{DB} \times \text{LA}) \div (\text{H} \times \text{DT})$

$(1,500 \text{ lbs.} \times 60" \times 96") \div (60" \times 96")$

$(8,640,000) \div (5,760)$

1,500 lbs. of tension on CM Hurricane 360° Chainfall "A"

Tension for Hurricane 360° Chainfall "B" =

$(\text{Load} \times \text{DA} \times \text{LB}) \div (\text{H} \times \text{DT})$

$(1,500 \text{ lbs.} \times 36" \times 120") \div (60" \times 96")$

$(6,480,000) \div (5,760)$

1,125 lbs. of tension on CM Hurricane 360° Chainfall "B"



WARNING!

**AN ENGINEER SHALL ANALYZE
YOUR SUPPORT STRUCTURE
BEFORE DRIFTING LOADS**

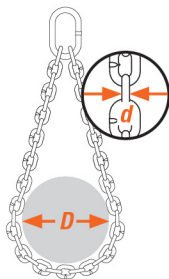
D/d RATIOS

These charts show reductions in working load limits when using basket type slings.

ALLOY CHAIN D/d RATIOS

This chart shows reductions in working load limits of a basket type alloy chain sling based on D/d ratio. Consult with the manufacturer for any D/d ratio below 2:1.

D/d Ratio	% Rated Capacity
6 and above	100
5/1	90
4/1	80
3/1	70
2/1	60



Note:

"D" = Diameter of the object contacting the sling

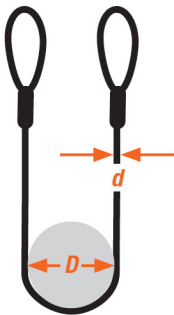
"d" = Diameter of the link body

Source: National Association of Chain Manufacturers

WIRE ROPE D/d RATIOS

Wire rope capacities are reduced when wire rope sling body is bending around a sharp corner.

D/d Ratio	% Rated Capacity
25/1	100%
20/1	92%
10/1	86%
4/1	75%
2/1	65%
1/1	50%



Note:

"D" = Diameter of the object contacting the sling

"d" = Diameter of the wire rope

LEVERAGE

To calculate the amount of handle force required to raise a load, one of the following formulas should be used:

$$HF \times HL = (\text{Load Weight} \div 2) \times TL$$

$$HF = [(\text{Load Weight} \div 2) \times TL] \div HL$$

Example: *How much handle force is required to raise load 3 in.?*

List of known values:

HF = ?

HL = 48 in.

LOAD WEIGHT = 1,200 lbs.

TL = 5 in.

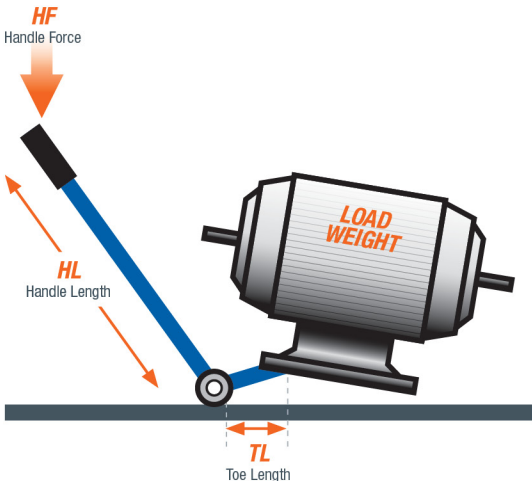
HF = [(Load Weight ÷ 2) x TL] ÷ HL

HF = [(1,200 ÷ 2) x 5] ÷ 48

HF = (600 x 5) ÷ 48

HF = (3,000) ÷ 48

HF = 62.5 lbs.



Always verify calculations with a qualified person.

PULLING FORCE

To calculate the pulling force required to move a load on a level or inclined plane, use the corresponding formula below:

TO MOVE A LOAD ON A LEVEL PLANE

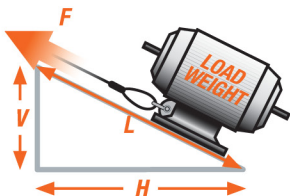
$$F = CF \times W$$



TO MOVE A LOAD ON AN UPHILL INCLINE

$$F = [(CF \times W) \times (H \div L)] + [(V \div L) \times W]$$

Note: For inclines greater than 45° from horizontal this formula will not produce accurate results



TO MOVE A LOAD ON DOWNHILL

$$F = [(CF \times W) \times (H \div L)] - [(V \div L) \times W]$$

- F** = Force required to move load
- CF** = Coefficient of friction
- W** = Load weight
- V** = Vertical distance in feet (height)
- H** = Horizontal distance in feet (run)

* Values apply to hard, clean surfaces sliding against one another. Actual CF values may differ depending on actual application surface conditions.

Coefficient of Friction for Popular Surfaces*

Wood on wood	0.50
Wood on metal	0.30
Wood on concrete	0.45
Concrete on concrete	0.65
Metal on concrete	0.60
Steel on steel	0.20
Cast iron on steel	0.25
Load on wheels	0.05
Load on ice	0.01

Always verify calculations with a qualified person.

BASIC KNOTS

FOR USE WITH ROPE ONLY
TYPICALLY USED FOR TAGLINES
(DO NOT TIE KNOTS IN SLINGS)

SQUARE KNOT

Can be used for tying two ropes of same diameter together.



SHEET BEND

The sheet bend is used for joining ropes of different sizes together, providing they are light or medium size.



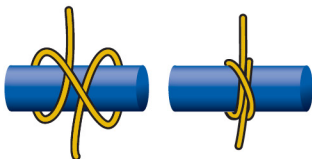
BOWLINE

A bowline is used to secure a loop in a piece of rope. This knot will not slip regardless of load.



CLOVE HITCH

This knot using half hitches is often used for securing round objects like bars, rails and pipes.



HITCH REDUCTIONS

VERTICAL



100%
of Rated Capacity

Hitch ratings on tags must be lowered when:

- Angles are introduced
- Tight chokes are made
- D/d ratio for full working load does not match specifications of sling



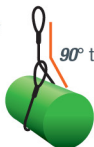
50%
of Rated Capacity

CHOKER

Based on rated choke capacity.



100%
OF RATED
CAPACITY



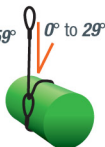
87%
OF RATED
CAPACITY



74%
OF RATED
CAPACITY



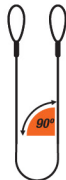
62%
OF RATED
CAPACITY



49%
OF RATED
CAPACITY

See pages 55 & 56 for more information

BASKET



100%
of Rated Capacity



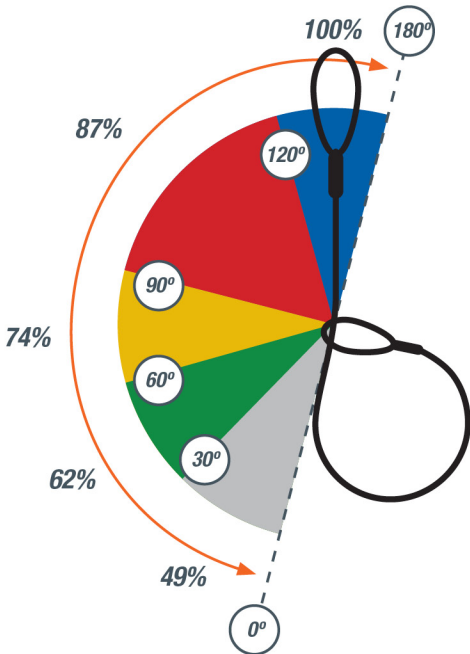
87%
of Rated Capacity

When a sling is rigged at an angle, reduction of the working load limit of the hitch must be done to account for higher tensions.



50%
of Rated Capacity

CHOKE REDUCTIONS



Choker Hitch Rated Capacity Adjustment

Angle of Choke	% of Rated Capacity
Over 120°	100%
90° to 120°	87%
60° to 89°	74%
30° to 59°	62%
0° to 29°	49%

CHOKE REDUCTIONS

TO CALCULATE ADJUSTED CHOKER RATINGS

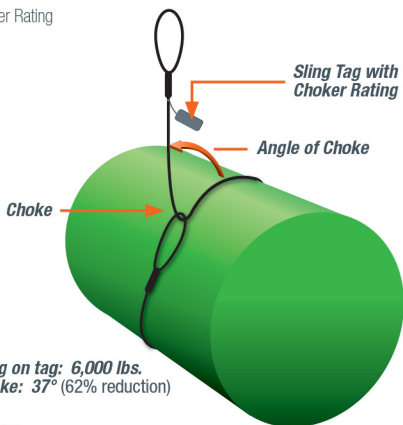
Use the formula below:

$$RC = C \times R$$

RC: Reduced Choker Rating

C: Choker Rating

R: Rated Capacity



Example:

Choker rating on tag: 6,000 lbs.

Angle of Choke: 37° (62% reduction)

$$RC = C \times R$$

$$RC = .62 \times 6,000$$

$$RC = 3,720$$

Reduced Rating: 3,720 lbs.



87%
OF RATED
CAPACITY



74%
OF RATED
CAPACITY



62%
OF RATED
CAPACITY

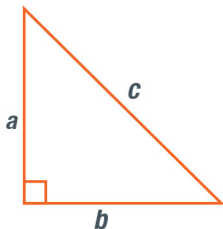


49%
OF RATED
CAPACITY

Always verify calculations with a qualified person.

EQUATIONS

HOW TO DETERMINE THE DIMENSIONS OF A RIGHT ANGLE TRIANGLE:



$$a = \sqrt{c^2 - b^2} \quad c^2 - b^2 = a^2$$

$$b = \sqrt{c^2 - a^2} \quad a^2 - c^2 = b^2$$

$$c = \sqrt{a^2 + b^2} \quad a^2 + b^2 = c^2$$

UNIT OF MEASURE CONVERSIONS

<i>Units of Measure</i>		
1 US pound (lb.)	=	16 oz.
1 US pound (lb.)	=	.45 kg
1 kilogram (kg)	=	2.2 lb.
1 kilogram (kg)	=	35 oz.
1 kilogram (kg)	=	1,000 grams
1 US ton (short)	=	2,000 lbs.
1 US ton (short)	=	.91 metric tons
1 US ton (short)	=	907 kg.
1 metric ton	=	2204.62 lb.
1 metric ton	=	1.102 US tons
1 metric ton	=	1,000 kg.
1 liter	=	.264 gallons (US)
1 liter	=	1.06 quarts
1 US (liq) gallon	=	4 quarts
1 US (liq) gallon	=	3.8 liters
1 US gallon water	=	8.3 lb.
1 cubic ft. of liquid	=	7.5 US gallons

Always verify calculations with a qualified person.

MATERIAL WEIGHTS

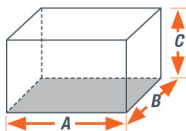
<i>Material</i>	<i>Weight (lbs.)</i>	
	<i>Per Cu. Ft.</i>	<i>Per Cu. In.</i>
Aluminum	165	0.0955
Brass	535	0.3096
Brick Masonry (common)	125	0.0723
Bronze	500	0.2894
Cast Iron	480	0.2778
Cement (portland, loose)	94	0.0544
Concrete (stone aggregate)	144	0.0833
Copper	560	0.3241
Earth (dry)	75	0.0434
Earth (wet)	100	0.0579
Ice	56	0.0324
Lead	710	0.4109
Snow (fresh fallen)	8	0.0046
Snow (wet)	35	0.0203
Steel	490	0.2836
Tin	460	0.2662
Water	62	0.0359
Gypsum Wall Board	54	0.0313
Wood (pine)	30	0.0174

CALCULATING WEIGHT AND VOLUME

WEIGHT = Volume x Material Weight per x Cu. Inch or Foot

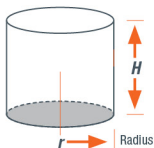
CUBE:

VOLUME = $A \times B \times C$



CYLINDER:

VOLUME = $\pi r^2 \times H$



Always verify calculations with a qualified person.

PRE-OPERATIONAL INSPECTION CHECKLIST

FOR HOISTS AND OVERHEAD CRANES

ITEM	ACTION
<input type="checkbox"/> TAGGED CRANE OR HOIST	Check that crane or hoist is not tagged with an out-of-order sign.
<input type="checkbox"/> WARNING & SAFETY LABELS	Check that warning and other safety labels are not missing and safety labels are legible.
<input type="checkbox"/> CONTROL DEVICES	Confirm that hoist motion matches control markings.
<input type="checkbox"/> HOOK	Check for damage, cracks, nicks, gouges and deformations of the throat opening. Check for wear on saddle or load bearing point, and any twisting. Refer to manufacturer's operator manual.
<input type="checkbox"/> HOOK LATCH	If a hook latch is required, check for proper operation.
<input type="checkbox"/> LIMIT SWITCHES	Check that the upper limit device stops the lifting motion of the hoist load block before striking any part of the hoist or crane.
<input type="checkbox"/> UNUSUAL SOUNDS	Check for any unusual sounds from the crane or hoist mechanism during operation.
<input type="checkbox"/> OIL LEAKAGE	Check for any sign of oil leakage on the crane and on the floor beneath the crane.
<input type="checkbox"/> HOIST CHAIN	Check for cracks, nicks, gouges, wear and stretch. Check that the chain is in the upper and lower sprockets and in the chain guide.
<input type="checkbox"/> WIRE ROPE	Check for broken wires, broken strands, kinks, and any deformation or damage to the rope structure.
<input type="checkbox"/> REEVING	Check that the wire rope is properly reeved and that rope parts are not twisted around each other.
<input type="checkbox"/> BRAKES	Check that all motions do not have excessive drift and that stopping distance is normal.
<input type="checkbox"/> HOUSEKEEPING & LIGHTING	Check area for accumulation of material to prevent tripping or slipping. Check area for poor lighting.
Name: _____ Date: _____	
Clock No.: _____ Time: _____	

HAND SIGNAL KNOWLEDGE

This is not a substitute for government standards or regulations. Review all applicable ASME and OSHA standards and regulations.

Please review all excerpts regarding signal person requirements from OSHA 1926.1400 Cranes and Derricks at www.osha.gov

- Signal person must know all signals for mobile cranes, tower cranes, and overhead cranes.
- Charts must be posted on equipment or conspicuously posted near hoisting operations.
- Must know basic understanding of crane operation.
- Lift director appoints a qualified signal person.
- Signal person and crane operator must identify each other prior to giving any signals.
- Modification to any signals must be agreed upon with the crane operator, lift director and signal person and can not conflict with standard signals.
- Only one person can give signals. Unless it is for an emergency stop signal – anyone can give that signal.
- Signals shall be continuous during crane operation. If at any time a signal is not understood, is not clear, disrupted or audible the crane operator is to stop movement and no response shall be made by the operator.
- All signals are given from the operators perspective.
Example: Swing left you would extend your right arm so operator would swing left.
- Voice signals must have three elements
 - Direction or function
 - Speed or distance
 - Stop command of prior functionExample: "Hoist 40', 30', 20', 10', 5' stop! Swing right 90 degrees, slowly, slowly, slowly, stop! Lower 40', 30', 20', 10' slowly, slowly, stop!"
- When moving a crane into position the following horn or audible signals shall be used.
 - Stop: One short audible signal
 - Go Ahead: Two short audible signals
 - Back up: Three short audible signals
- When in communication with more than one crane, a procedure or system must be used for identifying the crane the signal is for.

HAND SIGNALS

FOR MOBILE, OVERHEAD, GANTRY & TOWER CRANES

An operator should respond to signals only from the signal person directing the lift. However, the operator should obey an **EMERGENCY STOP** from any person at all times.



USE MAIN HOIST

Tap fist on head, then use regular signals.



USE WHIPLINE (AUXILIARY HOIST)

Tap elbow with one hand, then use regular signals.



HOIST

With forearm vertical and forefinger pointing up, move hand in small horizontal circle.



LOWER

With arm extended downward and forefinger pointing down, move hand in small horizontal circle.



RAISE BOOM

Arm extended and fingers closed with thumb pointing upward.



LOWER BOOM

Arm extended and fingers closed with thumb pointing downward.



RAISE BOOM & LOWER LOAD

Arm extended and thumb pointing up, flex fingers in and out as long as load movement is required.



LOWER BOOM & RAISE LOAD

Arm extended and thumb pointing down, flex fingers in and out as long as load movement is required.

HAND SIGNALS



SWING

Arm extended, with fingers in direction of swing of boom.



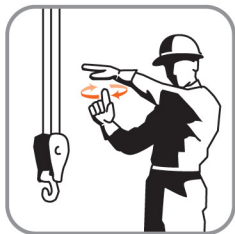
EXTEND BOOM (TELESCOPING BOOMS)

With both fists in front of body with thumbs pointing outward.



RETRACT BOOM (TELESCOPING BOOMS)

With both fists in front of body with thumbs pointing toward each other.



MOVE SLOWLY (EXAMPLE - "HOIST SLOWLY")

Use one hand to give any motion signal and place the other hand motionless in front of the hand giving the motion signal.



EXTEND BOOM *(TELESCOPING BOOMS)*

ONE HAND SIGNAL: One fist in front of the chest with the thumb tapping the chest.



RETRACT BOOM *(TELESCOPING BOOMS)*

ONE HAND SIGNAL: One fist in front of the chest with the thumb pointing outward and heel of fist tapping the chest.



STOP

Arm extended and palm down, move arm horizontally back and forth.



EMERGENCY STOP

With both arms extended and palms down, move arms horizontally back and forth.

HAND SIGNALS



TRAVEL **ONE TRACK** (LAND CRANES ONLY)

Indicate track to be locked by raising fist on that side. Rotate other fist in front of body in direction that opposite track is to travel (from the crane operator's perspective).



TRAVEL **BOTH TRACKS** (LAND CRANES ONLY)

Use both fists in front of body, making a circular motion about each other, indicating direction of travel, forward or backward.



TRAVEL/BRIDGE **TRAVEL**

With arm extended forward and hand open and slightly, making a pushing motion in the direction of travel.



DOG EVERYTHING

Clasp hands in front of the body.



MULTIPLE TROLLEYS

Hold up one finger for block marked "1" and two fingers for block marked "2". Regular hand signals to follow.



MAGNET IS DISCONNECTED

Crane operator spreads both hands apart with palms up.



TROLLEY TRAVEL

With palm up, fingers closed and thumb pointing in the direction of motion, jerk hand horizontally.

CONVERSION CHART

FRACTION/DECIMAL/MILLIMETER

<i>Imperial</i>		<i>Metric</i>
<i>Fraction (in.)</i>	<i>Decimal (in.)</i>	<i>mm</i>
1/64	0.0156	0.3969
1/32	0.0313	0.7938
3/64	0.0469	1.1906
1/16	0.0625	1.5875
5/64	0.0781	1.9844
3/32	0.0938	2.3813
7/64	0.1094	2.7781
1/8	0.125	3.175
9/64	0.1406	3.5719
5/32	0.1563	3.9688
11/64	0.1719	4.3656
3/16	0.1875	4.7625
13/64	0.2031	5.1594
7/32	0.2188	5.5563
15/64	0.2344	5.9531
1/4	0.25	6.35
17/64	0.2656	6.7469
9/32	0.2813	7.1438
19/64	0.2969	7.5406
5/16	0.3125	7.9375
21/64	0.3281	8.3344
11/32	0.3438	8.7313
23/64	0.3594	9.1281
3/8	0.375	9.525
25/64	0.3906	9.9219
13/32	0.4063	10.3188
27/64	0.4219	10.7156
7/16	0.4375	11.1125
29/64	0.4531	11.5094
15/32	0.4688	11.9063
31/64	0.4844	12.3031
1/2	0.5	12.7

<i>Imperial</i>		<i>Metric</i>
<i>Fraction (in.)</i>	<i>Decimal (in.)</i>	<i>mm</i>
33/64	0.5156	13.0969
17/32	0.5313	13.4938
35/64	0.5469	13.8906
9/16	0.5625	14.2875
37/64	0.5781	14.6844
19/32	0.5938	15.0813
39/64	0.6094	15.4781
5/8	0.625	15.875
41/64	0.6406	16.2719
21/32	0.6563	16.6688
43/64	0.6719	17.0656
11/16	0.6875	17.4625
45/64	0.7031	17.8594
23/32	0.7188	18.2563
47/64	0.7344	18.6531
3/4	0.75	19.05
49/64	0.7656	19.4469
25/32	0.7813	19.8438
51/64	0.7969	20.2406
13/16	0.8125	20.6375
53/64	0.8281	21.0344
27/32	0.8438	21.4313
55/64	0.8594	21.8281
7/8	0.875	22.225
57/64	0.8906	22.6219
29/32	0.9063	23.0188
59/64	0.9219	23.4156
15/16	0.9375	23.8125
61/64	0.9531	24.2094
31/32	0.9688	24.6063
63/64	0.9844	25.0031
1	1	25.4

TRAINING OPPORTUNITIES

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At Columbus McKinnon, we are committed to promoting the safe and efficient use of overhead cranes and rigging equipment. Our professionally developed courses consist of lecture and hands-on training, highlighting safe rigging, maintenance and lifting which include how to:

- *Properly secure loads*
- *Conduct overhead crane, hoist & rigging gear inspections*
- *Properly select and apply rigging equipment*
- *Troubleshoot & repair mechanical and electrical systems*
- *Disassemble, inspect, adjust and reassemble all CMCO hoists*
- *Reduce downtime and maximize production*
- *Prevent injuries and deaths*
- *Meet OSHA or ASME requirements*
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RIGGING GUIDE

A HANDBOOK FOR RIGGING AND HOISTING APPLICATIONS



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