PUB 3006 c.1

RIGGING HANDBOOK

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FOREWORD

This Handbook is prepared specifically for the LBL riggers.

The values given in the tables are based on a factor of safety of no less than five (5).

Never use material or equipment which shows visual defects.

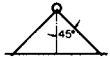
Never try to guess the weight of a load.

Never take chances.

Report all defects with equipment and material at once to Rigging Superintendent. Consult with him when you are in doubt.

SAFE

SLINGS - 6 X 19 IMPROVED PLOW STEEL IWRC - FLEMISH EYE SPLICE WITH SWAGED FERRULE

DIA.	SINGLE WIRE ROPE VERTICAL LIFT		TWO WIRE ROPES 30° HALF ANGLE	TWO WIRE ROPES 45° HALF ANGLE 
	SHACKLE CONNECTION	CHOKER CONNECTION		
1/4	1,100	800	1,900	1,600
3/8	2,400	1,800	4,200	3,400
1/2	4,400	3,300	7,600	6,200
5/8	6,800	5,100	11,800	9,600
3/4	9,800	7,300	17,000	13,900
7/8	12,800	9,600	22,000	18,000
1	16,000	12,000	28,000	23,000
1 1/8	21,000	15,000	36,000	30,000
1 1/4	26,000	19,000	45,000	37,000
1 3/8	31,000	23,000	54,000	44,000
1 1/2	37,000	27,000	64,000	52,000
1 3/4	49,000	36,000	85,000	69,000
2	64,000	48,000	111,000	90,000

WORKING LOADS

SHACKLE DROP-FORGED ST'L, WELDL'SS

ST'K DIA. "D"	OPENING B'TW'N EYES "O"	SAFE WORKING LOAD *
1/4	31/64	720
3/8	21/32	1,600
1/2	13/16	2,800
5/8	1 1/16	4,400
3/4	1 1/4	6,200
7/8	1 7/16	8,600
1	1 11/16	11,000
1 1/8	1 13/16	13,000
1 1/4	2	16,000
1 3/8	2 1/4	20,000
1 1/2	2 3/8	24,000
1 3/4	2 7/8	32,000
2	3 1/4	42,000

SAFETY HOIST RING CHROME-MOLY STEEL (AMER. DRILL BUSH'G CO.)

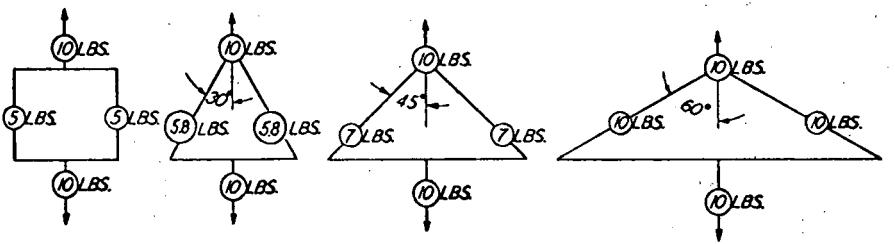
ST'K DIA. "D"	WIDTH "W"	SCREW THREAD "T"	SAFE WORKING LOAD *	RECOM. TIGHTEN'G TORQUE (Ft Lbs)
3/8	1 5/8	5/16 - 18	800	3.1
"	"	3/8 - 16	1,000	4.3
3/4	3 1/4	1/2 - 13	2,500	14
"	"	5/8 - 11	4,000	25
"	"	3/4 - 10	4,000	28
1	4 13/16	3/4 - 10	7,000	50
"	"	7/8 - 9	8,000	62
"	"	1 - 8	10,000	87
1 3/4	8	1 1/2 - 6	24,000	300

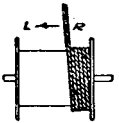
* IF TWO OR MORE SLINGS ARE USED AND THE HALF ANGLES ARE 30 DEGREES OR MORE, USE THE NEXT LARGER FITTING.

L&L SAFETY SERVICES 1972

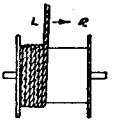
NOTE: Inspect Rigging Equipment Before Using and Make Allowances for Wear

How Sling-Leg Load Increases with Increased Fleet Angle

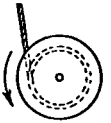




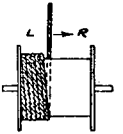
Overwind
Right to Left
Left Lay Rope



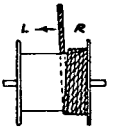
Overwind
Left to Right
Right Lay Rope



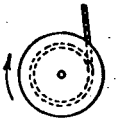
Overwind



Underwind
Left to Right
Left Lay Rope



Underwind
Right to Left
Right Lay Rope



Underwind

EYE BOLTS WITH SHOULDER		
For straight lift only		
Dia. Shank	I.D. of Eye	Working Load
1/4	3/4	400
3/8	1	800
1/2	1-3/16	1100
5/8	1-3/8	2000
3/4	1-1/2	2500
1	1-13/16	5200
1-1/2	2-1/2	12000
1-3/4		16000
2		22000

Material: Drop-forged steel

Minimum thread engagement: 2d

Do not use eyebolts without shoulder. When possible, safety hoist rings should be used in place of eyebolts.

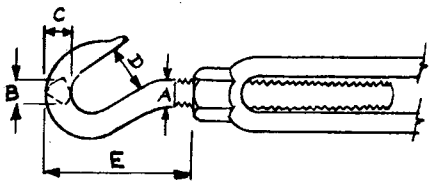
WEIGHT TABLES

Material	Approx. Weight Lbs. per cu ft.
Steel	490
Aluminum	165
Lead	710
Copper	537
Zinc	437
Brass	524
Concrete	150
" Heavy	225
Sand	120
Water	62.5
Cement	94
Lumber	40

Steel Plate Thickness	Weight in Lbs. per sq. ft.
1/16	2.55
1/8	5.10
3/16	7.65
1/4	10.20
5/16	12.75
3/8	15.30
7/16	17.85
1/2	20.40
9/16	22.95
5/8	25.50
11/16	28.05
3/4	30.60
13/16	33.15
7/8	35.70
15/16	38.25
1	40.80

TURNBUCKLES WITH HOOK AND HOOK END FITTINGS

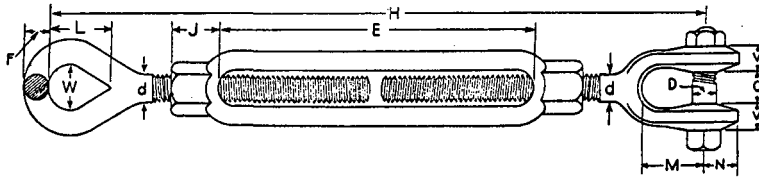
DROP-FORGED STEEL - WELDLESS
(Crosby-Laughlin)

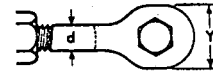


This type shall be avoided in any rigging due to their much lower safe working strength.
Use jaw or eye end fittings instead.

Turnbuckles with Eye and Jaw End Fittings

Drop-Forged Steel—Weldless

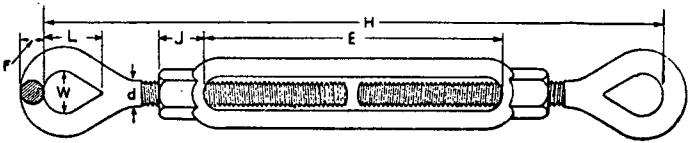




Size		Dimensions											Weight approx	Safe Working Load Pounds
Diam d in.	*Take-up E in.	D in.	H in.	J in.	M in.	N in.	O in.	V in.	Y in.	F in.	L in.	W in.	lb	
1/4	4	1/4	7 3/4	7/16	3/4	3/8	13/32	9/32	5/8	7/32	25/32	11/32	.33	400
5/16	4 1/2	1/4	9	1/2	1	3/8	15/32	9/32	11/16	9/32	15/16	7/16	.53	700
3/8	6	5/16	11 1/8	19/32	1 1/32	7/16	1/2	5/16	13/16	11/32	1 1/8	17/32	1.01	1,000
1/2	6	3/8	12 3/8	3/4	1 1/4	9/16	5/8	13/32	1	7/16	1 7/16	23/32	1.74	1,500
5/8	6	1/2	14 1/2	1 1/16	1 9/16	2 1/32	3/4	1/2	1 5/16	1/2	1 3/4	7/8	2.95	3,000
3/4	9	5/8	18 9/16	1 5/32	1 13/16	2 9/32	15/16	9/16	1 5/8	5/8	2 1/8	1	5.41	4,500
7/8	12	3/4	22 7/8	1 5/16	2 1/8	1 3/32	1 1/8	11/16	1 7/8	3/4	2 3/8	1 1/4	9.4	6,000
1	12	7/8	24 7/8	1 1/2	2 1/2	1 7/32	1 3/16	25/32	2 1/8	7/8	3	1 7/16	12.1	8,000
1 1/4	12	1 1/8	28	1 7/8	3 3/8	1 17/32	1 3/4	1	2 5/8	1 1/8	3 9/16	1 13/16	21.8	12,000
1 1/2	18	1 3/8	36	2 1/4	3 1/2	1 13/16	2 1/16	1 1/8	3 1/4	1 1/4	4 1/8	2 1/8	42.3	18,000
1 3/4	18	1 5/8	39	2 5/8	4 3/16	2 1/16	2 3/8	1 1/4	3 1/2	1 1/2	4 11/16	2 3/8	52.8	26,000
2	24	1 7/8	48 1/8	3	4 11/16	2 17/32	2 1/2	1 9/16	4 3/16	1 3/4	5 3/8	2 11/16	99.5	34,000
2 1/2	24	2 1/4	53 1/2	3 3/4	5 9/16	3 1/2	2 7/8	1 9/16	5 5/8	2	6 1/2	3 1/8	150	55,000
2 3/4	24	2 3/4	55 1/4	3 3/4	5 9/16	4	3 1/2	1 5/8	6 1/8	2 1/4	7	3 1/4	200	68,000

Turnbuckles with Eye and Eye End Fittings

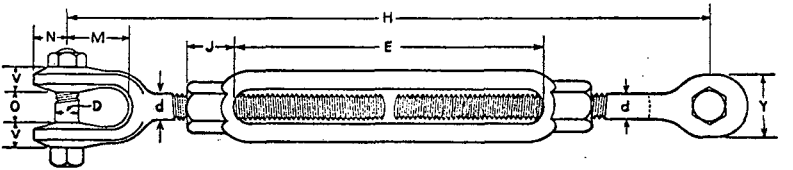
Drop-Forged Steel—Weldless



Size		Dimensions					Weight approx	Safe Working Load
Diam d in.	*Take-up E in.	F in.	H in.	J in.	L in.	W in.	lb	Pounds
1/4	4	7/32	8	7/16	25/32	11/32	0.31	400
5/16	4 1/2	9/32	9 3/8	1/2	15/16	7/16	.50	700
3/8	6	11/32	11 5/8	19/32	1 1/8	17/32	.94	1,000
1/2	6	7/16	13	3/4	1 7/16	23/32	1.62	1,500
5/8	6	1/2	15	1 1/16	1 3/4	7/8	2.75	3,000
3/4	9	5/8	19 3/8	1 5/32	2 1/8	1	5.12	4,500
7/8	12	3/4	23 5/8	1 5/16	2 3/8	1 1/4	8.75	6,000
1	12	7/8	26	1 1/2	3	1 7/16	11.2	8,000
1 1/4	12	1 1/8	29	1 7/8	3 9/16	1 13/16	20.3	12,000
1 1/2	18	1 1/4	37 1/4	2 1/4	4 1/8	2 1/8	40.2	18,000
1 3/4	24	1 1/2	40 1/4	2 5/8	4 11/16	2 3/8	49	26,000
2	24	1 3/4	49 5/8	3	5 3/8	2 11/16	94.7	34,000
2 1/2	24	2	54 5/8	3 3/4	6 1/2	3 1/8	140	55,000

Turnbuckles with Jaw and Jaw End Fittings

Drop-Forged Steel—Weldless



Size		Dimensions								Weight approx	Safe Working Load Pounds
Diam d in.	*Take-up E in.	D in.	H in.	J in.	M in.	N in.	O in.	V in.	Y in.	lb	
1/4	4	1/4	7 3/8	7/16	3/4	3/8	1 3/32	9/32	5/8	0.35	400
5/16	4 1/2	1/4	8 3/4	1/2	1	3/8	1 5/32	9/32	1 1/16	.58	700
3/8	6	5/16	11 1/16	1 9/32	1 1/32	7/16	1/2	5/16	1 3/16	1.08	1,000
1/2	6	3/8	11 5/8	3/4	1 1/4	2 1/32	5/8	1 3/32	1	1.86	1,500
5/8	6	1/2	13 15/16	1 1/16	1 9/16	2 7/32	3/4	1/2	1 5/16	3.16	3,000
3/4	9	5/8	17 1 1/16	1 5/32	1 13/16	3 1/32	1 5/16	9/16	1 5/8	5.7	4,500
7/8	12	3/4	22 3/16	1 5/16	2 1/8	1 3/32	1 1/8	1 1/16	1 7/8	10.1	6,000
1	12	7/8	23 1 1/16	1 1/2	2 1/2	1 7/32	1 3/16	2 5/32	2 1/8	12.9	8,000
1 1/4	12	1 1/8	27 3/8	1 7/8	3 3/8	1 17/32	1 3/4	1	2 5/8	23.3	12,000
1 1/2	18	1 3/8	34 7/8	2 1/4	3 1/2	1 13/16	2 1/16	1 1/8	3 1/4	44.5	18,000
1 3/4	24	1 5/8	37 7/8	2 5/8	4 3/16	2 1/16	2 3/8	1 1/4	3 1/2	56.3	26,000
2	24	1 7/8	47	3	4 11/16	2 17/32	2 1/2	1 9/16	4 3/16	105	34,000
2 1/2	24	2 1/4	52 3/8	3 3/4	5 9/16	3 1/2	2 7/8	1 9/16	5 5/8	161	55,000

MANILA ROPE

THREE STRAND—PLAIN LAY

Circumference		Diameter	Length & Gross Weight in Coil (Approx.)		Feet Per Pound (Min.)	Weight 100 Feet (Max.)	Minimum Strength in Pounds	
Thread	Inches	Inches	Feet	Lbs.			Breaking	Working
6 Fine	5/8	3/16	3330	50	66.6	1.5	450	90
6	3/4	1/4	2500	50	50.0	2.0	600	120
9	1	5/16	1725	50	34.5	2.9	1,000	200
12	1-1/8	3/8	1220	50	24.4	4.1	1,350	270
15	1-1/4	7/16	1200	63	19.0	5.3	1,750	350
18	1-3/8	15/32	1200	75	16.0	6.2	2,250	450
21	1-1/2	1/2	1200	90	13.3	7.5	2,650	530
27	1-3/4	9/16	1200	125	9.61	10.4	3,450	690
.....	2	5/8	1200	160	7.50	13.3	4,400	880
.....	2-1/4	3/4	1200	200	6.00	16.7	5,400	1,080
.....	2-1/2	13/16	1200	234	5.13	19.5	6,500	1,300
.....	2-3/4	7/8	1200	270	4.45	22.5	7,700	1,540
.....	3	1	1200	324	3.71	27.0	9,000	1,800
.....	3-1/4	1-1/16	1200	375	3.20	31.3	10,500	2,100
.....	3-1/2	1-1/8	1200	432	2.78	36.0	12,000	2,400
.....	3-3/4	1-1/4	1200	502	2.40	41.8	13,500	2,700
.....	4	1-5/16	1200	576	2.09	48.0	15,000	3,000
.....	4-1/2	1-1/2	1200	720	1.67	60.0	18,500	3,700
.....	5	1-5/8	1200	893	1.34	74.4	22,500	4,500
.....	5-1/2	1-3/4	1200	1073	1.12	89.5	26,500	5,300
.....	6	2	1200	1290	.930	108	31,000	6,200

FOUR-STRAND ROPE: Weight about 7% heavier than three-strand; Strength approximately 5% less.

SISAL ROPE: Weights same as G-W Manila rope; strength approximately 25% less.

SAFE LOAD FOR TIMBER COLUMNS

UNSUPPORTED LENGTH IN FEET

NOM SIZE	4	5	6	8	10	12	14	16	18
4 X 4	12,800	12,300	11,500	8,000	5,200	3,600	2,700		
6 X 6	30,300	29,900	29,500	28,000	25,000	19,000	14,000	11,000	8,500
8 X 8			56,000	55,000	53,000	50,000	45,000	37,000	29,000
10 X 10				90,000	88,000	86,000	83,000	78,000	71,000
12 X 12					131,000	129,000	127,000	124,000	119,000

UNIT STRESS - COMPRESSION PARALLEL TO GRAIN 1,000 P.S.I.

DOUGLAS FIR - GRADE: STANDARD OR BETTER
S 4 S

SAFE LOAD FOR TIMBER
MAX. FIBRE STRESS 1,200 P.S.I.
DOUGLAS FIR

Edge Loading P

Grade: Standard or Better
S 4 S

SPAN IN FEET AND "P" IN LBS.

NOM SIZE	WT Lbs/Ft	4	6	8	10	12	14	16	18
2 X 4	1.61	360	240	170					
2 X 6	2.54	860	570	425	340		DO NOT USE		
2 X 8	3.39	1,500	1,000	760	610	500	430		
2 X 10	4.29	2,400	1,600	1,200	1,000	800	700	600	500
2 X 12	5.19		2,400	1,800	1,400	1,200	1,000	900	800
3 X 6	4.10	1,600	925	700	550	450			
3 X 8	5.47	2,500	1,600	1,200	1,000	820	700		
3 X 10	6.93	4,000	2,600	2,000	1,600	1,300	1,100	1,000	900
3 X 12	8.39		3,900	2,900	2,300	1,900	1,700	1,500	1,300
4 X 4	3.65	800	540	400	320				
4 X 6	5.66	1,900	1,300	1,000	750	600			
4 X 8	7.55	3,400	2,300	1,700	1,400	1,100	1,000		
4 X 10	9.57	5,500	3,600	2,700	2,200	1,800	1,600	1,400	1,200
4 X 12	11.60		5,300	4,000	3,200	2,700	2,300	2,000	1,800
6 X 6	8.40	3,000	1,900	1,500	1,200	1,000			
6 X 8	11.50	5,200	3,400	2,600	2,100	1,700	1,500		

6 X 10	14.50	8,300	5,500	4,100	3,300	2,800	2,400	2,100	1,800
6 X 12	17.60		8,000	6,000	4,800	4,000	3,500	3,000	2,700
8 X 8	15.60	7,000	4,700	3,500	2,800	2,300	2,000	1,700	1,600
10 X 10	25.10	14,000	9,500	7,100	5,700	4,800	4,100	3,600	3,200
12 X 12	36.70		17,300	12,700	10,000	8,500	7,200	6,300	5,600

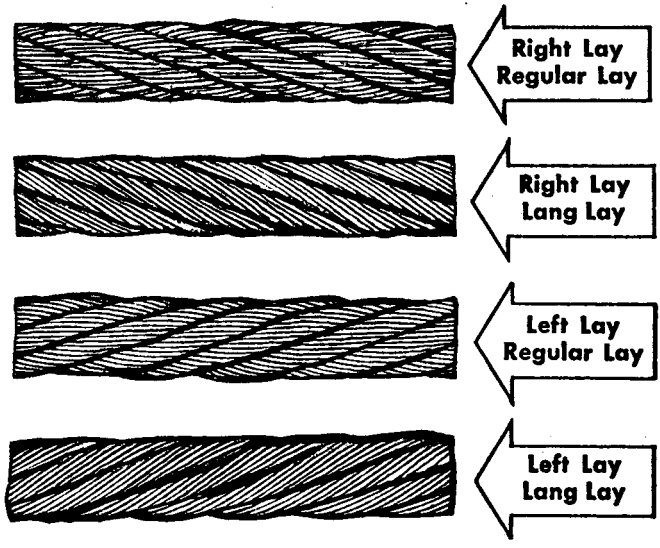
SAFE LOAD FOR TIMBER PLANKS
MAX. FIBRE STRESS 1,200 P.S.I.
DOUGLAS FIR

Flat Loading Grade: Standard or Better S 4 S

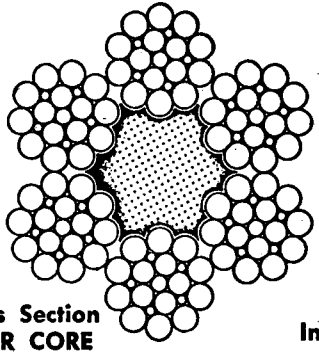
SPAN IN FEET AND "P" IN LBS.

NOM SIZE	WT Lbs/Ft	4	6	8	10	12	14	16	18
2 X 4	1.61	160	106						
2 X 6	2.54	250	170	120					
2 X 8	3.39	330	220	165	130		DO NOT USE		
2 X 10	4.29	420	280	210	170				
2 X 12	5.19	510	340	250	200				
3 X 6	4.10	650	420	320	260	220	180		
3 X 8	5.47	860	560	430	340	290	250	220	190
3 X 10	6.93	1,100	710	550	440	360	310	270	240
3 X 12	8.39	1,300	860	660	530	440	380	330	290
4 X 4	3.65	800	540	400	320	260	230	200	177
4 X 6	5.66	1,200	800	620	490	410	350	310	270
4 X 8	7.55	1,600	1,100	830	660	550	470	410	370
4 X 10	9.57	2,100	1,300	1,000	830	700	600	520	460
4 X 12	11.60	2,500	1,600	1,300	1,000	840	720	630	560
6 X 6	8.40	3,000	1,900	1,500	1,200	1,000	850	740	660

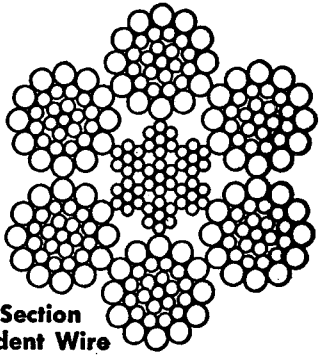
6 X 8	11.50	4,000	2,600	2,000	1,600	1,300	1,100	990	880
6 X 10	14.50	5,000	3,300	2,500	2,000	1,700	1,400	1,200	1,100
6 X 12	17.60	6,000	4,000	3,000	2,400	2,000	1,700	1,500	1,300
8 X 8	15.60	7,000	4,700	3,500	2,800	2,300	2,000	1,700	1,600
10 X 10	25.10	14,000	9,500	7,100	5,700	4,800	4,100	3,600	3,200
12 X 12	36.70		17,300	12,700	10,000	8,500	7,200	6,300	5,600



The "lay" of a rope is described in directional terms. It's a right lay when the strands pass from left to right across the rope. It's left lay when they pass from right to left.



Cross Section
FIBER CORE

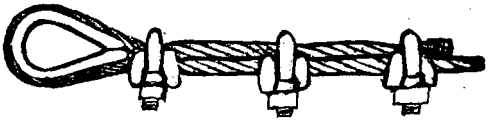


Cross Section
Independent Wire
ROPE CORE

Wire rope is also either regular or lang lay. In the regular lay the wires are laid in strands opposite in direction to the lay of the strands. In the lang lay rope, the wires are laid in the strands in the same direction as the lay of the strands.

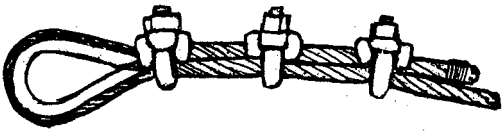
Most wire rope is regular lay. It has the greatest stability under the widest range of uses. On the other hand, lang lay is used in applications where greater flexibility and longer wearing services are needed.

Attaching by CLIPPING



RIGHT WAY

Wrong Way: clips staggered



Wrong Way: clips reversed

For Reference

Not to be taken from this room

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