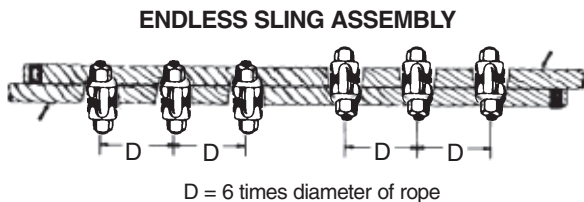


or piles, a timber hitch with two half-hitches (or a similar hitch) shall be used.

- (e) Only approved slings of proper size shall be used for slinging loads.
- (f) In using wire rope as straps for hooking onto tackle blocks, there shall be the same number of parts of rope in the strap as there are moving parts in the tackle. For instance, if triple-block tackle is used, there shall be six parts of rope for the strap.
- (g) Endless wire slings shall be made using a minimum of six fist grip rope clips as shown in Figure 12h. If the rope is greater than 5/8 in. (16 mm) additional fist grip rope clips are required, see Figure 12ac.

Figure 12h

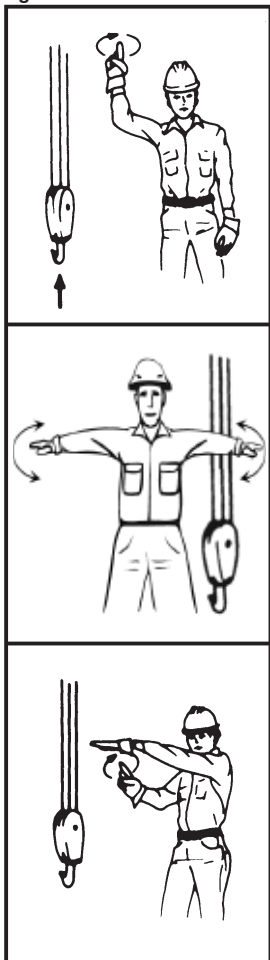


(Also see Section 12.7 Crosby Lifting Guide)

12.7 Crosby Lifting Guide

The following pages of information in this section have been printed with permission of The Crosby Group Inc. The strengths of the slings, shackles and other rigging equipment identified within these pages are to be used in conjunction with the referenced Crosby products. When using rigging equipment not manufactured by Crosby, obtain appropriate strength and capacity information from the manufacturer of the products that are being used.

Figure 12i



HAND HOISTING SIGNALS

HOIST.

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

EMERGENCY STOP.

Arms extended palms down, move hands rapidly right and left.

MOVE SLOWLY.

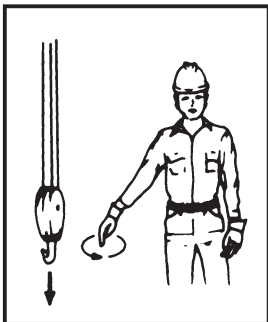
Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist Slowly shown in example.)

Figure 12j

HAND HOISTING SIGNALS

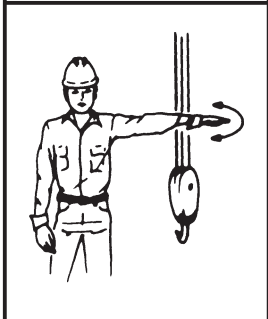
LOWER.

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



STOP.

Arm extended, palm down, move hand rapidly right and left.



DOG EVERYTHING.

Clasp hands in front of body.

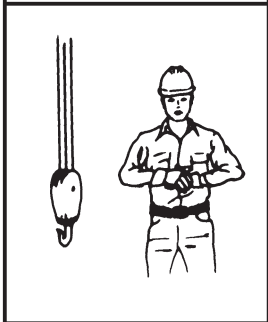


Figure 12k

RIGHT AND WRONG RIGGING PRACTICES

Use of Chokers



RIGHT:
No cutting action
on running lines.



WRONG:
Right, because of cutting action of
eye splice on running lines. Left,
bolt on running line can work loose.



Suspending Needle Beams or Scaffolds

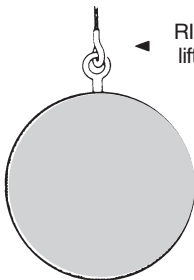


RIGHT: Sharp
corners padded.

WRONG:
Steel can
cut rope.



Eye Bolts



RIGHT: Vertical
lift on eye bolt.

WRONG:
Lifting on eye
bolts from an
angle reduces
safe loads as
much as 90%.



(Also see Section 12.7 Crosby Lifting Guide)

Figure 12l

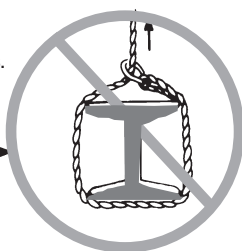
RIGHT AND WRONG RIGGING PRACTICES

Hoisting Structural Steel

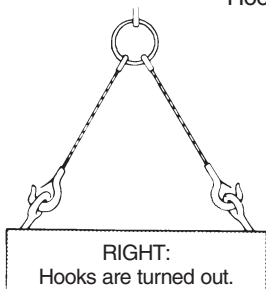


RIGHT: Use space blocks and pad corners.

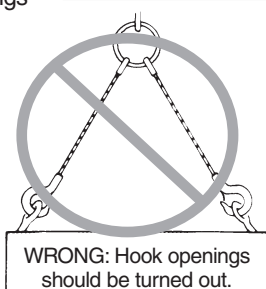
WRONG: Can bend flanges and cut rope.



Hook Slings

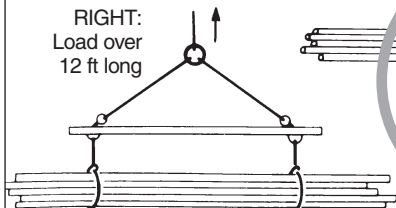


RIGHT:
Hooks are turned out.

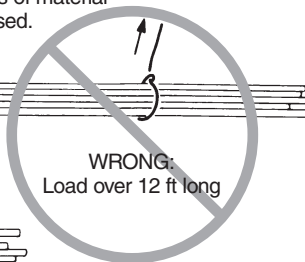


WRONG: Hook openings should be turned out.

NOTE: When hoisting 2 or more pieces of material over 12 ft long, double slings shall be used.



RIGHT:
Load over 12 ft long



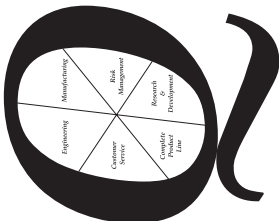
WRONG:
Load over 12 ft long

(Also see Section 12.7 Crosby Lifting Guide)

Figure 12m

Crosby® USER'S GUIDE LIFTING

1
VERSION (4/02)

RISK MANAGEMENT	TERMINOLOGY	FOR ADDITIONAL SUPPORT	
DEFINITION	WORKING LOAD LIMIT (WLL)	theCrosbygroup[®] inc. P.O. Box 3128 Tulsa Oklahoma 74101 Phone: (918) 834-4611 Fax: (918) 832-0940 1-800-777-1555 Web: www.thecrosbygroup.com E-Mail: crosbygroup@thecrosbygroup.com	
COMPREHENSIVE SET OF ACTIONS THAT REDUCES THE RISK OF A PROBLEM, A FAILURE, AN ACCIDENT	THE MAXIMUM MASS OR FORCE WHICH THE PRODUCT IS AUTHORIZED TO SUPPORT IN A PARTICULAR SERVICE.		
	PROOF TEST		
	A TEST APPLIED TO A PRODUCT SOLELY TO DETERMINE INJURIOUS MATERIAL OR MANUFACTURING DEFECTS.		
 Crosby® Quality Continuum	ULTIMATE STRENGTH		
	THE AVERAGE LOAD OR FORCE AT WHICH THE PRODUCT FAILS OR NO LONGER SUPPORTS THE LOAD.		
	DESIGN FACTOR		
	AN INDUSTRIAL TERM DENOTING A PRODUCT'S THEORETICAL RESERVE CAPABILITY; USUALLY COMPUTED BY DIVIDING THE CATALOG ULTIMATE LOAD BY THE WORKING LOAD LIMIT. GENERALLY EXPRESSED AS A RATIO, e.g. 5 TO 1.	BLOCKS & FITTINGS FOR WIRE ROPE & CHAIN CROSBY® FITTINGS LEBUS® MCKISSICK® WESTERN NATIONAL	

Load Rated[®]

Figure 12n




THE BASIC RIGGING PLAN	RESPONSIBILITY	2
<ol style="list-style-type: none"> 1. WHO IS RESPONSIBLE (COMPETENT) FOR THE RIGGING? COMMUNICATION ESTABLISHED? 2. IS THE EQUIPMENT IN ACCEPTABLE CONDITION? APPROPRIATE TYPE, PROPER IDENTIFICATION? 3. ARE THE WORKING LOAD LIMITS ADEQUATE? CAPACITY OF GEAR KNOWN? <p>WHAT IS THE WEIGHT OF LOAD? WHERE IS THE CENTER OF GRAVITY? WHAT IS THE SLING ANGLE? WILL THERE BE ANY ANGULAR OR SIDE LOADING? ARE THE SLINGS PADDED AGAINST SHARP CORNERS?</p>	<p>USER RESPONSIBILITY</p> <ol style="list-style-type: none"> 1. UTILIZE APPROPRIATE RIGGING GEAR SUITABLE FOR OVERHEAD LIFTING. 2. UTILIZE THE RIGGING GEAR WITHIN INDUSTRY STANDARDS AND THE MANUFACTURER'S RECOMMENDATIONS. 3. CONDUCT REGULAR INSPECTION AND MAINTENANCE OF THE RIGGING GEAR. <p>MANUFACTURERS RESPONSIBILITY</p> <ol style="list-style-type: none"> 1. PRODUCT AND APPLICATION INFORMATION 2. PRODUCT THAT IS CLEARLY IDENTIFIED 	
<ol style="list-style-type: none"> NAME OR LOGO LOAD RATING AND SIZE TRACEABILITY PRODUCT PERFORMANCE WORKING LOAD LIMIT DUCTILITY FATIGUE PROPERTIES IMPACT PROPERTIES 		
<ol style="list-style-type: none"> 4. WILL THE LOAD BE UNDER CONTROL? IS THE LOAD RIGGED TO THE CENTER OF GRAVITY? IS THE HITCH APPROPRIATE? TAG LINE NEEDED? IS THERE ANY POSSIBILITY OF FOULING? CLEAR OF PERSONNEL? ARE THERE ANY UNUSUAL LOADING OR ENVIRONMENTAL CONDITIONS? WIND, TEMPERATURE, OTHER? SPECIAL REQUIREMENTS? 		 

Figure 12o

INSPECTION OF HARDWARE	INSPECTION OF WIRE ROPE SLINGS 3
<p>DEFORMATION</p> <p>REMOVE FROM SERVICE IF ANY SIGNIFICANT DEFORMATION. CHECK THROAT OPENING OF HOOKS.</p> <p>WEAR</p> <p>REMOVE FROM SERVICE IF EXCESSIVE WEAR. WEAR IS EXCESSIVE IF:</p> <ul style="list-style-type: none"> MORE THAN 5% WEAR IN THROAT OR EYE OF HOOK AND OTHER CRITICAL AREAS OF HARDWARE. MORE THAN 10% WEAR IN OTHER AREAS. <p>CRACKS, NICKS, GOUGES</p> <p>REMOVE FROM SERVICE IF CRACKS, NICKS, OR GOUGES ARE DETECTED.</p> <p>MODIFICATION</p> <p>DO NOT WELD, DO NOT SUBSTITUTE SHACKLE PINS OR OTHER COMPONENTS, DO NOT HEAT, BEND OR MODIFY IN ANY MANNER.</p> <p>PROPER FUNCTION</p> <p>IMPROPERLY INSTALLED HARDWARE OR MALFUNCTION IS CAUSE FOR REMOVAL. CHECK FOR LATCHES, SWIVEL BEARINGS, LOCKING DEVICES, AND INSTALLATION OF WIRE ROPE CLIPS AND WEDGE SOCKETS.</p>	<p>PER ANSI B30.9</p> <p>ALL SLINGS AND ATTACHMENTS SHALL BE VISUALLY INSPECTED BY THE PERSON HANDLING THE SLING EACH DAY THEY ARE USED. IN ADDITION, A PERIODIC INSPECTION SHALL BE PERFORMED BY A DESIGNATED PERSON, AT LEAST ANNUALLY, AND SHALL INCLUDE A RECORD OF THE INSPECTION.</p> <p>INSPECTION CRITERIA</p> <ul style="list-style-type: none"> KINKING CRUSHING UNSTRANDING BROKEN OR CUT STRANDS STRANDING DISPLACEMENT CORE PROTRUSION CORROSION BIRDCAGING BROKEN WIRES <p>BROKEN WIRES</p> <p>REMOVE FROM SERVICE STRAND LAID AND SINGLE PART SLINGS IF TEN OR MORE RANDOMLY DISTRIBUTED WIRES IN ONE ROPE LAY, OR FIVE BROKEN WIRES IN ONE ROPE STRAND IN ONE ROPE LAY.</p> <p>DISTORTION OF WIRE ROPE</p> <p>REMOVE FROM SERVICE WIRE ROPE SLINGS THAT HAVE ANY DAMAGE RESULTING IN DISTORTION OF THE WIRE ROPE STRUCTURE SUCH AS KINKING, CRUSHING, UNSTRANDING, BIRDCAGING, STRAND DISPLACEMENT OR CORE PROTRUSION.</p>

Figure 12p

<h2>INSPECTION OF CHAIN SLINGS</h2>	<h2>INSPECTION OF SYNTHETIC SLINGS 4</h2>
<p>PER ANSI B30.9</p> <p>ALL SLINGS AND ATTACHMENTS SHALL BE VISUALLY INSPECTED BY THE PERSON HANDLING THE SLING EACH DAY THEY ARE USED. IN ADDITION, A PERIODIC INSPECTION (NORMAL SERVICE: YEARLY, SEVERE SERVICE: MONTHLY) SHALL BE PERFORMED BY A DESIGNATED PERSON, AT LEAST ANNUALLY, AND SHALL INCLUDE A RECORD OF THE INSPECTION.</p> <p>INSPECTION CRITERIA</p> <p>WEAR NICK, CRACKS, BREAKS GOUGES, STRETCH, BENDS</p> <p>WELD SPLATTER EXCESSIVE TEMPERATURE THROAT OPENING OF HOOK</p> <p>CHAIN LINKS</p> <p>REMOVE SLING FROM SERVICE IF LINKS ARE WORN EXCESSIVELY (MORE THAN 10% OR REFER TO MANUFACTURER'S INFORMATION), SHARP TRANSVERSE NICKS AND GOUGES SHOULD BE ROUNDED OUT BY GRINDING (DO NOT EXCEED WEAR ALLOWANCE). CHAIN LINKS AND ATTACHMENTS SHOULD HINGE FREELY TO ADJACENT LINKS.</p> <p>IDENTIFICATION</p> <p>CHAIN SLINGS SHALL HAVE PERMANENTLY AFFIXED IDENTIFICATION STATING: SIZE, GRADE, RATED LOAD, NUMBER OF LEGS AND MANUFACTURER.</p>	<p>PER ANSI B30.9</p> <p>ALL SLINGS AND ATTACHMENTS SHALL BE VISUALLY INSPECTED BY THE PERSON HANDLING THE SLING EACH DAY THEY ARE USED. IN ADDITION, A PERIODIC INSPECTION SHALL BE PERFORMED BY A DESIGNATED PERSON, AT LEAST ANNUALLY, AND SHALL INCLUDE A RECORD OF THE INSPECTION.</p> <p>INSPECTION CRITERIA</p> <p>ACID OR CAUSTIC BURNS MELTING OR CHARRING HOLES, CUTS TEARS, SNAGS</p> <p>BROKEN STITCHES WORN STITCHES EXCESSIVE ABRASION KNOTS</p> <p>ROUND SLING NOTES</p> <p>REMOVE FROM SERVICE ROUND SLINGS THAT HAVE CORE FIBER EXPOSED BY HOLES, TEARS, CUTS, EMBEDDED PARTICLES, WEAR OR SNAGS. REMOVE FROM SERVICE ROUND SLINGS THAT HAVE MELTING, CHARRING OR WELD SPLATTER ON ANY PART OF SLING.</p> <p>IDENTIFICATION</p> <p>WEB SLINGS AND ROUND SLINGS SHALL BE PERMANENTLY MARKED INDICATING: MANUFACTURER'S TRADEMARK AND CODE (OR STOCK NUMBER), RATED LOADS FOR THE THREE HITCHES AND MATERIAL.</p>

Figure 12q



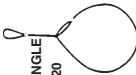
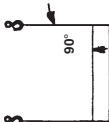
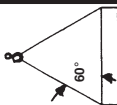
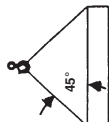
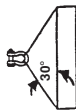
WIRE ROPE SLING CAPACITIES (LBS.) - FLEMISH EYE - ANSI B30.9 5							
6 X 19 AND 6 X 37 IMPROVED PLOW STEEL - IWRC 5/1 DESIGN FACTOR							
WIRE ROPE SIZE	 Q & T CARBON SHACKLE MINIMUM SHACKLE SIZE FOR A D/d>1 AT LOAD CONNECTION	 VERTICAL (SINGLE LEG)	 CHOKER	 TWO LEG OR BASKET HITCH	 60 DEGREE SLING ANGLE	 45 DEGREE SLING ANGLE	 30 DEGREE SLING ANGLE
1/4	5/16	1120	820	2200	1940	1500	1120
5/16	3/8	1740	1280	3400	3000	2400	1740
3/8	7/16	2400	1840	4800	4200	3400	2400
7/16	1/2	3400	2400	6800	5800	4800	3400
1/2	5/8	4400	3200	8800	7600	6200	4400
9/16	5/8	5600	4000	11200	9600	7900	5600
5/8	3/4	6800	5000	13600	11800	9600	6800
3/4	7/8	9800	7200	19600	16900	13800	9800
7/8	1	13200	9600	26400	22800	18600	13200
1	1-1/8	17000	12600	34000	30000	24000	17000
1-1/8	1-1/4	20000	15800	40000	34600	28300	20000
1-1/4	1-3/8	26000	19400	52000	45000	36700	26000
1-3/8	1-1/2	30000	24000	60000	52000	42400	30000
* RATED CAPACITIES BASED ON PIN DIAMETER OR HOOK NO LONGER THAN THE NATURAL EYE WIDTH (1/2 X EYE LENGTH) OR LESS THAN THE NOMINAL SLING DIAMETER							
REFER TO ANSI B30.9 FOR FULL DETAILS							
HORIZONTAL SLING ANGLES OF LESS THAN 30 DEGREES ARE NOT RECOMMENDED							

Figure 12r



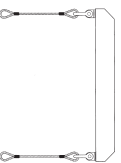
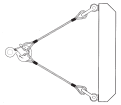
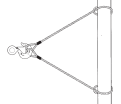
WIRE ROPE SLING CAPACITIES - TONS (2000 LBS.) - FLEMISH EYE - ASME B30.9 5A					
6 X 19 AND 6 X 37 EXTRA IMPROVED PLOW STEEL - IWRC 5/1 DESIGN FACTOR					
HORIZONTAL SLING ANGLES OF LESS THAN 30 DEGREES ARE NOT RECOMMENDED					
WIRE ROPE SIZE INCHES					
	SINGLE LEG (VERTICAL)	SINGLE CHOKER	TWO LEG SLING VERTICAL	TWO LEG SLING 60° HORIZONTAL SLING ANGLE 45° HORIZONTAL SLING ANGLE	TWO LEG CHOKER 60° HORIZONTAL SLING ANGLE
1/4	0.65	0.48	1.3	1.1 0.9	0.8
3/8	1.4	1.1	2.9	2.5 2.0	1.8
7/16	1.9	1.4	3.9	3.4 2.7	2.5
1/2	2.5	1.9	5.1	4.4 3.6	3.2
9/16	3.2	2.4	6.4	5.5 4.5	4.1
5/8	3.9	2.9	7.8	6.8 5.5	5.0
3/4	5.6	4.1	11.0	9.7 7.9	7.1
7/8	7.6	5.6	15.0	13.0 11.0	9.7
1	9.8	7.2	20.0	17.0 14.0	13.0
1-1/8	12.0	9.1	24.0	21.0 17.0	16.0
1-1/4	15.0	11.0	30.0	26.0 21.0	19.0

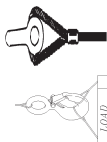
Figure 12s

WIRE ROPE SLINGS AND CONNECTIONS TO FITTINGS

USE A THIMBLE TO PROTECT SLING AND INCREASE D/d

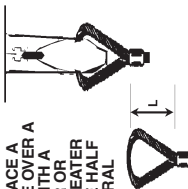


NEVER PLACE EYE OVER A FITTING SMALLER DIAMETER OR WIDTH THAN THE ROPE'S DIAMETER.

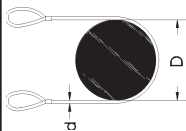
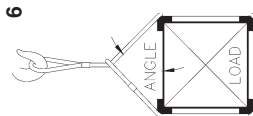


WIRE ROPE SLINGS AND CONNECTIONS TO FITTINGS

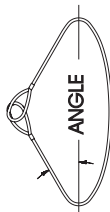
NEVER PLACE A SLING EYE OVER A FITTING WITH A DIAMETER OR WIDTH GREATER THAN ONE HALF THE NATURAL LENGTH OF THE EYE.



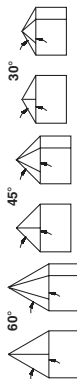
A CHOKER HITCH HAS 75% OF THE CAPACITY OF A SINGLE LEG ONLY IF THE CORNERS ARE SOFTENED AND THE HORIZONTAL ANGLE IS GREATER THAN 30 DEGREES. USE A BLOCK OF WOOD UNDER CHOKER TO INSURE ANGLE IS PROPER.



A BASKET HITCH HAS TWICE THE CAPACITY OF A SINGLE LEG ONLY IF D/d RATIO IS 25/1 AND THE LEGS ARE VERTICAL.



ANGLE	CAPACITY % OF SINGLE LEG
90	200 %
60	170 %
45	140 %
30	100 %


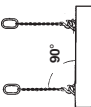
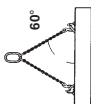
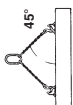
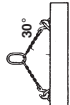


TRIPLE LEG SLINGS HAVE 50% MORE CAPACITY THAN DOUBLE LEG ONLY IF THE CENTER OF GRAVITY IS IN CENTER OF CONNECTION POINT AND LEGS ARE ADJUSTED PROPERLY (EQUAL SHARE OF THE LOAD)
QUAD LEG SLINGS OFFER IMPROVED STABILITY BUT DO NOT PROVIDE INCREASED LIFTING CAPACITY.

Figure 12t

CHAIN SLING CAPACITIES (LBS.) - CHAIN GR-8 - ASME B30.9 DESIGN FACTOR 4/1

7

CHAIN SIZE (IN.)						Crosby [®] QT ALLOY	
CHAIN GR - 8 DESIGN FACTOR 4/1	VERTICAL (SINGLE LEG)	TWO LEG OR BASKET HITCH	60 DEGREE SLING ANGLE	45 DEGREE SLING ANGLE	30 DEGREE SLING ANGLE	SINGLE LEG MASTER LINK SIZE (IN.)	DOUBLE LEG MASTER LINK SIZE (IN.)
1/4 - (9/32)	3500	7000	6050	4900	3500	1/2	1/2
3/8	7100	14200	12200	10000	7100	3/4	3/4
1/2	12000	24000	20750	16950	12000	7/8	1
5/8	18100	36200	31350	25500	18100	1	1-1/4
3/4	28300	56600	49000	40000	28300	1-1/4	1-1/2
7/8	34200	68400	59200	48350	34200	1-1/2	1-3/4
1	47700	95400	82600	67450	47700	—	—
1-1/4	72300	144600	125200	102200	72300	—	—

A CHAIN GRAB HOOK APPLICATION WILL RESULT IN A 20% REDUCTION OF CHAIN CAPACITY OF A SINGLE LEG. THE HORIZONTAL ANGLE MUST BE GREATER THAN 30 DEGREES.

TRIPLE LEG SLINGS HAVE 50% MORE CAPACITY THAN DOUBLE LEG ONLY IF THE CENTER OF GRAVITY IS IN CENTER OF CONNECTION POINT AND LEGS ARE ADJUSTED PROPERLY (EQUAL SHARE OF THE LOAD). QUAD LEG SLINGS OFFER IMPROVED STABILITY BUT DO NOT PROVIDE INCREASED LIFTING CAPACITY.

HORIZONTAL ANGLE	CAPACITY % OF SINGLE LEG
90	200%
60	170%
45	140%
30	100%

Figure 12u


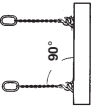
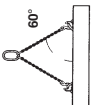
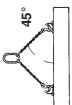
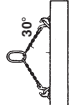












CHAIN SLING CAPACITIES (LBS.) - CHAIN GR-10 - ASME B30.9 DESIGN FACTOR 4/1 7A						
CHAIN SIZE (IN.)						Crosby QT ALLOY
CHAIN GR - 10 4 TO 1 DESIGN FACTOR	VERTICAL (SINGLE LEG)	TWO LEG OR BASKET HITCH	60 DEGREE SLING ANGLE	45 DEGREE SLING ANGLE	30 DEGREE SLING ANGLE	SINGLE LEG MASTER LINK SIZE (IN.)
1/4 - (9/32)	4300	8600	7400	6100	4300	1/4-5/16 in.
5/16	5700	11400	9900	8100	5700	1/4-5/16 in.
3/8	8800	17600	15200	12400	8800	3/8 in.
1/2	15000	30000	26000	21200	15000	1/2 in.
5/8	22600	45200	39100	32000	22600	5/8 in.
Crosby® Spectrum® 10 System Makes Assembly Easy						
<div>            </div> <div> Load Rated®  </div>						

Figure 12v

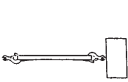
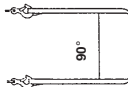
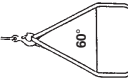
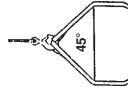
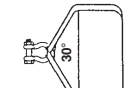
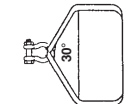
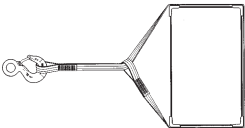
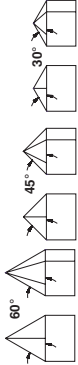
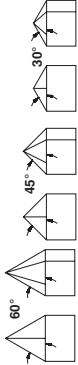
WEB SLING CAPACITIES - ANSI B30.9 - DESIGN FACTOR 5/1						9
	ANGLE 120°					
VERTICAL (SINGLE LEG)		CHOKER	TWO LEG OR BASKET	60 DEGREE SLING ANGLE	45 DEGREE SLING ANGLE	30 DEGREE SLING ANGLE
100% OF SINGLE LEG		80% OF SINGLE LEG	200% OF SINGLE LEG	170% OF SINGLE LEG	140% OF SINGLE LEG	SAME AS SINGLE LEG
<div> <div>  <p>BUNCHING</p> <p>PINCHING</p> </div> <div> <p>SYNTHETIC SLINGS</p> <p>RATED LOAD</p> <p>FOLDING, BUNCHING OR PINCHING OF SYNTHETIC SLINGS, WHICH OCCURS WHEN USED WITH SHACKLES, HOOKS OR OTHER APPLICATION WILL REDUCE THE RATED LOAD.</p> </div> </div> <div>  <p>A CHOKER HITCH HAS 80% OF THE CAPACITY OF A SINGLE LEG IF THE CORNERS ARE SOFTENED AND THE HORIZONTAL ANGLE IS GREATER THAN 30 DEGREES. USE A BLOCK OF WOOD UNDER CHOKES TO INSURE ANGLE IS PROPER.</p> </div> <div>  <p>TRIPLE LEG SLINGS HAVE 50% MORE CAPACITY THAN DOUBLE LEG ONLY IF THE CENTER OF GRAVITY IS IN CENTER OF CONNECTION POINT AND LEGS ARE ADJUSTED PROPERLY (EQUAL SHARE OF THE LOAD).</p> <p>QUAD LEG SLINGS OFFER IMPROVED STABILITY BUT DO NOT PROVIDE INCREASED LIFTING CAPACITY.</p> </div>						

Figure 12w

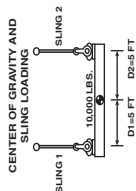
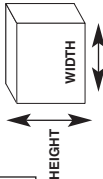
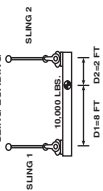
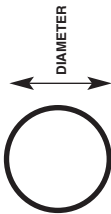
<p>CENTER OF GRAVITY AND SLING LOADING</p>	<p>10</p>
<p>WHEN LIFTING VERTICALLY, THE LOAD WILL BE SHARED EQUALLY IF THE CENTER OF GRAVITY IS PLACED EQUALLY BETWEEN THE PICK POINTS.</p> <p>IF THE WEIGHT OF THE LOAD IS 10,000 LBS., THEN EACH SLING WILL HAVE A LOAD OF 5,000 LBS. AND EACH SHACKLE AND EYEBOLT WILL ALSO HAVE A LOAD OF 5,000 LBS.</p> 	<p>WEIGHT = VOLUME X UNIT WEIGHT OF MATERIAL</p> <p>UNIT WEIGHT STEEL = 490 LBS/FT³ UNIT WEIGHT ALUMINUM = 165 LBS/FT³ UNIT WEIGHT CONCRETE = 150 LBS/FT³ UNIT WEIGHT WOOD = 50 LBS/FT³ UNIT WEIGHT WATER = 62 LBS/FT³ UNIT WEIGHT SAND AND GRAVEL = 120 LBS/FT³</p> <p>VOLUME OF CUBE = HEIGHT x WIDTH x LENGTH</p> 
<p>CENTER OF GRAVITY AND SLING LOADING</p> <p>WHEN THE CENTER OF GRAVITY IS NOT EQUALLY SPACED BETWEEN THE PICK POINTS, THE SLING AND FITTINGS WILL NOT CARRY AN EQUAL SHARE OF THE LOAD. THE SLING CONNECTED TO THE PICK POINT CLOSEST TO THE CENTER OF GRAVITY WILL CARRY THE GREATEST SHARE OF THE LOAD.</p> <p>SLING 2 IS CLOSEST TO COG. IT WILL HAVE THE GREATEST SHARE OF THE LOAD.</p> <p>SLING 2 = 10,000 X 8 / (8+2) = 8,000 LBS. SLING 1 = 10,000 X 2 / (8+2) = 2,000 LBS.</p> 	<p>WEIGHT = VOLUME X UNIT WEIGHT OF MATERIAL</p> <p>VOLUME OF SPHERE = $3.14 \times (\text{DIAM.} \times \text{DIAM.} \times \text{DIAM.}) / 6$</p> <p>VOLUME OF CYLINDER = $3.14 \times (\text{DIAM.} \times \text{DIAM.} \times \text{LENGTH}) / 4$</p> 

Figure 12x

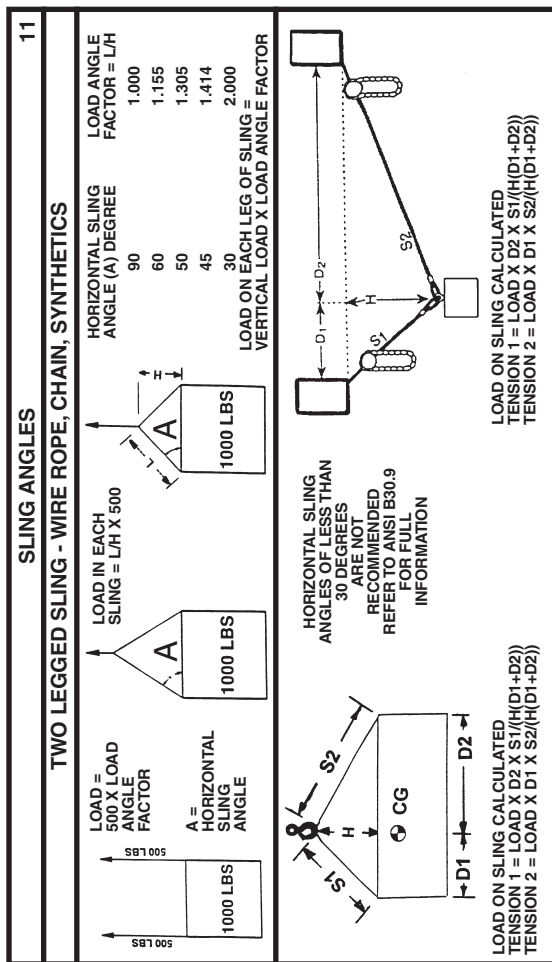


Figure 12y

Crosby® RIGGING HARDWARE

12

QUENCHED & TEMPERED SHACKLES

SCREW PIN AND BOLT TYPE
CARBON SHACKLE
DESIGN FACTOR 6/1

ALLOY SHACKLE
QUIC-CHECK®
DESIGN FACTOR 5/1

SHANK HOOK
SWIVEL HOOK
EYE HOOK

QUENCHED & TEMPERED HOOKS

DESIGN FACTOR IN METRIC TONS
EYEHOOKS - 5/1 (EXCEPT ALLOY 30 TON AND LARGER ARE 4-1/2 TO 1)
SHANK AND SWIVELS ARE 4-1/2 TO 1.

QUIC-CHECK®

NOMINAL SIZE (IN) DIAMETER OF BOLT	CARBON MAXIMUM WORKING LOAD TONS	ALLOY MAXIMUM WORKING LOAD TONS	INSIDE WIDTH AT PIN (INCHES)	DIA. OF PIN	CARBON MAXIMUM WORKING LOAD TONS	ALLOY MAXIMUM WORKING LOAD TONS	CODE	ALLOY MAXIMUM WORKING LOAD TONS	CODE	THROAT OPENING (INCHES)	DEFORMATION INDICATOR A - A
3/16	1/3	3/8	.38	.25	3/4	1	DC	1	DA	.89	1.50
1/4	1/2	.47	.47	.31	1-1/2	2	GC	1-1/2	GA	.91	2.00
5/16	3/4	.53	.53	.38	2	3	HC	2	HA	1.09	2.00
3/8	1	.66	.66	.44	3	5	IC	3	IA	1.36	2.50
7/16	1-1/2	.75	.75	.50	5	7	JC	5	JA	1.61	3.00
1/2	2	.81	.81	.53	7-1/2	10	KC	7	KA	2.08	4.00
5/8	3-1/4	1.06	1.06	.75	10	15	LC	10	LA	2.27	4.00
3/4	4-3/4	1.25	1.25	.88	15	20	NC	15	NA	3.02	5.00
7/8	6-1/2	1.44	1.44	1.00	20	25	OC	20	OA	3.25	6.50
1	8-1/2	1.69	1.69	1.13	25	30	PC	25	PA	3.00	7.00
1-1/8	9-1/2	1.81	1.81	1.25	30	40	SC	30	SA	3.38	8.00
1-1/4	12	2.03	2.03	1.38	40	60	TC	40	TA	4.12	10.00
1-3/8	13-1/2	2.25	2.25	1.50							
1-1/2	17	2.38	2.38	1.63							

* 320 EYE HOOK IS NOW RATED AT 5 TONS

- INSURE SCREW PIN IS TIGHT BEFORE EACH LIFT
- USE BOLT TYPE SHACKLE FOR PERMANENT INSTALLATION
- DO NOT SIDE LOAD ROUND PIN SHACKLE
- USE SCREW PIN OR BOLT TYPE TO COLLECT SLINGS.

MAXIMUM INCLUDED ANGLE 120 DEGREES

MAXIMUM INCLUDED ANGLE 90 DEGREES

- DO NOT SIDELOAD
- DO NOT TIP LOAD
- DO NOT BACKLOAD

EYE HOOK

FOR ADDITIONAL INFORMATION REFER TO THE Crosby® PRODUCT WARNINGS

Figure 12z

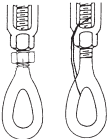
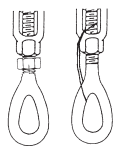



Grosby® RIGGING HARDWARE				Grosby® TURNBUCKLES				13
Grosby® LINKS AND RINGS WITH WIRE ROPE AND SYNTHETIC SLINGS 5/1 DESIGN FACTOR				Grosby® A-341 CARBON A-341 ALLOY A-342 ALLOY		Grosby® TURNBUCKLES		
SIZE INCHES	G-341	A-341	A-342	WORKING LOAD LIMIT POUNDS		WORKING LOAD LIMIT JAW AND EYE 5/1 DESIGN FACTOR	WORKING LOAD LIMIT HOOK END FITTING 5/1 DESIGN FACTOR	
1/2	2900	7000	7000			1/4	500	400
5/8	4200	9000	9000			5/16	800	700
3/4	6000	12300	12300			3/8	1200	1000
7/8	8300	14000	14000			1/2	2200	1500
1	10800	24360	24360			5/8	3500	2250
1-1/8	N/A	30600	N/A			3/4	5200	3000
1-1/4	16750	36000	36000			7/8	7200	4000
1-3/8	20500	43000	N/A			1	10000	5000
1-1/2	N/A	54300	54300			1-1/4	15200	6500
1-5/8	N/A	62600	N/A			1-1/2	21400	7500
1-3/4	N/A	84900	84900					
2	N/A	102600	102600					
WORKING LOAD LIMITS ARE FOR USE WITH WIRE ROPE AND SYNTHETIC SLINGS, NOT FOR CHAIN SLINGS. WORKING LOAD LIMITS ARE BASED ON SINGLE LEG (IN-LINE), OR RESULTANT LOAD ON MULTIPLE LEGS WITH AN INCLUDED ANGLE LESS THAN OR EQUAL TO 120 DEGREES.						THE USE OF LOCKNUTS OR MOUSING IS AN EFFECTIVE METHOD OF PREVENTING TURNBUCKLES FROM ROTATING.		
FOR ADDITIONAL INFORMATION REFER TO THE				Grosby®		PRODUCT WARNING		

Figure 12aa

Grosby® RIGGING HARDWARE

14

QUENCHED & TEMPERED DESIGN FACTOR 5/1							Grosby® SWIVEL HOIST RINGS 		DESIGN FACTOR 5/1	
SHANK DIAMETER	WORKING LOAD LIMIT IN LINEPULL (LBS.)	WORKING LOAD LIMIT 60 DEGREES SLING ANGLE (LBS.)	WORKING LOAD LIMIT 45 DEGREES SLING ANGLE (LBS.)	WORKING LOAD LIMIT ANGLE LESS THAN 45 DEGREES (LBS.)	WORKING LOAD LIMIT FULL PIVOT (LBS.)	THREAD SHANK SIZE U.N.C.	TORQUE FT - (LBS)			
1/4	650	420	195	160	800	5/16	7			
5/16	1200	780	360	300	1000	3/8	12			
3/8	1550	1000	465	380	2500	1/2	28			
1/2	2600	1690	780	650	4000	5/8	60			
5/8	5200	3380	1560	1300	7000	3/4	100			
3/4	7200	4680	2160	1800	8000	7/8	160			
7/8	10600	6890	3180	2650	10000	1	230			
1	13300	8645	3990	3325	15000	1-1/4	470			
1-1/4	21000	13600	6300	5250	24000	1-1/2	800			
1-1/2	24000	15600	7200	6000	30000	2	1100			
SHOULDER EYE BOLTS						SWIVEL HOIST RINGS				
<ul style="list-style-type: none"> NEVER EXCEED WORKING LOAD LIMITS. NEVER USE REGULAR NUT EYE BOLTS FOR ANGULAR LIFTS. ALWAYS USE SHOULDER NUT EYE BOLTS FOR ANGULAR LIFTS. FOR ANGULAR LIFTS, ADJUST WORKING LOAD AS SHOWN ABOVE. ALWAYS TIGHTEN NUTS SECURELY AGAINST THE LOAD. ALWAYS APPLY LOAD TO EYE BOLT IN THE PLANE OF THE EYE. 						<ul style="list-style-type: none"> WHEN USING LIFTING SLINGS OF TWO OR MORE LEGS MAKE SURE THE FORCES IN THE LEG ARE CALCULATED. SELECT THE PROPER SIZE SWIVEL HOIST RING TO ALLOW FOR LOAD IN SLING LEG. ALWAYS INSURE HOIST RING IS FREE TO ALIGN ITSELF WITH SLING. 				

FOR ADDITIONAL INFORMATION REFER TO THE

Grosby® PRODUCT WARNING

Figure 12ab

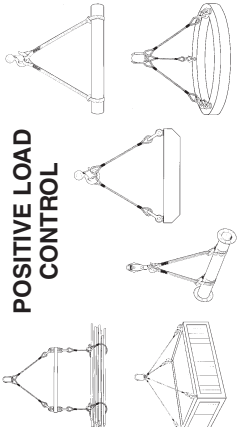
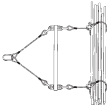
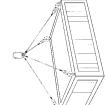
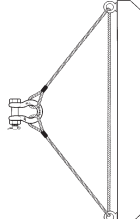
LOAD CONTROL	15
<p>POSITIVE LOAD CONTROL</p> 	 
<p>WHENEVER ANY SLING IS USED, THE FOLLOWING PRACTICES SHALL BE OBSERVED.</p> <ol style="list-style-type: none"> 1. SLINGS THAT ARE DAMAGED OR DEFECTIVE SHALL NOT BE USED. 2. SLINGS SHALL NOT BE SHORTENED WITH KNOTS OR BOLTS OR OTHER MAKESHIFT DEVICES. 3. SLING LEGS SHALL NOT BE KINKED. 4. SLINGS SHALL NOT BE LOADED IN EXCESS OF THEIR RATED CAPACITIES. 5. SLINGS USED IN A BASKET HITCH SHALL HAVE THE LOADS BALANCED TO PREVENT SLIPPAGE. 6. SLINGS SHALL BE SECURELY ATTACHED TO THEIR LOAD. 7. SLINGS SHALL BE PADDED OR PROTECTED FROM THE SHARP EDGES OF THEIR LOADS. 8. SUSPENDED LOADS SHALL BE KEPT CLEAR OF ALL OBSTRUCTION. 9. ALL EMPLOYEES SHALL BE KEPT CLEAR OF LOADS ABOUT TO BE LIFTED AND OF SUSPENDED LOADS. 10. HANDS OR FINGERS SHALL NOT BE PLACED BETWEEN THE SLING AND ITS LOAD WHILE THE SLING IS BEING TIGHTENED AROUND THE LOAD. 11. SHOCK LOADING IS PROHIBITED! 12. A SLING SHALL NOT BE PULLED FROM UNDER A LOAD WHEN THE LOAD IS RESTING ON THE SLING. <p>INSPECTION: EACH DAY BEFORE BEING USED, THE SLING AND ALL FASTENINGS AND ATTACHMENTS SHALL BE INSPECTED FOR DAMAGE OR DEFECTS BY A COMPETENT PERSON DESIGNATED BY THE EMPLOYER. ADDITIONAL INSPECTIONS SHALL BE PERFORMED DURING SLING USE WHERE SERVICE CONDITIONS WARRANT. DAMAGED OR DEFECTIVE SLINGS SHALL BE IMMEDIATELY REMOVED FROM SERVICE.</p>	 <p>REEVING THROUGH CONNECTIONS TO LOAD INCREASES LOAD ON CONNECTION FITTINGS BY AS MUCH AS TWICE. DO NOT REEVE!</p>

Figure 12ac

Crosby® RIGGING HARDWARE

16

Crosby®
WIRE ROPE
CLIPS

CLIPS 80% EFFICIENT
UNDER 1", 90% 1"
AND ABOVE

G-450
U-Bolt Clip

CLIPS 80% EFFICIENT
UNDER 1", 90% 1"
AND ABOVE

G-429
First Grip
Clip

SIZE	NUMBER OF CLIPS	TURNBACK LENGTH (IN.)	TORQUE FT-LBS.
1/8	2	3-1/4	4.5
3/16	2	3-3/4	7.5
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	11-12	65
9/16	3	12	95
5/8	3	12	95
3/4	4	18	130
1	5	26	225

APPLY U-BOLT OVER DEAD END OF THE WIRE ROPE. LIVE END OF THE ROPE RESTS IN THE SADDLE. A TERMINATION IS NOT COMPLETE UNTIL IT HAS BEEN RETORQUED A SECOND TIME. NEVER SADDLE A DEAD HORSE!

2

3

THE NUMBER OF CLIPS SHOWN IS BASED ON USING RRL OR RLL WIRE ROPE, 6X19 OR 6X37 CLASS, FC OR IWRC: IPS OR XIP: IT ALSO APPLIES TO ROTATION RESISTANT RRL WIRE ROPE, 8X19 CLASS, IPS, XIP, SIZES 1-1/2 INCH AND SMALLER, AND TO ROTATION RESISTANT RRL WIRE ROPE, 19X7 CLASS, IPS, XIP, SIZES 1-3/4 INCH AND SMALLER. FOR ELEVATOR, PERSONNEL HOIST, AND SMALLER, FOR ELEVATOR, PERSONNEL HOIST, AND SCAFFOLD APPLICATIONS REFER TO ANSI A17.1 AND ANSI A10.4. THESE STANDARDS DO NOT RECOMMEND THE USE OF U-BOLT STYLE WIRE ROPE CLIPS.

FOR ADDITIONAL INFORMATION REFER TO THE **Crosby®** PRODUCT WARNING

Do not use U-Bolts

12.8 Synthetic Webbing Slings – Selection, Use and Maintenance

This section applies to slings fabricated by sewing of woven synthetic webbing of nylon or polyester type yarns, for the purpose of hoisting, lifting, and general material handling.

12.8.1 Construction

12.8.1.1 Webbing

Webbing should be of fabric woven of high tenacity synthetic yarns, offering suitable characteristics for use in the fabrication of web slings. Webbing shall have the following characteristics.

- (a) Sufficient certified tensile strength to meet the sling manufacturer's requirements.
- (b) Uniform thickness and width.
- (c) Full woven width, including selvage edges.
- (d) Webbing ends shall be sealed by heat, or other suitable means, to prevent raveling.

12.8.1.2 Thread

The thread used in the manufacture of synthetic web slings shall be of the same generic type yarn as the sling webbing.

12.8.1.3 Stitching

- (a) Stitching shall be the only method used to fabricate synthetic web slings within the scope of this standard.
- (b) The stitching pattern and length of stitching shall be in accordance with the manufacturer's standard practice.