

APPLICATIONS & WARNINGS

Read and understand these instructions before using products.



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Application Information

RIGGING PRACTICE SHACKLES

Screw pin shall be fully engaged. If designed for a cotter pin, it shall be used and maintained. Applied load should be centered in the bow to prevent side loading. Multiple sling legs should not be applied to the pin. If side loaded, the rated load shall be reduced according to Table 1 on the following page.

Screw Pin Shackles Pin Security



MOUSE SCREW PIN WHEN USED IN LONG-TERM OR HIGH-VIBRATION APPLICATIONS.

Mouse or Mousing (screw pin shackle) is a secondary securement method used to secure screw pin from rotation or loosening. Annealed iron wire is looped through hole in collar of pin and around adjacent leg of shackle body with wire ends securely twisted together.

Shackles



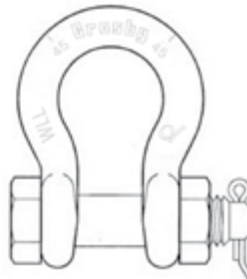
ROUND PIN

Do not side load, do not use as a collector ring, always use cotter pin.



SCREW PIN

Use when picking and placing a load, tighten pin prior to each lift.



BOLT-TYPE

Use in permanent or long-term installations, always use nut and cotter.

Connection of Slings to Shackles

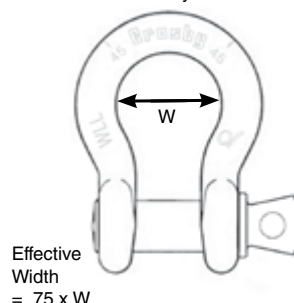


Diameter of shackle must be greater than wire rope diameter if no thimble in eye.



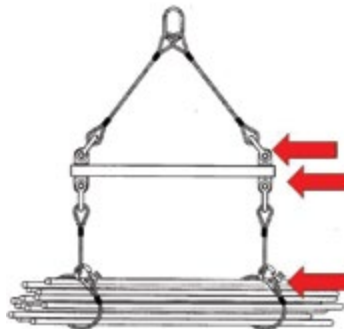
Shackle must be large enough to avoid pinching of synthetic slings.

Note that the effective width of the curved surface is only 75% of width.



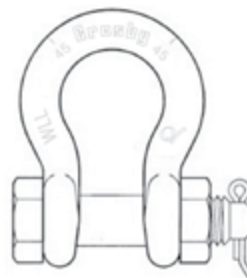
Effective Width = .75 x W

Bolt-Type Shackles

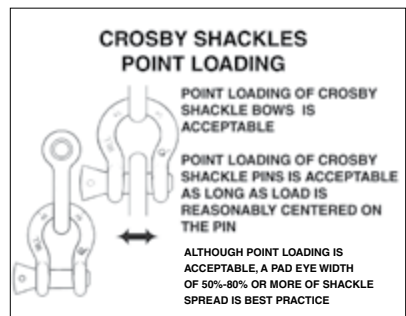
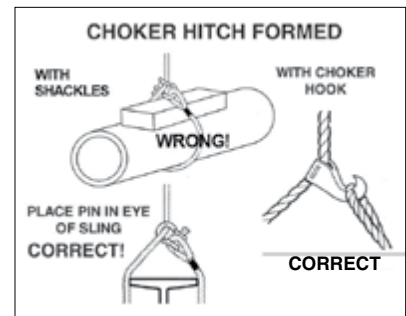
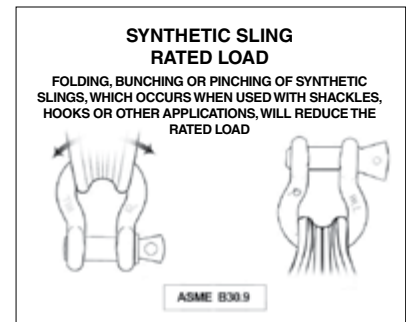
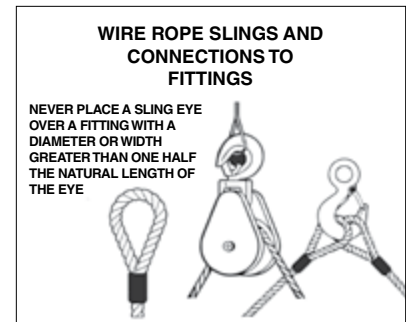
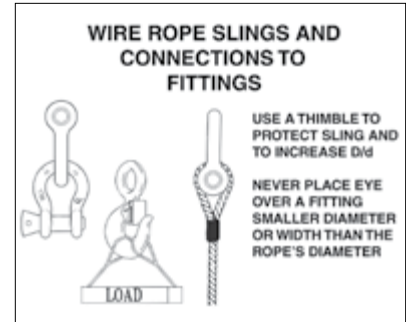


Use Bolt-Type Shackle for permanent or long-term connection.

Use Screw Pin Shackle for temporary connection.



Not necessary to tighten nut. Always use cotter pin.



Installation Guidelines

1. Extended prong cotter pins should be inserted into hole until the head is tangent to the bolt/pin, and oriented so the axis of the eye is parallel to the shank of the bolt/pin.
2. The prongs are to be bent in opposite directions around the bolt or pin as shown in Figure 1 below.
3. After installation, the cotter pin prongs should wrap around the bolt or pin by at least 60 degrees opposite directions of bolt or pin diameter.
4. The prongs may be bent with pliers or by gently tapping with a hammer. *Note: Avoid bending the prongs over sharp radii which may promote breakage. If a prong breaks off or becomes damaged during installation, replace the cotter pin.
5. The ends of the prongs may be curled to form a small loop to reduce the potential for snagging or puncture wounds.

Cotter Pin Sizes For Crosby Shackles

213 & 215 SHACKLES	
SHACKLE SIZE	COTTER PIN SIZE
1/4"	3/32 x 3/4"
5/16"	3/32 x 1"
3/8"	1/8 x 1"
7/16"	1/8 x 1"
1/2"	1/8 x 1"
5/8"	3/16 x 1 1/4"
3/4"	3/16 x 1 1/4"
7/8"	5/16 x 1 1/2"
1"	5/16 x 1 3/4"
1 1/8"	5/16 x 1 3/4"
1 1/4"	5/16 x 2"
1 3/8"	5/16" x 2 1/4"
1 1/2"	5/16" x 2 1/4"
1 3/4"	5/16" x 2 3/4"
2"	3/8 x 3"

2130 & 2150 SHACKLES	
SHACKLE SIZE	COTTER PIN SIZE
3/16"	3/32 x 3/4"
1/4"	3/32 x 3/4"
5/16"	3/32 x 1"
3/8"	1/8 x 1"
7/16"	1/8 x 1"
1/2"	1/8 x 1"
5/8"	3/16 x 1 1/4"
3/4"	3/16 x 1 1/4"
7/8"	1/4 x 1 1/2"
1"	1/4 x 1 3/4"
1 1/8"	1/4 x 1 3/4"
1 1/4"	1/4 x 2"
1 3/8"	5/16 x 2 1/4"
1 1/2"	5/16 x 2 1/4"
1 3/4"	5/16 x 2 3/4"
2"	3/8 x 3"
2 1/2"	7/16 x 4"
3"	3/8 x 4 1/2"
3 1/2"	3/8 x 4 1/2"
4"	3/8 x 4 1/2"

2140 SHACKLES	
SHACKLE SIZE	COTTER PIN SIZE
1 1/2"	5/16" x 2 1/4"
1 3/4"	5/16" x 2 3/4"
2"	3/8" x 3"
2 1/2"	7/16" x 4"
3"	3/8" x 4 1/2"
3 1/2"	3/8" x 4 1/2"
4"	3/8" x 4 1/2"
4 3/4"	3/8" x 7"
5"	3/8" x 8"
6"	3/8" x 8 1/2"
7"	3/8" x 10 1/2"
7 1/2"	3/8" x 10 1/2"
8"	3/8" x 13 1/2"

2160 SHACKLES	
SHACKLE WLL (t)	COTTER PIN SIZE
7	3/16" x 1 1/4"
12-1/2	1/4" x 1 3/4"
18	1/4" x 2"
30	5/16 x 2 1/4"
40	5/16" x 2 3/4"
55	3/8" x 3"
75	3/8" x 3"
125	3/8" x 4"
200	1/2" x 5 1/4"
300	5/8" x 6"
400	5/8" x 8"
500	3/4" x 9"
600	3/4" x 10"
700	3/4" x 11"
800	3/4 x 13" R3
900	3/4" x 13"
1000	3/4" x 14"
1250	3/4" x 15"
1500R3	3/4" x 17"
4	3/8 x 4 1/2"

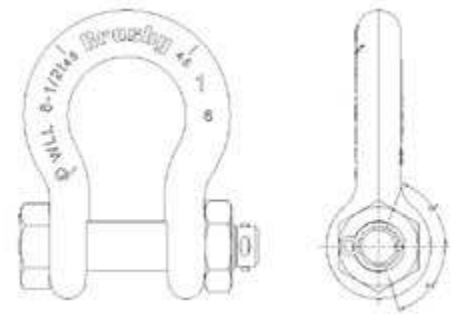


Figure 1
Cotter pin installation in a 1" bolt type shackle.

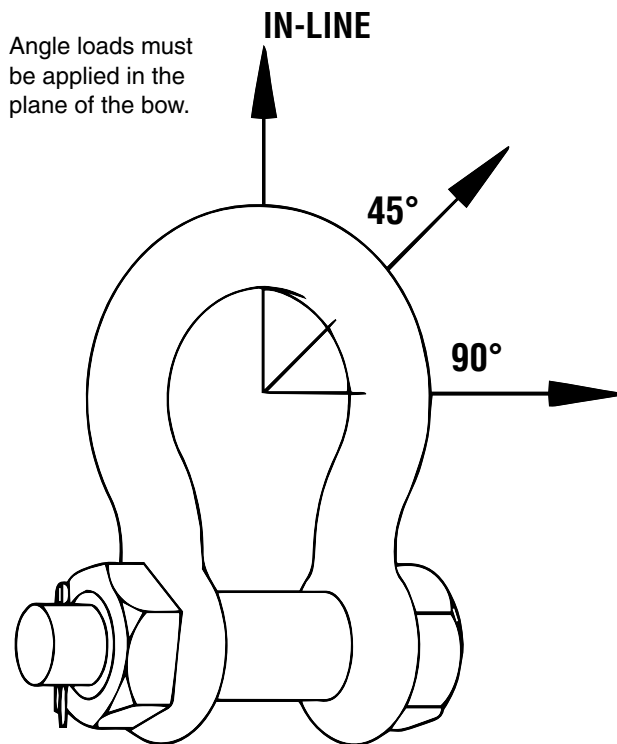
Application Information

Point Loading of Crosby® Shackles

It has been determined that all Crosby® shackles can be point-to-point loaded to the Working Load Limit without bending of the pin/bolt. This loading can be bow-to-bow, bow-to-pin, or pin-to-pin (if there is not interference between the diameter of the shackle ears). However, caution should be given to maintain the load at the center of the span by spacers so the load will not slide over to one side, and overload that ear. See "Off Center Loading Of Crosby® Screw Pin & Bolt Type Shackles – 3/16" to 3" Sizes"

Angular Loading Of Crosby® Screw Pin & Bolt Type Shackles

Crosby® has made representative tests with smaller size shackles with the load applied at 90 degrees to the normal plane of loading (ie. in-line). The test results indicated that in order to maintain a proof load of 2 times the Working Load Limit (2 x WLL), the Working Load Limit should be reduced to 50% (ie. one-half the catalog working load rating). **DO NOT SIDE LOAD G/S-213 OR G/S-215 ROUND PIN SHACKLES.** Calculations based on the above test indicates the Working Load Limit should be reduced as shown below for loads applied at various angles to the normal plane of loading:



SIDE LOADED RATING REDUCTION TABLE FOR 3/16" - 3" (120 METRIC TONS)

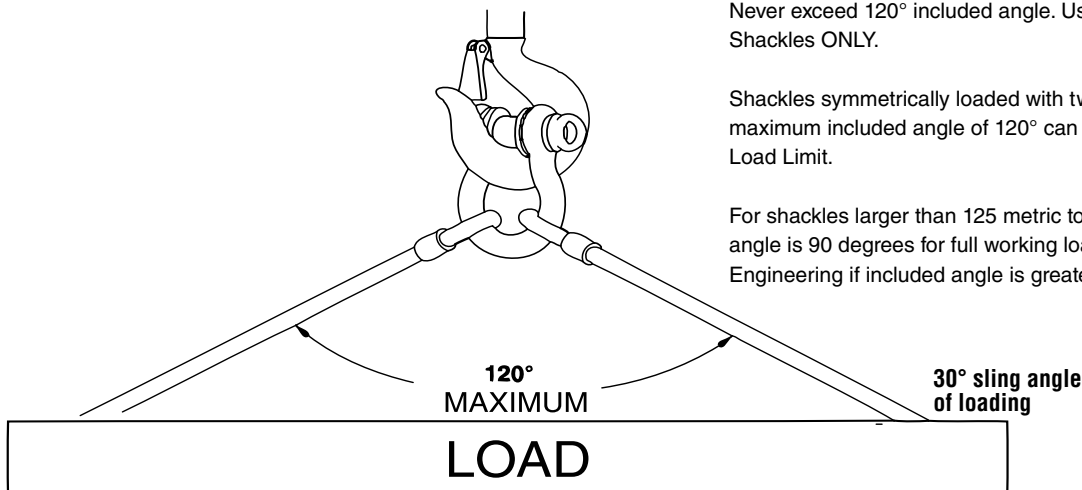
Table 1	
Side Loading Reduction Chart for Screw Pin and Bolt Type Shackles Only+	
Angle of Side Load from Vertical In-Line of Shackle	Adjusted Working Load Limit
0° - 10° In-Line*	100% of Rated Working Load Limit
11° - 20° from In-Line*	85% of Rated Working Load Limit
21° - 30° from In-Line*	75% of Rated Working Load Limit
31° - 45° from In-Line*	70% of Rated Working Load Limit
46° - 55° from In-Line*	60% of Rated Working Load Limit
56° - 70° from In-Line*	55% of Rated Working Load Limit
71° - 90° from In-Line*	50% of Rated Working Load Limit

+ In-Line load is applied perpendicular to pin. * **DO NOT SIDE LOAD ROUND PIN SHACKLE.**

Table 1	
SHACKLE SIZE GREATER THAN 3" ANGLE FROM IN-LINE (DEGREES) REDUCTION IN WLL	
0° - 5° In-Line*	0% of Rated Working Load Limit
6° - 10° from In-Line*	15% of Rated Working Load Limit
>10° from In-Line*	ANALYSIS REQ'D.

For shackles larger than 125 metric tons, where the angle of the side load is greater than 5 degrees, contact Crosby Engineering.

INCLUDED ANGLE - SHACKLES



Never exceed 120° included angle. Use Bolt Type and Screw Pin Shackles ONLY.

Shackles symmetrically loaded with two leg slings having a maximum included angle of 120° can be utilized to full Working Load Limit.

For shackles larger than 125 metric tons, the maximum included angle is 90 degrees for full working load limit. Contact Crosby Engineering if included angle is greater than 90 degrees.

For shackles larger than 125 metric tons, the maximum included angle is 90 degrees for full working load limit. Contact Crosby Engineering if included angle is greater than 90 degrees.

Application Information

Round Pin Shackles



Round Pin Shackles can be used in tie down, towing, suspension or lifting applications where the load is strictly applied in-line. Round pin shackles should never be used in rigging applications to gather multiple sling legs, or where side loading conditions may occur.

Bolt-Type Shackles



Screw Pin Shackles



Screw Pin Shackles are used in Pick and Place* applications. For permanent or long-term installations, Crosby recommends the use of bolt type shackles.

If you choose to disregard Crosby's recommendation, the screw pin shall be secured from rotation or loosening .

Screw pin shackles can be used for applications involving side-loading circumstances. Reduced working load limits are required for side-loading applications. While in service, do not allow the screw pin to be rotated by a live line, such as a choker application.

* Pick and Place application: Pick (move) a load and place as required. Tighten screw pin before each pick.

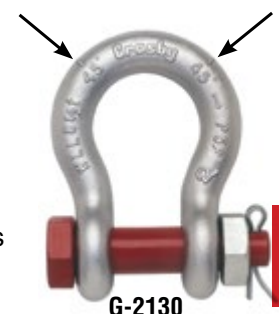
Bolt-Type Shackles can be used in any application where round pin or screw pin shackles are used. In addition, they are recommended for permanent or long term installations and where the load may slide on the shackle pin causing the pin to rotate. The bolt-type shackle's secondary securement system, utilizing a nut and cotter, eliminates the requirement to tighten nut before each lift or movement of load.

QUIC-CHECK®



All Crosby Shackles, with the exception of 2160, 2169, 2170, 252 and 253 styles incorporate markings forged into the product that address an easy to use **QUIC-CHECK®** feature. Angle indicators are forged into the shackle bow at 45 degree** angles from vertical. These are utilized on screw pin and bolt type shackles to quickly check the approximate angle of a two-legged hitch, or quickly check the angle of a single leg hitch when the shackle pin is secured and the pull of the load is off vertical (side loaded), thus requiring a reduction in the working load limit of the shackle.

** **Round Pin Shackles** utilize the 45 degree **QUIC-CHECK®** indicators to ensure load is applied strictly in-line.



Technical Information

2006/42/EC highlights the responsibility of the manufacturer, distributor and end user of lifting gear. Gunnebo Industries shackles are specified, monitored and documented in compliance with the most stringent requirements for the product concerned. A certified ISO 9001:2008 to 9001:2015 system is an evidence of our quality standard. See website or user instructions for assembly instructions. Meets listed current specifications and standards at time of publication of this catalog.

Instructions For Safe Use

1. The user is obliged to keep a valid Test Certificate for any shackle being used in a lifting operation.
2. Before use each shackle should be inspected to ensure that:
 - all markings in the body and the pin of the shackle are legible and in compliance with the relevant Test Certificate.
 - the shackle pin is of the correct type.
 - the body and pin are not distorted or unduly worn.
 - The body and pin are free from nicks, cracks, grooves and corrosion.
 - If there is any doubt with regards to the above criteria being met, the shackle should not be used for a lifting operation.
3. It is important to ensure that the pin is safely locked after assembly. For repeated lifting between inspections of the gear, it is recommended to use a safety bolt type shackle with nut and split-pin - the user must ensure that the split-pin is fitted, to prevent the nut from unscrewing during use.
4. Incorrect seating of a pin may be due to a bent pin, damaged threads or misalignment of the holes. Do not use the shackle under these circumstances, but refer the matter to a competent person (i.e. dealer, manufacturer)
5. Shackles should be fitted to the load in a manner that allows the shackle body to take the load in a straight line along its centerline to avoid undue bending stresses which will reduce the load capacity of the shackle. When using shackles in conjunction with multi-leg slings, due consideration should be given to the effect of the angle between the sling legs. When a shackle is used to secure the top block of a set of block and tackle the load on this shackle is increased by the value of the hoisting effect.
6. To avoid eccentric loading of the shackle it is recommended to center load on pin as far as possible over the total length of the pin or to use loose spacers.
7. Never modify, repair or reshape a shackle by welding, heating or bending as this will affect the nominal WLL.
8. Never heat treat a shackle as this may affect the WLL.

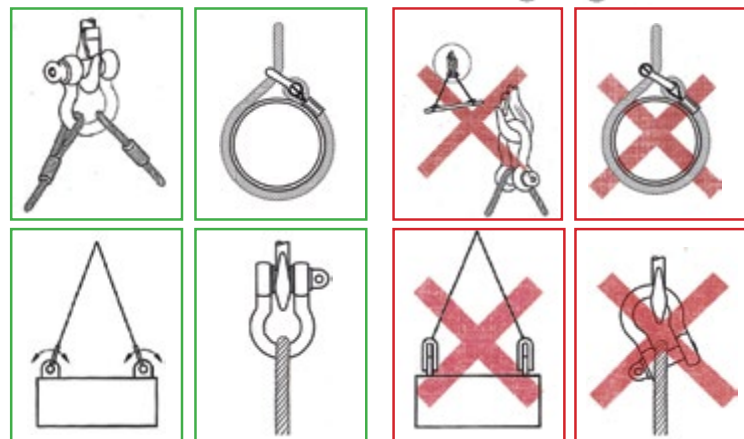
Side loads should be avoided as the products are not designed for this purpose. If side loads cannot be avoided, the following reduction factors must be taken into account:

Reduction for side loading

Load angle	New Working Load Limit
0°	100% of original WLL
45°	70% of original WLL
90°	50% of original WLL

Avoid applications where, due to load movement, the shackle pin can rotate

Shackle must be loaded in straight direction



Temperature

If extreme temperature situations are applicable, the following load reductions must be taken into account.

Reduction for elevated temperatures

Temperature:	New Working Load Limit
-20 - 200° C	100% of original Working Load Limit
200 - 300° C	90% of original Working Load Limit
300 - 400° C	75% of original Working Load Limit
> 400° C	not allowed

Crosby® HOIST HOOKS

WARNINGS & APPLICATION INSTRUCTIONS

**WARNING**

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- See OSHA Rule 1926.1431(g)(1)(i)(A) and 1926.1501(g)(4)(iv)(B) for personnel hoisting by cranes and derricks, and OSHA Directive CPL 2-1.36 - Interim Inspection Procedures During Communication Tower Construction Activities. A Crosby 319, L-320 or L-322 hook with a PL latch attached and secured with a bolt, nut and cotter pin (or toggle pin) may be used for lifting personnel. A Crosby 319N, L-320N or L-322N hook with an S-4320 latch attached and secured with cotter pin or bolt, nut and pin; or a PL-N latch attached and secured with toggle pin may be used for lifting personnel. A hook with a Crosby SS-4055 latch attached shall NOT be used for personnel lifting.
- See OSHA Directive CPL 2-1.36 - Crosby does not recommend the placement of lanyards directly into the positive locking Crosby hook when hoisting personnel. Crosby requires that all suspension systems (vertical lifelines / lanyard) shall be gathered at the positive locked load hook by use of a master link, or a bolt-type shackle secured with cotter pin.
- Threads may corrode and/or strip and drop the load.
- Remove securement nut to inspect or to replace L-322, S-3316, and S-3319 bearing washers (2).
- Hook must always support the load. The load must never be supported by the latch.
- Never apply more force than the hook's assigned Working Load Limit (WLL) rating.
- Read and understand these instructions before using hook.

QUIC-CHECK® Hoist hooks incorporate markings forged into the product which address two (2) **QUIC-CHECK®** features:

1. **Deformation Indicators** – Two strategically placed marks, one just below the shank or eye and the other on the hook tip, which allows for a **QUIC-CHECK®** measurement to determine if the throat opening has changed, thus indicating abuse or overload.
2. **To check**, use a measuring device (i.e., tape measure) to measure the distance between the marks. The marks should align to either an inch or half-inch increment on the measuring device. If the measurement does not meet criteria, the hook should be inspected further for possible damage.
3. **Angle Indicators** – Indicates the maximum included angle which is allowed between two (2) sling legs in the hook. These indicators also provide the opportunity to approximate other included angles between two sling legs.

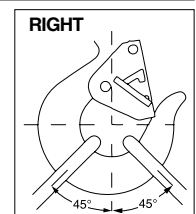
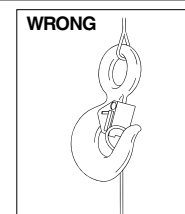
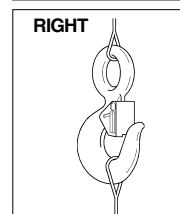
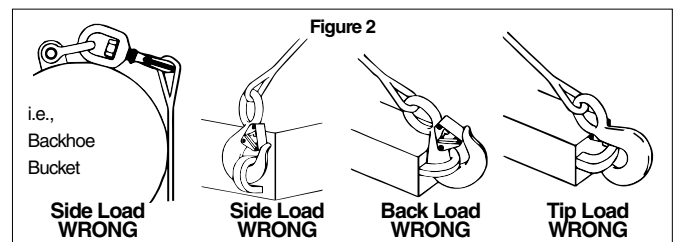
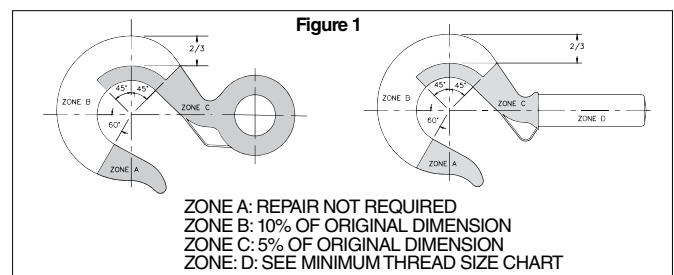
**IMPORTANT SAFETY INFORMATION - READ & FOLLOW**

A visual periodic inspection for cracks, nicks, wear, gouges and deformation as part of a comprehensive documented inspection program, should be conducted by trained personnel in compliance with the schedule in ASME B30.10.

- For hooks used in frequent load cycles or pulsating loads, the hook and threads should be periodically inspected by Magnetic Particle or Dye Penetrant (Note: Some disassembly may be required).
- Never use a hook whose throat opening has been increased, or whose tip has been bent more than 10 degrees out of plane from the hook body, or is in any other way distorted or bent.

Note: A latch will not work properly on a hook with a bent or worn tip.

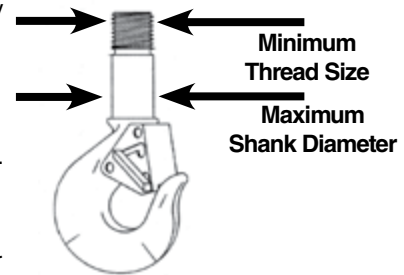
- Never use a hook that is worn beyond the limits shown in Figure 1.
- Any crack in a hook is reason to take it out of service. Hooks with a nick or gouge can be repaired only by a qualified person by grinding lengthwise, following the contour of the hook, provided that the reduced dimension is within the limits shown in Figure 1. Contact Crosby Engineering to evaluate any crack.
- Never repair, alter, rework, or reshape a hook by welding, heating, burning, or bending.
- Never side load, back load, or tip load a hook. (Side loading, back loading and tip loading are conditions that damage and reduce the capacity of the hook.) (See Figure 2)
- Eye, Shank and Swivel hooks are designed to be used with wire rope or chain. Clevis hooks are design to be used with chain. Efficiency of assembly may be reduced when used with synthetic material.
- Do not swivel the L-322, S-3316, or S-3319 swivel hooks while supporting a load. These hooks are distinguishable by hex nuts and flat washers.
- The L-3322 swivel hook is designed to rotate under load. The L-3322 is distinguishable from the L-322 by use of a round nut designed to shield bearing.
- The frequency of bearing lubrication on the L-3322 depends upon frequency and period of product use as well as environmental conditions, which are contingent upon the user's good judgment.
- The use of a latch may be mandatory by regulations or safety codes; e.g., OSHA, MSHA, ANSI/ASME B30, Insurance, etc. (Note: When using latches, see instructions in "Understanding The Crosby Group Warnings" for further information.)
- Always make sure the hook supports the load (See Figure 3). The latch must never support the load (See Figure 4).
- When multileg slings are placed in the base (bowl/saddle) of the hook, the maximum included angle between sling legs shall be 90 deg. The maximum sling leg angle with respect to the hook centerline for any rigging arrangement shall be 45 degrees. A collector ring, such as a link or shackle, should be used to maintain in-line load when more than two legs are placed in a hook or for angles greater than 45 degrees with respect to hook centerline. When more than two legs are placed in the hook bunching of the legs shall be avoided.
- See ASME B30.10 "Hooks" for additional information.



READ AND UNDERSTAND THESE INSTRUCTIONS BEFORE USING HOOKS **IMPORTANT – BASIC MACHINING AND THREAD INFORMATION**

- Wrong thread and/or shank size can cause stripping and loss of load.
- The maximum diameter is the largest diameter, after cleanup, that could be expected after allowing for straightness, pits, etc.
- All threads must be Class 2 or better.
- The minimum thread length engaged in the nut should not be less than one (1) thread diameter. Install a properly sized retention device to secure the nut to the hook shank after the nut is properly adjusted at assembly. Nut retention devices such as set screws or roll pins are suitable for applications using anti-friction thrust bearings or bronze thrust washers. If the hook is intended for other applications that introduce a higher torque into the nut, a more substantial retaining device may be required.
- Hook shanks are not intended to be swaged on wire rope or rod.
- Hook shanks are not intended to be drilled (length of shank) and internally threaded.

- Crosby can not assume responsibility for, (A) the quality of machining, (B) the type of application, or (C) the means of attachment to the power source or load.
- Consult the Crosby Hook Identification & Working Load Limit Chart (See below) for the minimum thread size for assigned Working Load Limits (WLL).†
- Remove from service any Hook which has threads corroded more than 20% of the nut engaged length.



CROSBY HOOK IDENTIFICATION & WORKING LOAD LIMIT CHART†

Hook Identification			Working Load Limit (t)						Frame Size	Maximum Shank Diameter after Machining (in)	Minimum Thread Size	
319C 319CN L-320C L-320CN L-322C L-322CN	319AN L-320A L-322A L-322AN 3319 L-3322B	319BN	319C 319CN L-320C L-320CN L-322C L-322CN	319A 319AN L-320A L-320AN L-322A L-322AN L-3322B	319BN	S-3319	S-3316	319C 319CN (Carbon)			319A 319AN (Alloy)	
DC	DA	DB	.75	1	.5	—	—	D	.53	1/2 - 13unc	1/2 - 13 unc	
FC	FA	FB	1	1.5	.6	—	.45	F	.62	5/8 - 11unc	5/8 - 11 unc	
GC	GA	GB	1.5	2	1	—	—	G	.66	5/8 - 11unc	5/8 - 11 unc	
HC	HA	HB	2	3	1.4	1.63	.91	H	.81	3/4 - 10unc	3/4 - 10 unc	
IC	IA	IB	3	*4.5 / 5	2.0	2.5	—	I	1.03	7/8 - 9unc	7/8 - 9 unc	
JC	JA	JB	5	7	3.5	4.5	—	J	1.27	1-1/8 - 7unc	1-1/8 - 7 unc	
KC	KA	KB	7.5	11	5.0	—	—	K	1.52	1-1/4 - 7unc	1-3/8 - 6 unc	
LC	LA	LB	10	15	6.5	—	—	L	1.75	1-5/8 - 8un	1-5/8 - 8 un	
NC	NA	NB	15	22	10	—	—	N	2.00	2 - 8un	2 - 8 un	
OC	OA	—	20	30	—	—	—	O	2.50	2-1/4 - 8un	2-1/4 - 8 un	
PC	PA	—	25	37	—	—	—	P	3.50	2-3/4 - 8un	2-3/4 - 8 un	
SC	SA	—	30	45	—	—	—	S	3.50	3 - 8un	3 - 8 un	
TC	TA	—	40	60	—	—	—	T	4.00	3-1/4 - 8un	3-1/2 - 8 un	
UC	UA	—	50	75	—	—	—	U	4.50	3-3/4 - 8un	4 - 4 unc	
—	WA	—	—	100	—	—	—	W	6.12	—	4-1/2 - 8 un	
—	XA	—	—	150	—	—	—	X	6.38	—	5-1/2 - 8 un	
—	YA	—	—	200	—	—	—	Y	7.00	—	6-1/4 - 8 un	
—	ZA	—	—	300	—	—	—	Z	8.62	—	7-1/2 - 8 un	

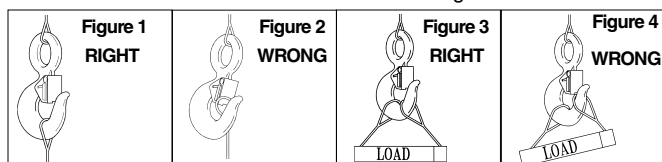
* 319AN, L-320AN, L-3322 and L-322AN are rated at 5 tons.

† Working Load Limit - The maximum mass or force which the product is authorized to support in general service when the pull is applied in-line, unless noted otherwise, with respect to the centerline of the product. This term is used interchangeably with the following terms: 1. WLL, 2. Rated Load Value, 3. SWL, 4. Safe Working Load, 5. Resultant Safe Working Load.

Warning and Application Instructions For Crosby® Hook Latch Kit

IMPORTANT SAFETY INFORMATION - READ & FOLLOW

- Always inspect hook and latch before using.
- Never use a latch that is distorted or bent.
- Always make sure spring will force the latch against the tip of the hook.
- Always make sure hook supports the load. The latch must never support the load (See Figures 1 & 2).
- When placing two (2) sling legs in hooks, make sure the angle between the legs is less the 90° and if the hook or load is tilted, nothing bears against the bottom of this latch (See Figures 3 & 4).
- Latches are intended to retain loose sling or devices under slack conditions.
- Latches are not intended to be an anti-fouling device.



⚠ WARNING

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- See OSHA Rule 1926.1431(g)(1)(i)(A) and 1926.1501(g)(4)(iv)(B) for personnel hoisting for cranes and derricks. Only a Crosby or McKissick hook with a PL Latch attached and secured with bolt, nut and cotter (or Crosby Toggle Pin) or a Crosby hook with a S-4320 Latch attached and secured with a cotter pin, or a Crosby SHUR-LOC® hook in the locked position may be used for any personnel hoisting. A hook with a Crosby SS-4055 latch attached shall NOT be used for personnel lifting.
- Hook must always support the load. The load must never be supported by the latch.
- DO NOT use this latch in applications requiring non-sparking.
- Read and understand these instructions before using hook and latch.

McKissick® HOIST HOOKS

WARNINGS & APPLICATION INSTRUCTIONS



WARNING

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- See OSHA Rule 1926.1431(g)(1)(i)(A) and 1926.1501(g)(4)(iv) (B) for personnel hoisting by cranes and derricks, and OSHA Directive CPL 2-1.36 - Interim Inspection Procedures During Communication Tower Construction Activities. A Crosby 319, L-320 or L-322 hook with a PL latch attached and secured with a bolt, nut and cotter pin (or toggle pin) may be used for lifting personnel. A Crosby 319N, L-320N or L-322N hook with an S-4320 latch attached and secured with cotter pin or bolt, nut and pin; or a PL-N latch attached and secured with toggle pin may be used for lifting personnel. A hook with a Crosby SS-4055 latch attached shall NOT be used for personnel lifting.
- See OSHA Directive CPL 2-1.36 - Crosby does not recommend the placement of lanyards directly into the positive locking Crosby hook when hoisting personnel. Crosby requires that all suspension systems (vertical lifelines / lanyard) shall be gathered at the positive locked load hook by use of a master link, or a bolt-type shackle secured with cotter pin.
- Threads or Split-Nut may corrode and/or strip and drop the load.
- Remove securement nut to inspect or to replace S-322 and S-3319 bearing washers (2).
- Hook must always support the load. The load must never be supported by the latch.
- Never apply more force than the hook's assigned Working Load Limit (WLL) rating.
- Read and understand these instructions before using hook.

QUIC-CHECK® Hoist hooks incorporate markings forged into the product which address two (2) QUIC-CHECK® features:

Deformation Indicators - Two strategically placed marks, one just below the shank or eye and the other on the hook tip, which allows for a

QUIC-CHECK® measurement to determine if the throat opening has changed, thus indicating abuse or overload.

To check, use a measuring device (i.e., tape measure) to measure the distance between the marks. The marks should align to either an inch or half-inch increment on the measuring device. If the measurement does not meet criteria, the hook should be inspected further for possible damage.

Angle Indicators - Indicates the maximum included angle which is allowed between two (2) sling legs in the hook. These indicators also provide the opportunity to approximate other included angles between two sling legs.



IMPORTANT SAFETY INFORMATION - READ & FOLLOW

- A visual periodic inspection for cracks, nicks, wear, gouges and deformation as part of a comprehensive documented inspection program, should be conducted by trained personnel in compliance with the schedule in ASME B30.10.
- For hooks used in frequent load cycles or pulsating loads, the hook and threads should be periodically inspected by Magnetic Particle or Dye Penetrant. (Note: Some disassembly may be required.)
- Never use a hook whose throat opening has been increased, or whose tip has been bent more than 10 degrees out of plane from the hook body, or is in any other way distorted or bent.

- **Note: A latch will not work properly on a hook with a bent or worn tip.**
- Never use a hook that is worn beyond the limits shown in Figure 1.
- Any crack in a hook is reason to take it out of service. Hooks with a nick or gouge can be repaired only by a qualified person by grinding lengthwise, following the contour of the hook, provided that the reduced dimension is within the limits shown in Figure 1. Contact Crosby Engineering to evaluate any crack.
- Remove from service any hook which has threads corroded more than 20% of the nut engagement length.
- Never repair, alter, rework, or reshape a hook by welding, heating, burning, or bending.
- Never side load, back load, or tip load a hook. (Side loading, back loading and tip loading are conditions that damage and reduce the capacity of the hook.) (See Figure 2)
- Eye hooks, shank hooks and swivel hooks are designed to be used with wire rope or chain. Efficiency of assembly may be reduced when used with synthetic material.
- Do not swivel the L-322 or S-3319 swivel hooks while supporting a load. These hooks are distinguishable by hex nuts and flat washers.
- The L-3322 swivel hook is designed to rotate under load. The L-3322 is distinguishable from the L-322 by use of a round nut designed to shield bearing.
- The frequency of bearing lubrication on the L-3322 depends upon frequency and period of product use as well as environmental conditions, which are contingent upon the user's good judgment.
- The use of a latch may be mandatory by regulations or safety codes; e.g., OSHA, MSHA, ASME B30, Insurance, etc.. (Note: When using latches, see instructions in "Understanding: The Crosby Group Warnings" for further information.)
- Always make sure the hook supports the load (See Figure 3). The latch must never support the load (See Figure 4).
- When multileg slings are placed in the base (bowl/saddle) of the hook, the maximum included angle between sling legs shall be 90 deg. The maximum sling leg angle with respect to the hook centerline for any rigging arrangement shall be 45 degrees. A collector ring, such as a link or shackle, should be used to maintain in-line load when more than two legs are placed in a hook or for angles greater than 45 degrees with respect to hook centerline. When more than two legs are placed in the hook bunching of the legs shall be avoided.
- Reference Crosby's Hoist Hook Warning and Application Information for basic machining and minimum thread size.
- See ASME B30.10 "Hooks" for additional information.

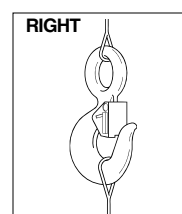
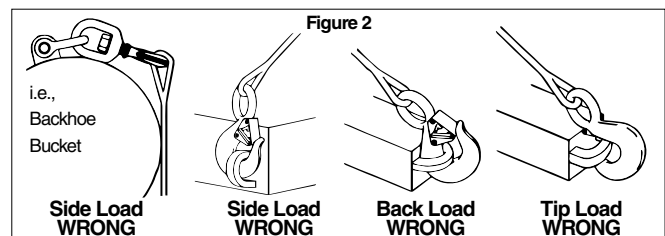
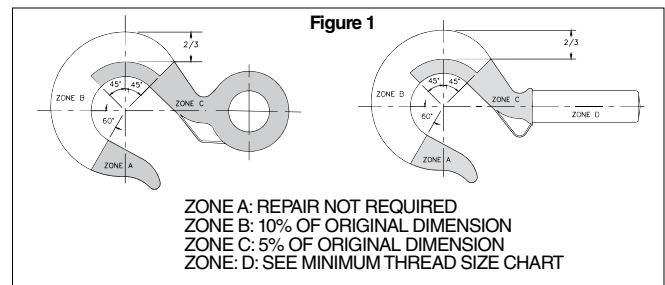


Figure 3

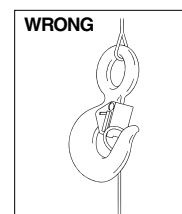


Figure 4

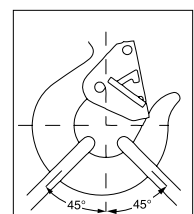


Figure 5

Removal of Split-Nut assembly (Reference Figure A):

- Remove vinyl cover.
- Remove spring retaining ring.
- Slide steel keeper ring off split nuts **⚠ CAUTION** Removal of keeper ring will allow split nut halves to fall from hook shank).
- Remove split nut halves.

Inspection of split nut assembly and hook shank interface area (Reference Figure B):

- Inspect hook shank and split nut for signs of deformation on and adjacent to the load bearing surfaces.
- Inspect outside corner of hook shank load bearing surface to verify the corner is sharp.
- Verify retaining ring groove will allow proper seating of the retaining ring.
- Inspect retaining ring for corrosion or deformation. Remove from service any retaining ring that has excessive corrosion or is deformed.
- Use fine grit emery or crocus cloth to remove any corrosion from machined hook shank and split nut assembly.
- Follow inspection recommendations listed in this document under IMPORTANT SAFETY INFORMATION.
- If corrosion is present on the nut / shank interface area and deterioration or degradation of the metal components is evident, further inspection is required.
 - The use of a feeler gauge is required to properly measure the maximum allowable gap width between the split nut inside diameters and shank outside diameters.
 - With one split nut half seated against the hook shank, push the nut to one side and measure the maximum gaps as shown in Figure B. The hook should be measured in four places, 90-degrees apart.
 - Repeat above inspection procedure with other half of split nut.
 - Remove from service any hook and split nut assembly that exhibits a gap greater than 0.030".

Installation of split nut assembly (Reference Figure A):

- Coat hook shank and inside of split nut with an anti-seize compound or heavy grease.
- Install split nut halves onto shank. The flanged bottom of the split nut should be closest to the hook shoulder.

- Slide steel keeper ring over split nut halves. Verify the split nut halves properly seat against the load bearing surface of the hook shank and the steel keeper ring seats against the flange of the split nut.
- Install retaining ring onto split nut halves. Verify the retaining ring seats properly in the retaining ring groove on the outside diameter of the split nut assembly.
- Install vinyl cover over split nut and hook shank assembly.
- Verify all fasteners are correctly installed.
- Always use Genuine Crosby replacement parts.

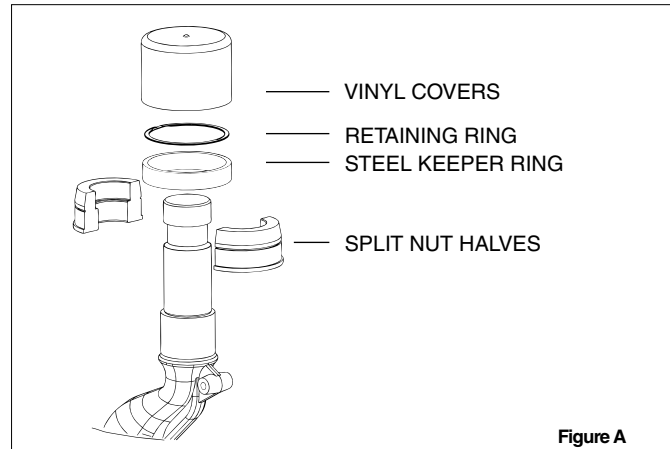


Figure A

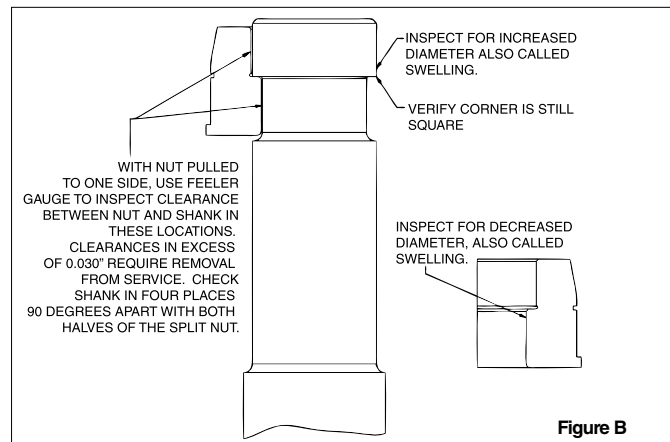
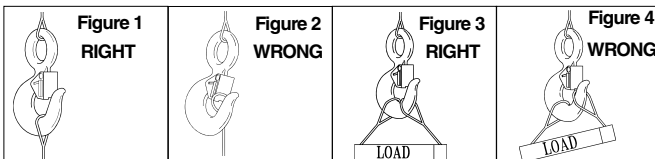


Figure B

Warning and Application Instructions For McKissick® Hook Latch Kit

IMPORTANT SAFETY INFORMATION - READ & FOLLOW

- Always inspect hook and latch before using.
- Never use a latch that is distorted or bent.
- Always make sure spring will force the latch against the tip of the hook.
- Always make sure hook supports the load. The latch must never support the load (See Figures 1 & 2).
- When placing two (2) sling legs in hooks, make sure the angle between the legs is less the 90° and if the hook or load is tilted, nothing bears against the bottom of this latch (See Figures 3 & 4).
- Latches are intended to retain loose sling or devices under slack conditions.
- Latches are not intended to be an anti-fouling device.



⚠ WARNING

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- See OSHA Rule 1926.1431(g)(1)(i)(A) and 1926.1501(g)(4)(iv) (B) for personnel hoisting for cranes and derricks. Only a Crosby or McKissick hook with a PL Latch attached and secured with bolt, nut and cotter (or Crosby Toggle Pin) or a Crosby hook with a S-4320 Latch attached and secured with a cotter pin, or a Crosby SHUR-LOC® hook in the locked position may be used for any personnel hoisting. A hook with a Crosby SS-4055 latch attached shall NOT be used for personnel lifting.
- Hook must always support the load. The load must never be supported by the latch.
- Do not use this latch in applications requiring non-sparking.
- Read and understand these instructions before using hook and latch.

Crosby® / BULLARD® GOLDEN GATE® HOOKS

WARNINGS & APPLICATION INSTRUCTIONS



QUIC-CHECK® Hoist Hooks incorporate markings forged into the product which address two (2) **QUIC-CHECK®** features:

Deformation Indicators – Two strategically placed marks, one just below the shank or eye and the other on the hook tip, which allows for a **QUIC-CHECK®** measurement to determine if the throat opening has changed, thus indicating abuse or overload.

To check, use a measuring device (i.e., tape measure) to measure the distance between the marks. The marks should align to either an inch or half-inch increment on the measuring device. If the measurement does not meet criteria, the hook should be inspected further for possible damage.

Angle Indicators – Indicates the maximum included angle which is allowed between two (2) sling legs in the hook. These indicators also provide the opportunity to approximate other included angles between two sling legs.

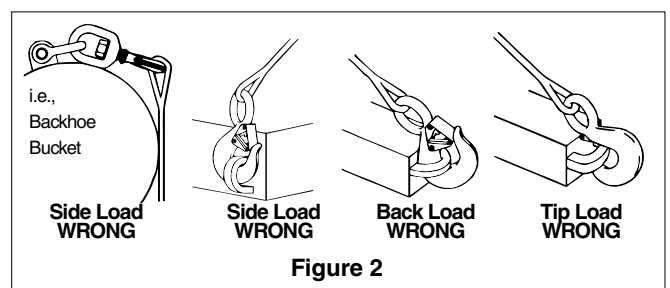
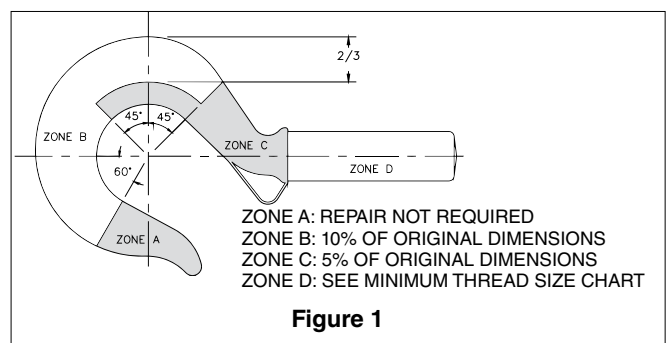


IMPORTANT SAFETY INFORMATION - READ & FOLLOW

- A visual periodic inspection for cracks, nicks, wear, gouges and deformation as part of a comprehensive documented inspection program, should be conducted by trained personnel in compliance with the schedule in ANSI B 30.10.
- For hooks used in frequent load cycles or pulsating loads, the hook and threads should be periodically inspected by Magnetic Particle or Dye Penetrant. (Note: Some disassembly may be required.)
- See WARNING box and Figure 6 for special instructions for securing the nut to the shank at assembly.
- Never use a hook whose throat opening has been increased, or whose tip has been bent more than 10 degrees out of plane from the hook body, or is in any other way distorted or bent. **Note: A gate will not work properly on a hook with a bent or worn tip.**
- Manual - closing gates must be completely closed for the lock to work.
- Never use a hook that is worn beyond the limits shown in Figure 1.
- Remove from service any hook with a crack, nick, or gouge. Hooks with a nick or gouge shall be repaired by grinding lengthwise, following the contour of the hook, provided that the reduced dimension is within the limits shown in Figure 1. Contact Crosby Engineering to evaluate any crack.
- Never repair, alter, rework, or reshape a hook by welding, heating, burning, or bending.
- Never side load, back load, or tip load a hook. Side loading, back loading and tip loading are conditions that damage and reduce the capacity of the hook (See Figure 2).
- Eye hooks, shank hooks and swivel hooks are designed to be used with wire rope or chain. Efficiency of assembly may be reduced when used with synthetic material.

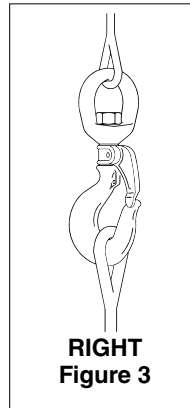
⚠ WARNING

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- Before using, inspect the hook and gate daily to ensure it is in proper operating condition.
- Failure to properly insert the pin could result in the load falling.
- All Golden Gate® Hooks with threaded shanks require a pin to secure the nut to the shank. This pin prevents the nut from backing off or unscrewing from the threads and causing the load to drop.
- If the pin and nut are removed from the shank to replace any hook components, the pin and nut must be installed before use.
NOTE: 1. If a solid pin was used, the old pin "must" be discarded and a new pin inserted to secure the nut to the shank.
2. If a spring pin (coil type) was used, it may be reused provided that the spring pin and / or the drill hole was not damaged.
- The gate is not a load-bearing device. Do not allow the sling or other loads to bear against the gate.
- Threads may corrode and / or strip and drop the load.
- Hands, fingers and body should be kept away from the hook and load whenever possible.
- Never apply more force than the hook's assigned Working Load Limit (WLL) rating.
- Read and understand these instructions before using.

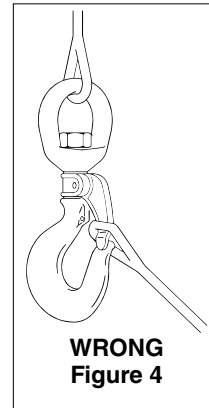


- The use of a latch may be mandatory by regulations or safety codes: e.g., OSHA, MSHA, ASME B30, Insurance etc.
- Always make sure the hook supports the load (See Figure 3). The gate must never support the load (See Figure 4).
- When multileg slings are placed in the base (bowl/saddle) of the hook, the maximum included angle between sling legs shall be 90 deg. The maximum sling leg angle with respect to the hook centerline for any rigging arrangement shall be 45 degrees. A collector ring, such as a link or shackle, should be used to maintain in-line load when more than two legs are placed in a hook or for angles greater than 45 degrees with respect to hook centerline. When more than two legs are placed in the hook bunching of the legs shall be avoided.
- See ASME B30.10 "Hooks" for additional information.
- If any of the following conditions exist, remove hook from service immediately and repair with genuine Crosby / Bullard Golden Gate® hook parts or replace the hook.
 - The gate does not lock in the closed position.
 - The gate is worn, deformed, inoperative, or fails to bridge the hook throat opening.
 - Load pins or bolts in the chain connectors are worn or bent.

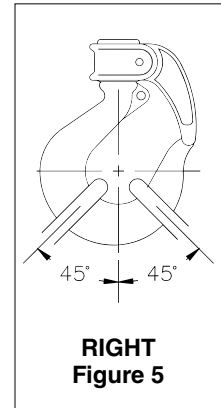
- When hook is used to support a hoist, the weight of the hoist must be deducted from the assigned hook Working Load Limit.
- The rated capacity of chain connector hook assemblies must equal or exceed the capacity of the hoist.



RIGHT
Figure 3



WRONG
Figure 4



RIGHT
Figure 5

Important – Basic Machining and Thread Information – Read and Follow

- Wrong thread and/or shank size can cause stripping and loss of load.
- The maximum diameter is the largest diameter that will fit into the gate.
- All threads must be Class 2 or better.
- The minimum thread length engaged in the nut should not be less than one (1) thread diameter.
- All nuts must be secured to the shank by cross drilling the nut and threaded shank and inserting the appropriate coil type spring pin (See WARNING box and Figure 6 for special instructions).
- Coil type spring pin must be as long as the distance across the nut flats or diameter (See Figure 6).
- Consult the Crosby / Bullard Golden Gate® Hook Identification and Working Load Limit Chart (See below) for the coil type spring pin diameter.
- Remove any hook from service that requires a larger coil type spring than that shown in the chart below.

- Hook shanks are not intended to be swaged on wire rope or rod.
- Hook shanks are not intended to be drilled and internally threaded.
- Crosby cannot assume responsibility for:
 - (A) the quality of machining,
 - (B) the type of application, or
 - (C) the means of attachment to the power source or load.
- Consult the Crosby/Bullard Golden Gate® Hook Identification & Working Load Limit Chart (below) for the minimum thread size for assigned Working Load Limits (WLL). +
- Remove from service any hook which has threads corroded more than 20% of the nut engaged length.

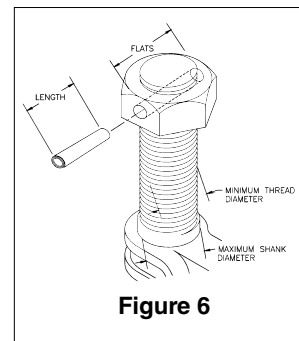


Figure 6

Crosby® / Bullard Golden Gate® Hook Identification and Working Load Limit Chart

Hook / Gate Size	Working Load Limit ** + (t)	Maximum Shank Diameter (in)	Minimum Thread Size	Spring* Pin Size (in)	Drilled Hole Size (in)	Hook / Gate Size	Working Load Limit (t)	Maximum Shank Diameter (in)	Minimum Thread Size	Spring* Pin Size (in)	Drilled Hole Size (in)
1	.5	—	—	—	—	11	9.2	1.497	1-1/2 - 6 UNC	5/16	.308 / .319
2	1.0	.498	1/2 - 13 UNC	1/8	.124 / .129	12	12.3	1.622	1-5/8 - 5-1/2 UNC	5/16	.308 / .319
3	1.4	.559	9/16 - 12 UNC	1/8	.124 / .129	13	15.0	1.747	1-3/4 - 5 UNC	3/8	.370 / .383
4	1.7	.623	5/8 - 11 UNC	1/8	.124 / .129	14	18.5	1.997	2 - 4-1/2 UNC	3/8	.370 / .383
5	2.3	.747	3/4 - 10 UNC	5/32	.155 / .160	16	24.7	2.747	2-3/4 - 4 UNC	1/2	.493 / .510
6	4.0	.872	7/8 - 9 UNC	3/16	.185 / .192	16-A	33.0	2.747	2-3/4 - 4 UNC	1/2	.493 / .510
7	4.2	.997	1 - 8 UNC	3/16	.185 / .192	17	49.5	3.996	4 - 4 UNC	3/4	.743 / .760
8	5.5	1.122	1-1/8 - 7 UNC	1/4	.247 / .256	17-A	66.0	3.996	4 - 4 UNC	3/4	.743 / .760
9	7.2	1.247	1-1/4 - 7 UNC	1/4	.247 / .256	—	—	—	—	—	—

* Heavy Duty Coil Type Spring Pin.

** Minimum ultimate strength is 4 times the Working Load Limit.

+ Working Load Limit - The maximum mass or force which the product is authorized to support in general service when the pull is applied in-line, unless noted otherwise with respect to centerline of the product. This term is used interchangeably with the following terms: 1. WLL, 2. Rated Load Value, 3. SWL, 4. Safe Working Load, 5. Resultant Safe Working Load. Ultimate Load is 4 times the Working Load.

S-4320 HOOK LATCH KIT

WARNINGS & APPLICATION INSTRUCTIONS



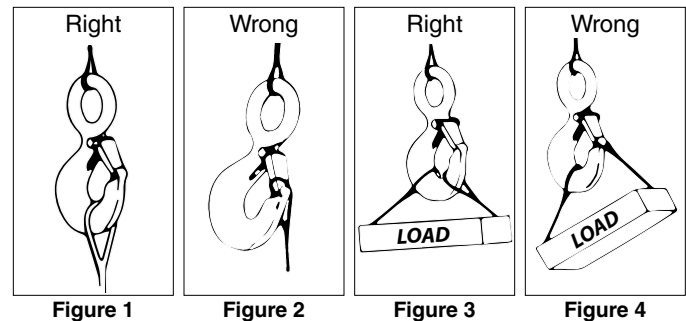
(For Crosby 319N, 320N, and 322N, S-1327, and A-1339 Hooks)

Important Safety Information - Read & Follow

- Always inspect hook and latch before using.
- Never use a latch that is distorted or bent.
- Always make sure spring will force the latch against the tip of the hook.
- Always make sure hook supports the load. The latch must never support the load (See Figures 1 & 2).
- When placing two (2) sling legs in hook, make sure the angle between the legs is less than 90° and if the hook or load is tilted, nothing bears against the bottom of this latch (See Figures 3 & 4).
- Latches are intended to retain loose sling or devices under slack conditions.
- Latches are not intended to be an anti-fouling device.
- When using latch for personnel lifting, select proper cotter pin (See Figure 5). See Step 7 below for proper installation instructions.
 - Never reuse a bent cotter pin.
 - Never use a cotter pin with a smaller diameter or different length than recommended in Figure 5.
 - Never use a nail, a welding rod, wire, etc., in place of recommended cotter pin.
 - Always ensure cotter pin is bent so as not to interfere with sling operation.
 - Periodically inspect cotter pin for corrosion and general adequacy.

⚠ WARNING

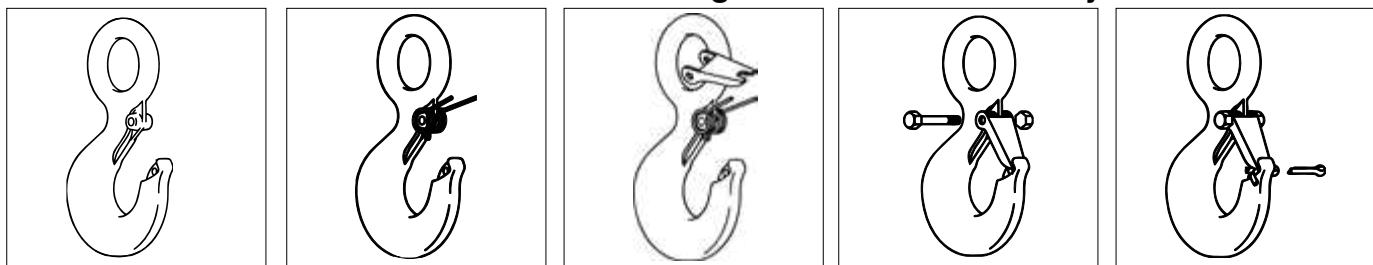
- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- Hook must always support the load. The load must never be supported by the latch.
- See OSHA Rule 1926.1431(g)(1)(i)(A) and 1926.1501(g)(4)(iv)(B) for Personnel Hoisting by Crane or Derricks. A Crosby S-319N, S-320N, S-322N, S-1327, and A-1339 Hook with an S-4320 latch attached (when secured with cotter pin) may be used for lifting personnel.
- An S-4320 Latch is only to be used with a Crosby S-319N, S-320N, S-322N, S-1327, and A-1339 Hook.
- DO NOT use this latch in applications requiring non-sparking.
- Read and understand these instructions before using hook and latch.



Hook Identification Code	Recommended Cotter Pin Dimensions (in)	
	Diameter	Length
D	1/8	3/4
F	1/8	3/4
G	1/8	1
H	3/16	1-1/4
I	1/4	1-1/2
J	5/16	2
K	5/16	2
L	3/8	3
N	3/8	3

† The current SS-4055 latch kit and the PL latch will not fit new 319N, 320N, or 322N hooks. They will continue to be offered in both styles to service existing hooks. Important – The new S4320 latch kit will not fit the old 319, 320, or 322 hooks.

IMPORTANT – Instructions for Assembling S-4320 Latch on Crosby 320N Hooks



Step 1

1. Place hook at approximately a 45 degree angle with the cam up.

Step 2

2. Position coils of spring over cam with legs of spring pointing toward point of hook and loop of spring positioned down and lying against the hook.

Step 3

3. Position latch to side of hook points. Slide latch onto spring legs between lockplate and latch body until latch is partially over hook cam. Then depress latch and spring until latch clears point of hook.

Steps 4, 5, & 6

4. Line up holes in latch with hook cam.
5. Insert bolt through latch, spring, and cam.
6. Tighten self-locking nut on one end of bolt.

Step 7 – For Personnel Lifting

7. With latch in closed position and rigging resting in bowl of hook, insert cotter pin through hook tip and secure by bending prongs.

Crosby® HOOK LATCH KIT

WARNINGS & APPLICATION INSTRUCTIONS



**SS-4055
(Stainless Steel)**

IMPORTANT SAFETY INFORMATION - READ & FOLLOW

- Always inspect hook and latch before using.
- Never use a latch that is distorted or bent.
- Always make sure spring will force the latch against the tip of the hook.
- Always make sure hook supports the load. The latch must never support the load (See Figures 1 & 2).
- When placing two (2) sling legs in hook, make sure the angle between legs is small enough and the legs are not tilted so that nothing bears against the bottom of the latch (See Figures 3 & 4).
- Latches are intended to retain loose sling or devices under slack conditions.
- Latches are not intended to be an anti-fouling device.

⚠ WARNING

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- See OSHA Rule 1926.1431(g)(1)(i)(A) and 1962.1501(g)(4)(iv)(B) A hook and this style latch must not be used for lifting personnel.
- Hook must always support the load. The load must never be supported by the latch.
- Read and understand these instructions before using hook and latch.

RIGHT



Figure 1

WRONG



Figure 2

RIGHT



Figure 3

WRONG

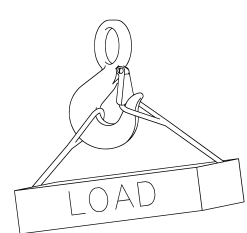
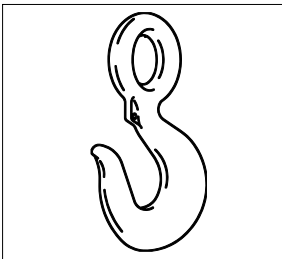


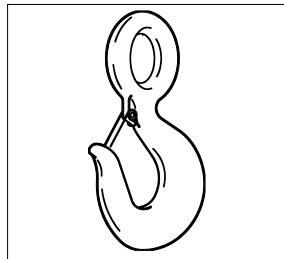
Figure 4

IMPORTANT – Instructions for Assembling Model SS-4055 Latch on Crosby Hooks



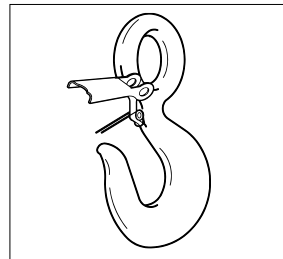
Step 1

1. Place hook at approximately a 45 degree angle with the cam up.



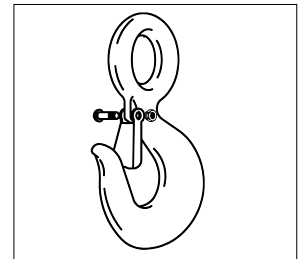
Step 2

2. Position coils of spring over cam with tines of spring pointing toward point of hook and loop of spring positioned down and lying against the hook.



Step 3

3. Position latch over tines of spring with ears partially over hook cam. Swing latch to one side of hook, point and depress latch and spring until latch clears point of hook.

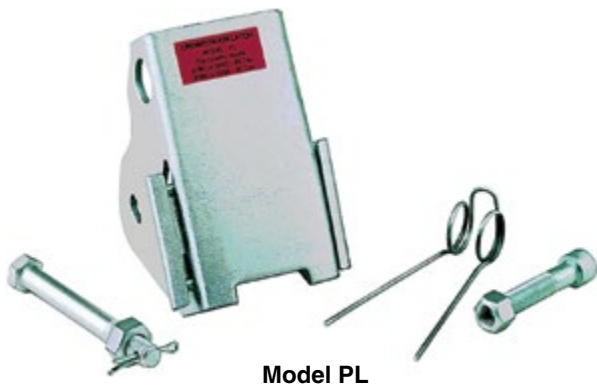


Steps 4, 5, & 6

4. Line up holes in latch with hook cam.
5. Insert bolt through latch, spring, and cam.
6. Tighten self-locking nut on one end of bolt.

Crosby® MODEL PL HOOK LATCH KIT

WARNINGS & APPLICATION INSTRUCTIONS

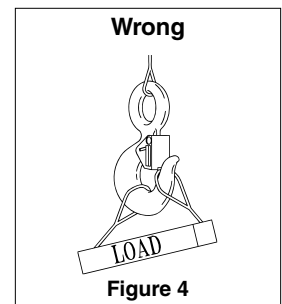
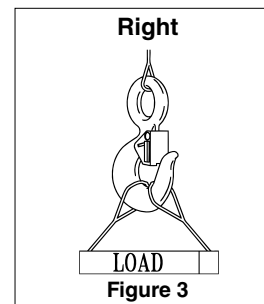
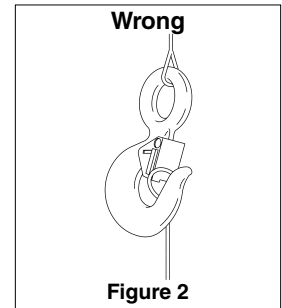
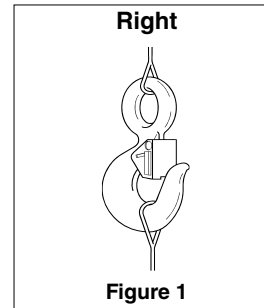


IMPORTANT SAFETY INFORMATION - READ & FOLLOW (Pat. USA & Canada)

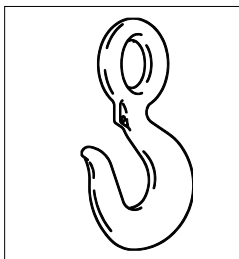
- Always inspect hook and latch before using.
- Never use a latch that is distorted or bent.
- Always make sure spring will force the latch against the tip of the hook.
- Always make sure hook supports the load. The latch must never support the load (See Figures 1 & 2).
- When placing two (2) sling legs in hook, make sure the angle between the legs is less than 90° and if the hook or load is tilted, nothing bears against the bottom of this latch (See Figures 3 & 4).
- Latches are intended to retain loose sling or devices under slack conditions.
- Latches are not intended to be an anti-fouling device.

⚠ WARNING

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- See OSHA Rule 1926.1431(g)(1)(i)(A) and 1926.1501(g)(4)(iv)(B) for Personnel Hoisting by Cranes or Derricks. A Crosby or McKissick Hook with a positive Locked PL or S-4320 Latch may be used to Lift Personnel.
- Hook must always support the load. The load must never be supported by the latch.
- DO NOT use this latch in applications requiring non-sparking.
- Read and understand these instructions before using hook and latch.

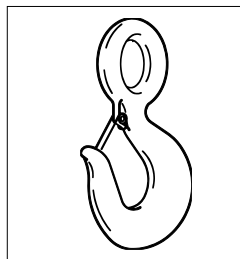


IMPORTANT - Instructions for Assembling Model PL Latch on Crosby or McKissick Hooks



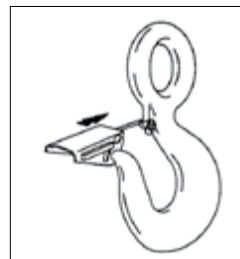
Step 1

1. Place hook at approximately a 45 degree angle with the cam up.



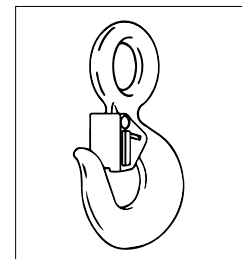
Step 2

2. Position coils of spring over cam with legs of spring pointing toward point of hook and loop of spring positioned down and lying against the hook.



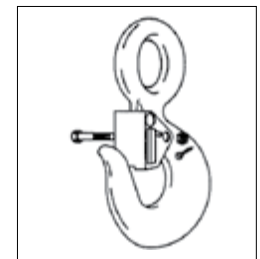
Step 3

3. Position latch to side of hook points. Slide latch onto spring legs between lockplate and latch body until latch is partially over hook cam. Then depress latch and spring until latch clears point of hook.



Steps 4, 5, & 6

4. Line up holes in latch with hook cam.
5. Insert bolt through latch, spring, and cam.
6. Tighten self-locking nut on one end of bolt.



Step 7 — For Personnel Lifting

7. With latch in closed position and rigging resting in bowl of hook, insert bolt through latch and secure with nut and cotter pin. When bolt, nut and cotter pin are not being used, store them in a designated place upon the personnel platform.

Crosby® MODEL PL-N/O HOOK LATCH KIT

WARNINGS & APPLICATION INSTRUCTIONS



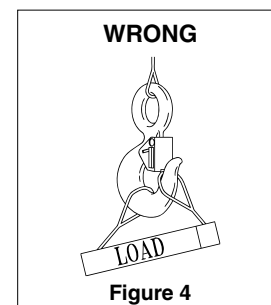
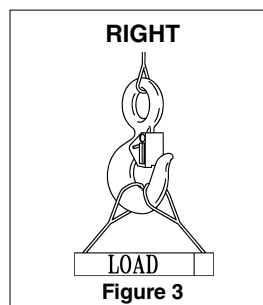
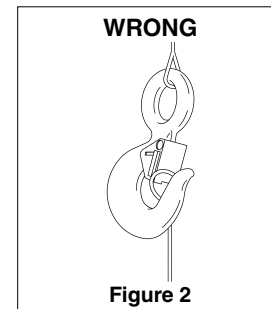
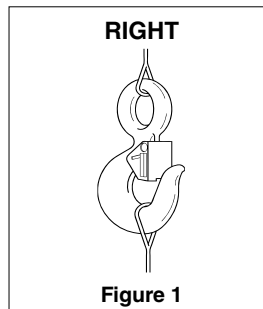
Model PL-N/O

IMPORTANT SAFETY INFORMATION - READ & FOLLOW

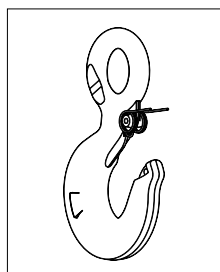
- Always inspect hook and latch before using.
- Never use a latch that is distorted or bent.
- Always make sure spring will force the latch against the tip of the hook.
- Always make sure hook supports the load. The latch must never support the load (See Figures 1 & 2).
- When placing two (2) sling legs in hook, make sure the angle between the legs is less than 90° and if the hook or load is tilted, nothing bears against the bottom of this latch (See Figures 3 & 4).
- Latches are intended to retain loose sling or devices under slack conditions.
- Latches are not intended to be an anti-fouling device.

⚠ WARNING

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- See OSHA Rule 1926.1431(g)(1)(i)(A) and 1926.1501(g)(4)(iv)(B) for Personnel Hoisting by Crane or Derricks. A Crosby or McKissick Hook with a Positive Locked PL-N/O or S-4320 Latch may be used to lift personnel.
- Hook must always support the load. The load must never be supported by the latch.
- DO NOT use this latch in applications requiring non-sparking.
- Read and understand these instructions before using hook and latch.

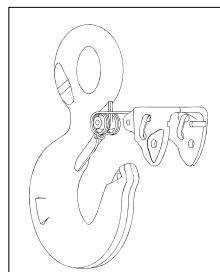


IMPORTANT - Instructions for Assembling Model PL-N/O Latch on Crosby or McKissick Hooks



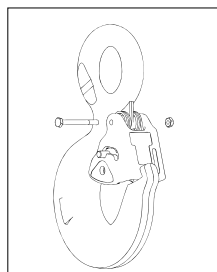
Step 1

1. Place hook in upright position. Position coils of spring over cam with legs of spring pointing toward tip of hook, and loop of spring positioned down and lying against the hook.



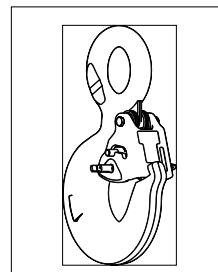
Step 2

2. Slip the latch over the spring until the two spring legs are positioned into the grooves located on the inside of the latch housing (legs of spring should fit between the gate and the housing).



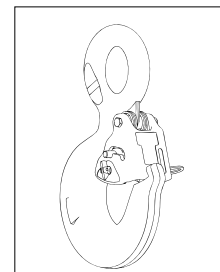
Step 3 4, 5, & 6

3. Slide latch housing up the spring legs until latch clears hook tip.
4. Resting latch on interlocking hook tip, line up holes in latch with hook cam.
5. Insert bolt through latch spring & cam.
6. Tighten self-locking nut on one end of bolt.



Step 7,8 - For Personnel Lifting

7. Rigging should be resting in bowl of hook, with latch in closed position and gate locked.
8. Insert toggle lock pin through hole and depress spring until toggle clears hole on other side of latch.



Step 9 - For Personnel Lifting

9. Rotate toggle 90 degrees to secure pin (ensure toggle is in closed position as shown).

Crosby® SHUR-LOC® HOOKS

WARNING & APPLICATION INSTRUCTIONS



Important Safety Information - Read and Follow

- A visual periodic inspection for cracks, nicks, wear, gouges and deformation as part of a comprehensive documented inspection program, should be conducted by trained personnel in compliance with the schedule in ASME B30.10.
- For hooks used in frequent load cycles, pulsating loads, or severe duty as defined by ASME B30.10, the hook and threads should be periodically inspected by Magnetic Particle or Dye Penetrant (Note: Some disassembly may be required).
- Never use a hook whose throat opening has been increased 5%, not to exceed 1/4" (6mm) or shows any visible apparent bend or twist from the plane of the unbent hook, or is in any other way distorted or bent. **NOTE: A latch will not work properly on a hook with a bent or worn tip.**
- Never use a hook that is worn beyond the limits shown in Figure 1.
- Remove from service any hook with a crack, nick, or gouge. Hooks with a nick, or gouge shall be repaired by grinding lengthwise, following the contour of the hook, provided that the reduced dimension is within the limits shown in Figure 1. Contact Crosby Engineering to evaluate any crack.
- Never repair, alter, rework, or reshape a hook by welding, heating, burning, or bending.
- Never side load, back load or tip load a hook. Side loading, back loading and tip loading are conditions that damage and reduce the capacity of the hook (See Figure 2).
- S-1326A can be used for limited rotations under load (infrequent, noncontinuous).
- Efficiency of synthetic sling material may be reduced when used in eye or bowl of hook.
- Always make sure the hook supports the load (See Figure 3). Do not use hook tip for lifting (See Figure 4).

⚠ WARNING

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- Positive locking latch will unlock when trigger is depressed. Never use hook unless hook and latch are fully closed and locked.
- Keep body parts clear of pinch point between hook tip and hook latch when closing.
- Keep hand(s) from between throat of hook and sling or other device.
- Do not use hook tip for lifting.
- Do not use hook handle for lifting.
- Do not rig the finger pull open, place objects in the finger pull area, or in any way inhibit complete and full operation of the finger pull mechanism.
- Shank threads may corrode and/or strip and drop the load.
- Remove securement nut to inspect threads for corrosion or to replace S-1326A bearing washers (2) and or S-13326 thrust bearing.
- Never apply more force than the hook's assigned Working Load Limit (WLL) rating.
- See OSHA Rule 1926.1431(g) and 1926.1501(g) for personnel hoisting by cranes or derricks. A Crosby 1318A, 1326A, 13326, 1316A, or 1317A hook may be used for lifting personnel.
- Use only genuine Crosby parts as replacements.
- Read and understand these instructions before using hook.

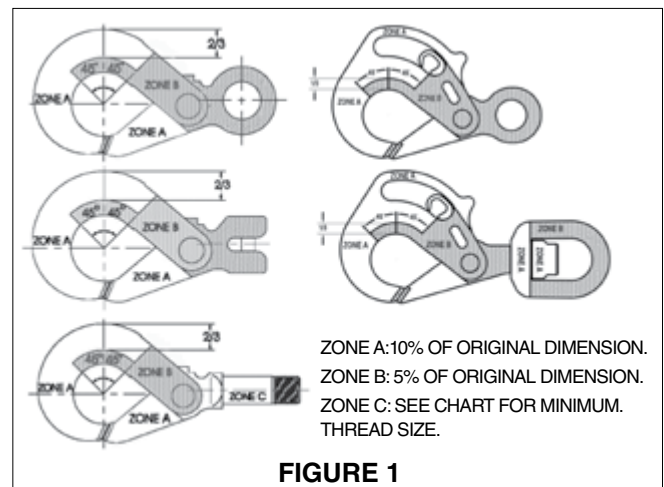


FIGURE 1

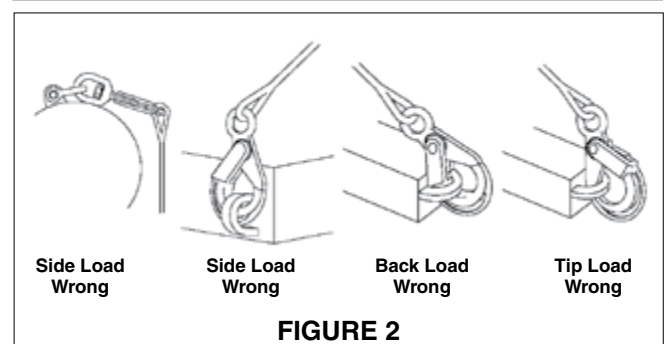
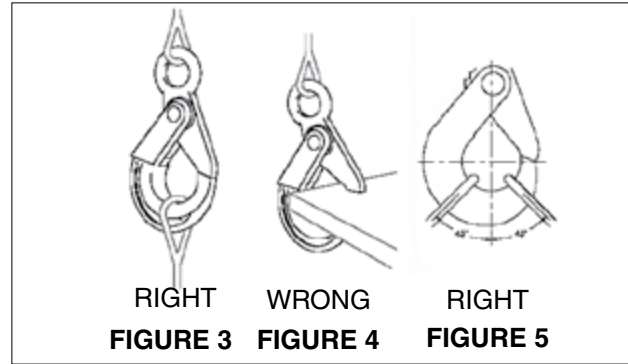


FIGURE 2

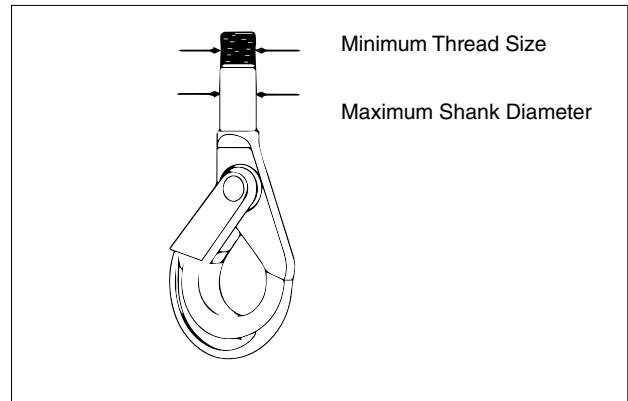
- When placing two (2) sling legs in hook, make sure the angle from vertical to the leg nearest the hook tip is not greater than 45 degrees, and the included angle between the legs does not exceed 90 degrees* (See Figure 5).
- See ASME B30.10 "Hooks" for additional information.

*For two legged slings with angles greater than 90°, use an intermediate link such as a master link or bolt type shackle to collect the legs of the slings. The intermediate link can then be placed over the hook to provide an en línea load on the hook. This approach must also be used when using slings with three or more legs.



Important Basic Machining and Thread Information: Read and Follow

- Wrong thread and/or shank size can cause stripping and loss of load.
- The maximum diameter is the largest diameter, after cleanup, that could be expected after allowing for straightness, pits, etc.
- All threads must be Class 2 or better.
- The minimum thread length engaged in the nut should not be less than one (1) thread diameter.
- Hook shanks are not intended to be swaged on wire rope or rod.
- Hook shanks are not intended to be drilled (length of shank) and internally threaded.
- Crosby cannot assume responsibility for, (A) the quality of machining, (B) the type of application, or (C) the means of attachment to the power source or load.
- Consult the Crosby Hook Identification & Working Load Limit Chart (See below) for the minimum thread size for assigned Working Load Limits (WLL).†
- Remove from service any Hook which has threads corroded more than 20% of the nut engaged length.



Crosby® Hook Identification & Working Load Limit Chart †

S-1316A & S-1317A Only Grade 100 Chain			S-1318A, S-1326A					S-1318A Only † †		
Chain Size		Working Load Limit (lb)** 4:1	Grade 100 Chain			Wire Rope XXIP Mechanical Splice		Maximum Shank Diameter		Minimum Thread Size (in)
			Chain Size		Working Load Limit (lb)** 4:1	Wire Rope Size (in)	Working Load Limit (lb)* 5:1			
(in)	(mm)		(in)	(mm)				(in)	(mm)	
—	6	3200	—	6	3200	5/16	2200	.72	18	5/8 - 11 UNC
1/4	7	4300	1/4	7 - 8	4300	7/16	4200	.94	24	5/8 - 11 UNC
5/16	8	5700	5/16	8	5700	7/16	4200	.94	24	3/4 - 10 UNC
3/8	10	8800	3/8	10	8800	1/2	5600	1.06	27	3/4 - 10 UNC
1/2	13	15000	1/2	13	15000	5/8	8600	1.19	30	1-1/8 - 7 UNC
5/8	16	22600	5/8	16	22600	7/8	16600	1.38	35	1-3/8 - 6 UNC
3/4	18/20	35300	3/4	18-20	35300	1	22000	—	—	—
7/8	22	42700	7/8	22	42700	1-1/8	26500	—	—	—
1	26	59700	1	26	59700	1-1/4	32500	—	—	—

* Ultimate Load is 5 times the Working Load Limit based on XXIP Wire Rope.

** Ultimate Load is 4 times the Working Load Limit based on Grade 100 Chain.

† Working Load Limit - The maximum mass of force which the product is authorized to support in general service when the pull is applied in-line, unless noted otherwise, with respect to the centerline of the product. This term is used interchangeably with the following terms: 1. WLL, 2. Rated Load Value, 3. SWL, 4. Safe Working Load, 5. Resultant Safe Working Load.

Technical Information

The following information aims to give advice and explain the most common questions in order to ensure safe and proper use of lifting equipment.

It is of the utmost importance that this information is known to the user, and in accordance with the Machinery Directive 2006/42/EC this information must be delivered to the customer.

See website or user instructions for assembly instructions.

Meets listed current specifications and standards at time of publication of this catalog.

All G80 and G100 Alloy Chains, and Alloy components meet or exceed the safety standards as prescribed by ASME B30.9 and OSHA 1910-184 for slings. Always comply with applicable International, National, Federal and local regulations as they govern worksite activity. Understand all governing laws and safety standards before any products are used. Contact your International, National, Federal and local standards and regulations organizations for reference assistance.

Extreme Environments

The in-service temperature affects the WLL as follows:

Temperature (°F)	Reduction of WLL			
	Gunnebo Grade 10 (400) chain	Crosby Grade 10 & Gunnebo Grade 10 (200) chain	Crosby & Gunnebo Grade 10 components	Crosby & Gunnebo Grade 8 chain & components
-40 to + 392 °F	0 %	0 %	0 %	0 %
+392 to + 572 °F	10 %	Not allowed	10 %	10 %
+572 to + 752 °F	25 %	Not allowed	25 %	25 %

Upon return to normal temperature, the sling reverts to its full capacity within the above temperature range. Chain slings should not be used above or below these temperatures. Note: A chain sling with Grade 10 (100) chain must not be used in temperatures above 392°F.

- Chain and components must not be used in alkaline (>pH10) or acidic conditions (<pH6).
- Comprehensive and regular examination must be carried out when used in severe or corrosive inducing environments.
- In uncertain situations consult your Gunnebo Industries dealer.

Surface Treatment

Note: Hot-dip galvanizing or plating is not allowed outside the control of the manufacturer.

Protect Yourself and Others

- Before each use the chain sling should be checked for obvious damage or deterioration.
- Know the weight of the load, the center of gravity and ensure it is ready to move and no obstacles will obstruct the lift.
- Check the conformity of the load with the WLL of the ID tag for the specific working configuration. Never use a sling without a legible valid ID tag!
- Prepare the landing site.
- Never overload a sling and avoid shock loading.
- Never use an improper sling configuration.
- Never use a worn out or damaged sling.
- Never ride on the load.
- Never walk or stand under a suspended load.
- Take into consideration that the load may swing or rotate.
- Watch your feet and fingers while loading/unloading.
- Always ensure that your back is clear.

General Advice

- Ensure that the sling is precisely as ordered.
- Ensure that the manufacturers certificate is in order.
- A metal I.D. Tag must always be attached to a chain sling, showing serial number, size, reach, rated capacity at angle of lift and manufacturer.
- Ensure that all details of the chain sling are recorded.
- Ensure that the staff using the chain sling has received the appropriate information and training.

Asymmetrical Loading Conditions

For unequally loaded chain legs we recommend that the WLL are determined as follows:

- 2-leg slings calculated as the corresponding 1-leg sling
- 3 and 4-leg slings calculated as the corresponding 1-leg sling. (If it is certain that 2-legs are equally carrying the major part of the load, it can be calculated as the corresponding 2-leg sling.)

Correct Use

Machining and threading specifications for BKT shank hook

- BKT self-locking hook shank machining limits are defined and are given in TABLE 2 and these limits are required for WLL's given. Failure to comply can result in stripped threads and loss of load. Hook shank threads shall end with a thread relief. Hook shank shall not be swaged to wire rope or rod. Hook shank shall not be drilled and internally threaded.
- Gunnebo Industries cannot assume responsibility for:
 - Machining quality,
 - Application,
 - Attachment to power source or load

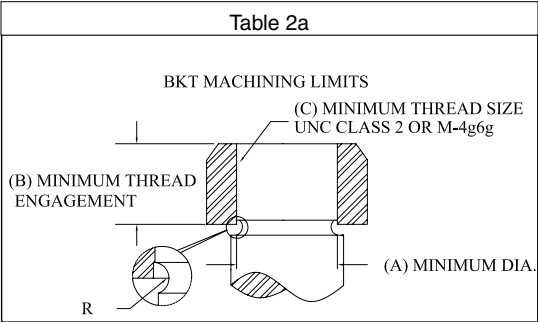
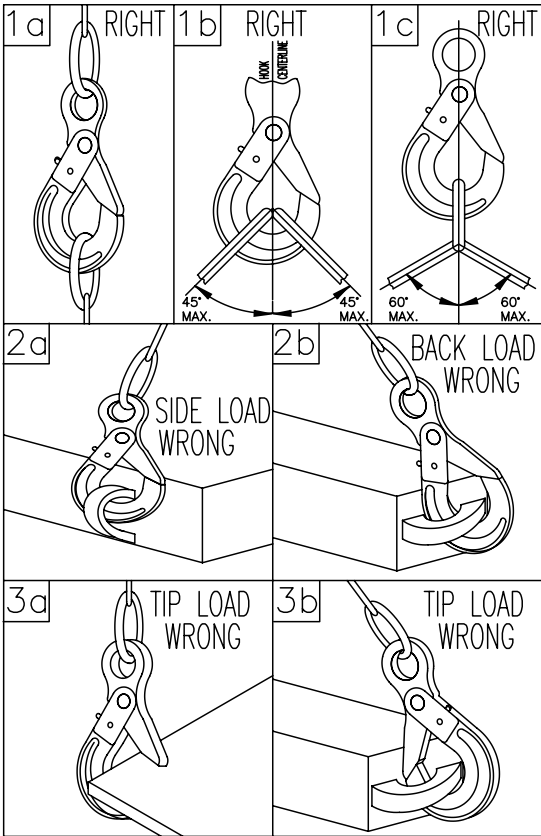


Table 2b				
English				
Trade Size		(A)	(B)	(C) Min. Thread
MM	IN	Dia.	Len.	Class 2
5/6	7/32	.430	.563	9/16-12 UNC
7/8	9/32	.485	.625	5/8-11 UNC
10	3/8	.600	.750	3/4-10 UNC
13	1/2	.820	1.00	1-8 UNC
16	5/8	1.048	1.25	1-1/4-7 UNC

Table 2c				
Metric				
Table Size		(A)	(B)	(C) Min. Thread
MM	IN	Dia.	Len.	Class 4g6g
5/6	7/32	11	14	M14x2
7/8	9/32	13	16	M16x2
10	3/8	16	20	M20x2.5
13	1/2	20	24	M24x3
16	5/8	25	30	M30x3.5

Safe use of self-locking hook

- Alloy steel BK self-locking hooks may be used to rig personnel platforms when lift system is in full compliance with OSHA 1926.1501(g) and passing the applicable inspection criteria.
- Loads shall be centered in the base (bowl/ saddle) of hook to prevent point loading of the hook (See Figure 1a, 1b & 1c).
- Hooks shall not be used in such a manner as to place a side load or back load on the hook (See Figure 2a & 2b).
- When using a device to close the throat opening of the hook, care shall be taken that the load is not carried by the closing device (See Figure 3a & 3b).
- Hands, fingers and body shall be kept from between hook and load.
- The use of a hook with a latch does not preclude the inadvertent detachment of a slack sling or a load from the hook. Visual verification of proper hook engagement is required in all cases.
- Self-locking hooks shall be locked during use.
- When a hook is equipped with a latch, the latch should not be restrained from closing during use.
- Self-locking hooks shall not be rigged with more than two (2) sling legs in the hook saddle and sling leg angles shall not be greater than 45° from hook centerline (Figure 1b).
- Self-locking hooks shall be rigged with a master ring or shackle when three (3) or more sling legs are used or sling leg angles exceed 45° from hook centerline (Figure 1c).



Correct Use

A chain sling is usually attached to the load and the crane by means of terminal fittings such as hooks, links etc.

When frequently using a sling to it's maximum load, we recommend increasing the sling size by one dimension.

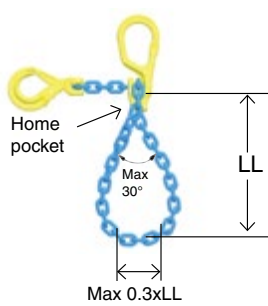


Chain should be without twists or knots, if the chain leg needs length adjustment use a shortening device. The lifting point should be seated well down in the terminal fitting, never on the point or wedged in the opening. The terminal fitting should be free to incline in any direction.

The chain may be passed under or through the load to form a choke hitch or basket hitch. The chain should be allowed to assume it's natural angle and should not be hammered down.

Where choke hitch is employed the WLL of the chain sling shall be reduced by 20%.

Endless chain slings shall be rated in the same way as a 2-legged sling.

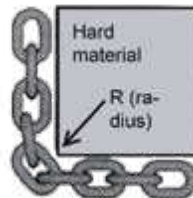


Home pocket loop shall have an internal loop top angle of max. 30°. Rule of thumb: Cross dimension of the load shall be max. 0.3 times the loop length (LL)

Definition: The home pocket is the shortening pocket of the top component directly above the clevis to which the chain is connected.

Sharp edges

Use edge protectors to prevent sharp edges from damaging the chain. If lifting over sharp edges reduce the working load with the following reduction tor.



Edge load	R > 2 x chain Ø	R > chain Ø	R < chain Ø
Reduction factor	1.0	0.7	0.5

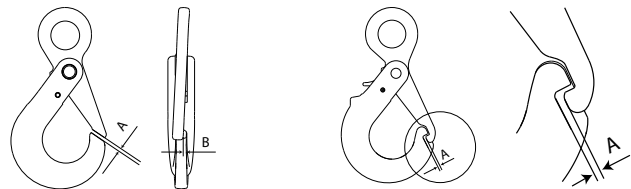
- The angle of the edge must not be below 90°.
- Chain links shall be protected from being bent or deformed and from receiving cuts or gouges.
- Chain sling WLL is to be reduced when chain is rigged over an edge radius R less than two (2) x chain diameter (d).
- Reduced WLL equals chain sling WLL from identification tag x reduction factor.
- Slings shall be padded or protected from the edges of their loads when the edge radius is less than 0.5 of the chain diameter(d).
- Slings shall be rigged to prevent chain from sliding over a load edge radius while lifting.
- Slings used in basket hitch shall have the loads balanced to prevent slipping.

When lifting with chain directly on lugs the lug diameter > 3x the pitch of the chain, otherwise the WLL must be reduced by 50%.

Maintenance

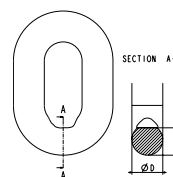
Periodic thorough examination must be carried out at least every 12 months or more frequently according to local statutory regulations, type of use and past experience.

- Overloaded chain slings must be taken out of service.
- If the lifting equipment is more than 25 years old, it must be recorded in the inspection register. An investigation into both its previous operating history and its current use should be made, as there is a potentially significant risk of fatigue, environmental impact etc.
- Chain and components including load pins which have been damaged, deformed, elongated, bent or showing signs of cracks or gouges shall be replaced. Carefully grind away small sharp cuts and burrs. Additional testing by magnetic particle inspection and/or proof loading at max. 2 x WLL may be carried out.
- The maximum permissible increase in hook aperture must not exceed 10% of the products nominal dimension.
- Check the function of latches, triggers and retaining pins / bushes, replace when necessary. Always use Gunnebo Industries original spare parts.
- Max. clearance between hook and latch. Note: For a Griplatch hook measure the difference between dimension A with unloaded spring and dimension A when the latch is pressed against the hook. Clearance B not applicable.



Trade size		Max. clearance (A)				Max. clearance (B)	
		Material handling		Personnel handling		(NA for griplatch hooks)	
mm	inch	mm	inch	mm	inch	mm	inch
6	7/32	2.2	0.09	1.5	0.06	3.5	0.14
7/8	9/32	2.7	0.11	1.9	0.07	4.5	0.18
7	9/32	2.7	0.11	1.9	0.07	4.5	0.18
8	5/16	2.7	0.11	1.9	0.07	4.5	0.18
10	3/8	3.0	0.12	2.1	0.08	6.0	0.24
13	1/2	3.3	0.13	2.3	0.09	7.0	0.28
16	5/8	4.0	0.16	2.8	0.11	9.0	0.35
18/20	3/4	5.5	0.22	3.9	0.15	10.0	0.39
22	7/8	6.0	0.24	4.2	0.17	11.0	0.43
26	1	6.5	0.26	4.6	0.18	12.0	0.47
32	1 1/4	7.0	0.28	4.9	0.19	13.0	0.51

- The wear of the chain and component shall in no place exceed 10% of the products nominal dimension. The chain link wear is defined and measured as the reduction of the mean diameter measured in two perpendicular directions, see picture.



$$\frac{d_1 + d_2}{2} > 0.9d_n$$

d_n = nominal diameter

Quality assurance

Type testing

In order to prove the design, material, heat treatment and method of manufacture, each size of component and chain has been type tested in the finished condition in order to demonstrate that the component and chain possesses the required mechanical properties. The following testing procedures are particularly relevant:

Test for deformation

The Manufacturing Proof Force (MPF) for the relevant size of the component is applied and removed. The dimensions after proof loading shall not alter from the original dimensions within the tolerances prescribed in our specifications and in the international standards.

Static tensile test

The Breaking Force (BF) for each component and size is verified. The verified value shall be at least equal to the Minimum Breaking Force (MBF) value. The MBF value is equal to the Working Load Limit (WLL) multiplied by the safety factor.

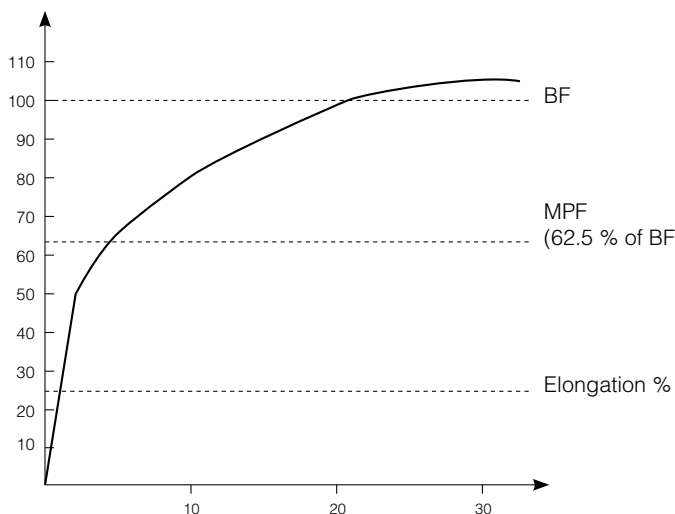
Fatigue test

By fatigue testing in pulsator testing machines the toughest conditions of service are simulated.

Stress / elongation diagram

Force

% of min Breaking Force



Manufacturing testing

During manufacture continuous process tests are carried out according to the requirements in our specifications and in the latest international standards. The following testing procedures are particularly relevant:

Non destructive test

3% of every production batch of forged components are subject to magnetic particle or dye penetrating examination.

Proof force / visual inspection

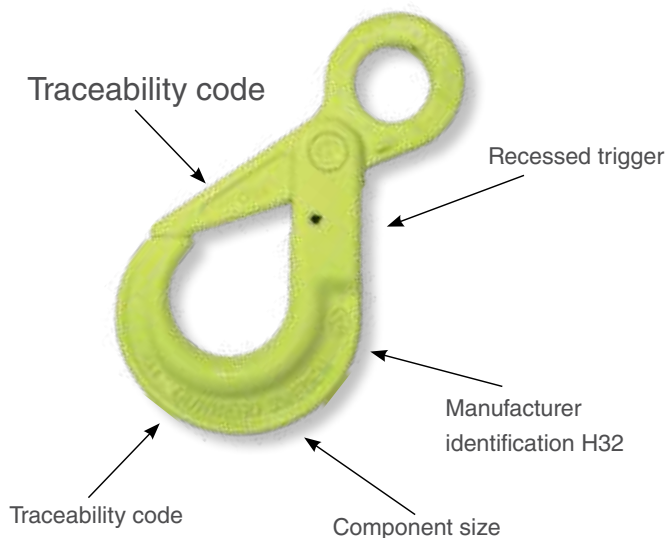
Each individual component and chain link is tested to the Manufacturing Proof Force (MPF) level before delivery. The MPF level is 2.5 times the WLL, equal to 62.5% of the Minimum Breaking Force. Visual inspection is carried out on each chain link and each forged component to detect defects.

Static tensile and ultimate elongation test

During chain manufacture, samples are tested and the Minimum Breaking Force (MBF) value and the total ultimate elongation are verified.

Bending deflection

During manufacturing, of chain and master links, samples are taken and the minimum bend deflection is verified.



Crosby® S-4338 Pin Latch

WARNING & APPLICATION INSTRUCTIONS

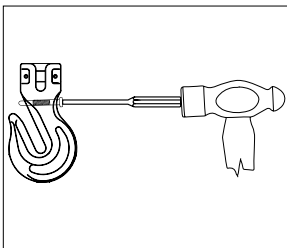


S-4338 Pin Latch

Important Safety Information Read and Follow

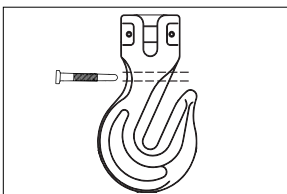
- Always inspect hook and pin latch before using.
- Never use a pin latch that is distorted or bent.
- Always make sure internal spring will force the pin latch forward closing throat opening of grab hook (See Figure 1).
- When a Pin Latch is provided, it is designed to retain loose chain under slack condition.
- Always make sure hook supports the load. The pin latch must never support the load (See Figure 1, 2, 3 and 4).
- Pin latch is not intended to be an anti-fouling device.
- Recommended for use with Crosby L-1338 or L-1358 Grab Hooks.

Important – Instructions for Assembling

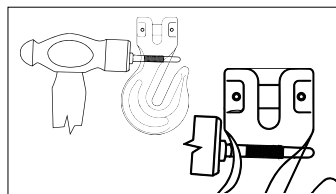


Step 1: Using a hammer and the correct roll-pin punch per chart on the right, drive the old latch pin assembly out of hook.

Hook Size (in)	Punch Dia. (mm)	Punch Dia. (in)	A (in)
1/4	7	7/32	3
5/16	8	7/32	3
3/8	10	7/32	3
1/2	13	5/16	4
5/8	16	3/8	4



Step 2: Insert new S-4338 pin assembly into hook.



Step 3: Using hammer, tap lightly on latch pin head until guide bushing shoulder touches hook.

⚠ WARNING

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- Hook must always support the load. The load must never be supported by the pin latch.
- See OSHA Rule 1926.1431(g)(1)(i)(A) and 1926.1501(g)(4)(iv)(B). A hook and this style latch must not be used for lifting personnel.
- Read and understand these instructions before using hook and pin latch.

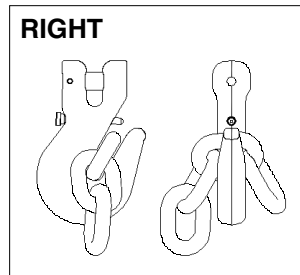


Figure 1

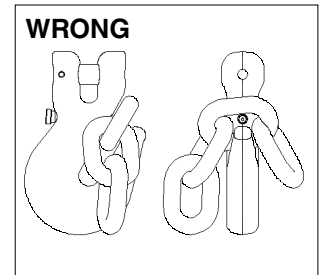


Figure 2

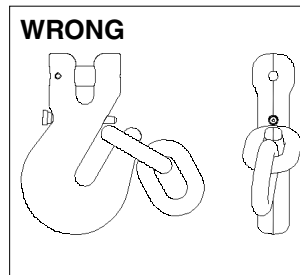


Figure 3

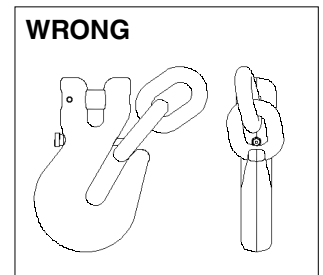


Figure 4

ALLOY STEEL CHAIN SLINGS AND CROSBY ELIMINATOR®

WARNING SELECTION, USE & APPLICATION INFORMATION



⚠ WARNING

- Loads may disengage from sling if proper rigging procedures and inspection are not followed.
- A falling load may cause serious injury or death.
- Inspect sling for damage before each use.
- Do not attempt to use sling above rated load and angle upon which it is based.
- Consult sling load chart for capacity reduction due to sling angle or type of hitch used.
- Read and understand these instructions before using sling.

IMPORTANT SAFETY INFORMATION

Read and Follow

These warnings and instructions are applicable to alloy chain slings produced from Crosby Grade 8 (80) and Grade 10 (100) chain and components.

- Only alloy chain, grade 80 (Crosby Spectrum 8®), or grade 100 (Crosby Spectrum 10®), should be used for overhead lifting applications.
- Working Load Limit (WLL) is the maximum load in pounds which should ever be applied to chain, when the chain is new or in "as new" condition, and when the load is uniformly applied in direct tension to a straight length of chain.
- Working Load Limit (WLL) is the maximum working load for a specific minimum sling angle, measured from the horizontal plane. The minimum sling angle and Working Load Limit is identified on the sling.
- The Working Load Limit or Design factor may be affected by wear, misuse, overloading, corrosion, deformation, intentional alterations, sharp corner cutting action diameter of curvature over which the sling is used (D/d) and other use conditions.
- Shock loading and extraordinary conditions must be taken into account when selecting alloy chain slings.
- See OSHA Regulation for Slings 1910.184, ASME B30.9-"SLINGS", ASME B30.10-"HOOKS", and ASME B30.26 "RIGGING HARDWARE" for additional information.

ASME B30.9 requires a designated person inspect each new sling and attachments prior to initial use, as well as the user or other designated person perform a visual inspection on a sling each day it is used. In addition, a periodic inspection shall be performed by a designated person at least annually, and shall maintain a record of the last inspection. For further inspection information, see Chain Inspection section of this document, or refer to ASME B30.9-1.9.

CAUSE FOR REMOVAL FROM SERVICE

A sling shall be removed from service if any of the following are visible on chain or attachments:

- Wear, nicks, cracks, breaks, gouges, stretch, bend, weld splatter, discoloration from excessive temperature, or throat openings of hooks.

- Chain links and attachments that do not hinge freely to adjacent links.
- Latches on hooks, if present, that do not hinge freely, seat properly or show evidence of permanent distortion.
- Excessive pitting or corrosion.
- Missing or illegible sling identification.
- Makeshift fasteners, hooks, or links formed from bolts, rods, etc.
- Mechanical coupling links in the body of the chain.
- Other damage that would cause a doubt as to the strength of the chain.

OPERATING PRACTICES

- The weight of the load must be known, calculated, estimated or measured. The loading on the slings will depend on where the center of gravity is located.
- Select sling having suitable characteristics for the type of load, hitch and environment.
- Slings shall not be loaded in excess of the rated capacity.
- Consideration shall be given to the sling load angle which affects rated capacity (See load chart Table 4 for Grade 100 (SPECTRUM 10®) and Table 5 for Grade 80 (SPECTRUM 8®)).
- Never rig a sling with an angle less than 30 degrees to horizontal.
- Slings in a basket hitch should have the load balanced to prevent slippage.
- The sling shall be hitched in a manner providing control of the load.
- Never side load, back load, or tip load a hook.
- Always make sure the hook supports the load. The latch must never support the load.
- Read and understand Crosby hook and hook latch Warnings and Application Instructions.
- For two legged slings with angles greater than 90 degrees, use an intermediate link such as a master link or bolt type shackle to collect the legs of the slings. The intermediate link can be placed over the hook to provide an in-line load on the hook. This approach must also be used when using slings with three or more legs.
- When using chain slings in choker applications, the Working Load Limit must be reduced by 20%. Crosby recommends a minimum angle of choke of 120 degrees (see Figure 1). Consult the manufacturer when planning to use an angle of choke less than 120 degrees. If Crosby A-1338 Cradle Grab hooks are used at the minimum angle of choke of 120 degrees, the full sling rated WLL can be utilized.
- When using chain slings in basket applications where the D/d (see figure 2) is less than 6, the rated load must be reduced by the values given in Table 1. This reduction does not eliminate the need to protect chain slings against damage caused by contact with edges, corners, or protrusions. Do not use a chain sling with a D/d that is less than two.
- In shortening applications, a 20% reduction of the Working Load Limit is required except when using the Crosby A-1338 Cradle Grab Hooks, S-1311 Chain Shortener Link, the A-1355 Chain Choker Hook in conjunction with the S-1325 Chain Coupler Link, or the Crosby ELIMINATOR® shortener link. They can be used without any reduction to the Working Load Limit.



Figure 1

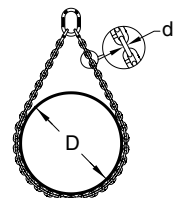


Figure 2

- Slings should always be protected from being damaged by sharp corners.
- Slings should not be dragged on the floor or over abrasive surfaces.
- Chain sling links should not be twisted or kinked.
- Slings should not be pulled from under loads if the load is nesting on the sling.
- Slings that appear to be damaged should not be used unless inspected and accepted by designated person.
- All portions of the human body should be kept from between the sling and the load, and from between the sling and the crane hook or hoist hook.
- Personnel shall stand clear of the suspended load.
- Personnel shall not ride the sling.
- Shock loading should be avoided.
- Twisting or kinking the legs (branches) should be avoided.
- During lifting, with or without the load, personnel should be alert for possible snagging.
- When using a basket hitch, the legs of the sling should contain or support the load from the sides, above the center of gravity, so that the load remains under control.
- Sling shall be long enough so that the rated capacity of the sling is adequate when the angle of the legs (branches) is taken into consideration (See Table 4 for Grade 100 Chain and Table 5 for Grade 80 Chain).

General Usage

It must be recognized that certain factors in the usage of chain and attachments can be abusive and lessen the load that the chain or attachments can withstand. Some examples are twisting of the chain; disfigurement; deterioration by straining, usage, weathering and corrosion; rapid application of load or jerking; applying excessive loads; sharp corner cutting, D/d, action and non-symmetrical loading effects.

Environmental Effects

- Excessive high or low temperatures or exposure to chemically active environments such as acid or corrosive liquids or fumes can reduce the performance of the chain and components.
- Extreme temperature will reduce the performance of alloy steel chain slings.
- Normal operating temperature is -40°F to 400°F (-40°C to 200°C).
- Reference temperature exposure chart to determine reduction of WLL due to operating at, and after exposure to, elevated temperatures (see Table 2 for Grade 80 Chain and Table 3 for Grade 100 chain).
- Chemically active environments can have detrimental effects on the performance of chain. The effects can be both visible loss of material and undetectable material degradation causing significant loss of strength.

Special Surface Coating/Plating/Galvanizing

- Chain should not be subjected to galvanizing, or any plating process. If it is suspected the chain has been exposed to chemically active environment, remove from service.

Table 1	
Use of Crosby Chain with Diameter of Curvature Less Than 6	
D/d	Reduction of Basket Hitch Rated Load
2	40%
3	30%
4	20%
5	10%
6 and above	none

Table 2			
Grade 80 Crosby & Gunnebo Chain At Elevated Temperatures			
Temperature of Chain		Temporary Reduction of Rated Load at Elevated Temperature*	Permanent Reduction of Rated Load After Exposure to Temperature**
(F°)	(C°)		
Below 400	Below 200	None	None
400	200	10%	None
500	260	15%	None
600	316	20%	5%
700	371	30%	10%
800	427	40%	15%
900	482	50%	20%
1000	538	60%	25%

Over 1000 Over 538 OSHA 1910.184 requires all slings exposed to temperatures over 1000° F to be removed from service.

* The Crosby Group does not recommend the use of alloy chain slings at temperatures above 800° F.

** When chain slings are used at normal operating temperature after being heated to temperatures shown in the first column.

Table 3			
Grade 100 Crosby & Gunnebo Chain At Elevated Temperatures			
Temperature		Temporary Reduction of Rated Load at Elevated Temperature*	Permanent Reduction of Rated Load After Exposure to Temperature**
(F°)	(C°)		
Below 400	Below 200	None	None
400	200	15%	None
500	260	25%	5%
600	316	30%	15%
700	371	40%	20%
800	427	50%	25%
900	482	60%	30%
1000	538	70%	35%

Over 1000 Over 538 OSHA 1910.184 requires all slings exposed to temperatures over 1000 F to be removed from service.

* The Crosby Group does not recommend the use of alloy chain slings at temperatures above 800° F.

** When chain slings are used at normal operating temperature after being heated to temperatures shown in the first column.

CHAIN INSPECTION INSPECTION AND REMOVAL FROM SERVICE PER ASME B30.9

Refer to ASME B30.9-1.9 for further information

Frequent Inspection

- A visual inspection for damage shall be performed by the user or designated person each day the sling is used.
- Conditions such as those listed in ASME B30.9-1.9.4 Removal Criteria, or any other condition that may result in a hazard, shall cause the sling to be removed from service. Slings shall not be returned to service until approved by a qualified person.
- Written records are not required for frequent inspections.

Periodic Inspection

- A complete inspection for damage of sling shall be periodically performed by a designated person. Each link and component shall be examined individually, taking care to expose and examine all surfaces including the inner link surface. The sling shall be examined for conditions such as those listed in ASME B30.9-1.9.4 Removal Criteria, and a determination made as to whether they constitute a hazard.
- Periodic Inspection Frequency: Periodic inspection intervals shall not exceed one year. The frequency of periodic inspections should be based on:
 - Frequency of sling use.
 - Severity of service conditions.
 - Nature of lifts being made.
 - Experience gained on the service life of slings used in similar circumstances.

Guidelines for the interval are:

1. Normal Service – yearly
 2. Severe Service – monthly to quarterly
 3. Special Service – as recommended by a qualified person
- c. Written records of the most recent periodic inspection shall be maintained, and shall include the condition of the sling.

Removal Criteria

An alloy sling chain shall be removed from service if conditions such as the following are present:

- a. Missing or illegible sling identification.
- b. Cracks or breaks.
- c. Excessive wear, nicks, or gouges. Minimum thickness on chain link shall not be below the values listed in Table 6.
- d. Stretched chain links or components.
- e. Bent, twisted, or deformed chain links or components
- f. Evidence of heat damage.
- g. Excessive pitting or corrosion.
- h. Lack of ability of chain or components to hinge (articulate) freely.
- i. Weld spatter.
- j. For hooks, removal criteria as stated in ASME B30.10.
- k. Other conditions, including visible damage, that cause doubt as to the continued use of the sling.

Repair

- a. Slings shall be repaired only by the sling manufacturer or a qualified person.
- b. A repaired sling shall be marked to identify the repairing agency per ASME B30.9 Section 9-1.7.

- c. Chain and components used for sling repair shall comply with the provisions of ASME B30.9.
- d. Repair of hooks shall comply with ASME B30.10.
- e. Cracked, broken or bent chain links or components other than hooks shall not be repaired; they shall be replaced.
- f. Mechanical coupling links shall not be used within the body of an alloy chain sling to connect two pieces of chain.
- g. Modifications or alterations to the sling or components shall be considered as repairs and shall conform to all other provisions of ASME B30.9.
- h. All repairs shall comply with the proof test requirements of ASME B30.9 Section 9-1.6.

Table 6			
Minimum Allowable Chain Link Thickness at Any Point			
Nominal Chain Size		Minimum Thickness	
(in)	(mm)	(in)	(mm)
7/32	5.5	0.189	4.80
9/32	7	0.239	6.07
5/16	8	0.273	6.93
3/8	10	0.342	8.69
1/2	13	0.443	11.26
5/8	16	0.546	13.87
3/4	20	0.687	17.45
7/8	22	0.750	19.05
1	26	0.887	22.53
1-1/4	32	1.091	27.71
Refer to ASME B30.9			

Table 4
Grade 100 (Spectrum 10®) Alloy Chain Working Load Limit – 4 to 1 Design Factor

Spectrum 10® Alloy Chain Size		90°	60°	45°	30°	60°	45°	30°
(in)	(mm)	Single Leg	Double Leg / Single Basket			Triple and Quad Leg / Double Basket		
—	6	3200	5500	4500	3200	8300	6800	4800
1/4 (9/32)	7	4300	7400	6100	4300	11200	9100	6400
5/16	8	5700	9900	8100	5700	14800	12100	8500
3/8	10	8800	15200	12400	8800	22900	18700	13200
1/2	13	15000	26000	21200	15000	39000	31800	22500
5/8	16	22600	39100	32000	22600	58700	47900	33900
3/4	20	35300	61100	49900	35300	91700	74900	52950
7/8	22	42700	74000	60400	42700	110900	90600	64000
1	26	59700	103400	84400	59700	155100	12600	89550
1-1/4	32	90400	156600	127800	90400	234900	191700	135600

* For choker applications, the Working Load Limit must be reduced by 20%. The Crosby A-1338 cradle grab hook and S1311N chain shortener link do not require any reduction of the Working Load Limit. The design factor of 4 to 1 on Spectrum® 10 Alloy Chain agrees with the design factor used by the International Standards Organization (I.S.O.) and ANSI B30.9 and is the preferred set of Working Load Limit values to be used. Do not use sling angles of less than 30°.

Table 5
Grade 80 (Spectrum 8®) Alloy Chain Working Load Limit – 4 to 1 Design Factor

Spectrum 8® Alloy Chain Size		90°	60°	45°	30°	60°	45°	30°
(in)	(mm)	Single Leg	Double Leg / Single Basket			Triple and Quad Leg / Double Basket		
—	6	2500	3600	3000	2500	6500	5300	3750
1/4 (9/32)	7	3500	6100	4900	3500	9100	7400	5200
5/16	8	4500	7800	6400	4500	11700	9500	6800
3/8	10	7100	12300	10000	7100	18400	15100	10600
1/2	13	12000	20800	17000	12000	31200	25500	18000
5/8	16	18100	31300	25600	18100	47000	38400	27100
3/4	20	28300	49000	40000	28300	73500	60000	42400
7/8	22	34200	59200	48400	34200	88900	72500	51300
1	26	47700	82600	67400	47700	123900	101200	71500
1-1/4	32	72300	125200	102200	72300	187800	153400	108400

* For choker applications, the Working Load Limit must be reduced by 20%. The Crosby A-1338 cradle grab hook and S1311N chain shortener link do not require any reduction of the Working Load Limit. The design factor of 4 to 1 on Spectrum® 8 Alloy Chain agrees with the design factor used by the International Standards Organization (I.S.O.) and ASME B30.9 and is the preferred set of Working Load Limit values to be used. Do not use sling angles of less than 30°.

CROSBY ELIMINATOR®

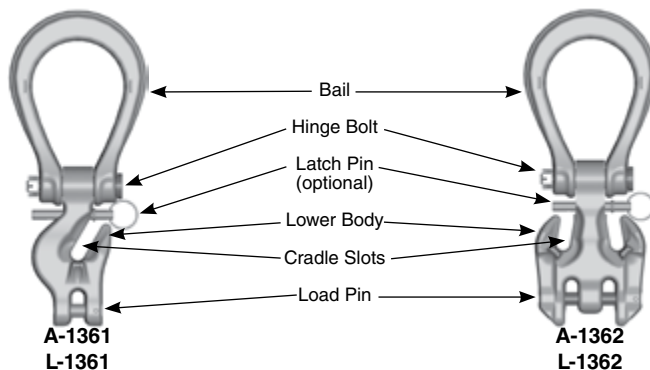
WARNING & APPLICATION INSTRUCTIONS

WARNING

- Failure to read, understand, and follow these instructions may cause death or serious injury.
- Read and understand these instructions before using the Crosby ELIMINATOR®.
- Incorrectly rigging or terminating exerts additional force or loading, which the Crosby ELIMINATOR® is not designed to accommodate.

Crosby ELIMINATOR® Definitions

The Crosby ELIMINATOR® consists of a bail, hinge bolt, latch pin, and lower body with cradle slot/slots.



The Crosby ELIMINATOR® incorporates markings forged into the product which address a **QUIC-CHECK®** feature:

Deformation Indicators – Two strategically placed marks on each leg of the bail, which allows for a **QUIC-CHECK®** measurement to determine if the bail opening has changed, thus indicating abuse or overload. To check, use a measuring device (i.e. tape measure) to measure the distance between the marks. The marks should align to either an inch or half-inch increment on the measuring device. If the measurement does not meet criteria, the Crosby ELIMINATOR® bail should be inspected further for possible damage.

Important Safety Information Read and Follow

- A visual periodic inspection for cracks, nicks wear, gouges and deformation as part of a comprehensive documented inspection program, should be conducted by trained personnel in compliance with ANSI B30.9.
- Remove from service any Crosby ELIMINATOR® components with a crack, nick, or gouge. The bail and body of a Crosby ELIMINATOR® with nick or gouge shall be repaired by a qualified person. The qualified person shall repair by grinding longitudinally following the contour of the forging, provided that the reduced dimension is within the limits shown in (Fig. A).

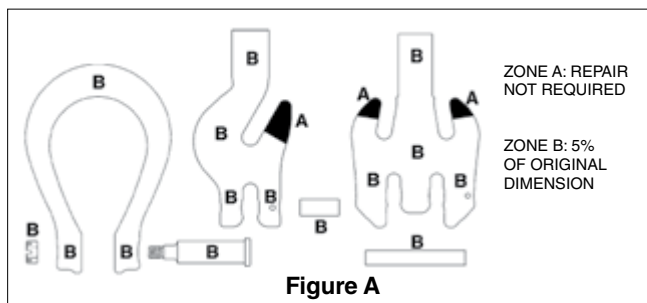


Figure A

- Never repair, alter, rework, or reshape a Crosby ELIMINATOR® by welding, heating, burning, or bending.
- Crosby ELIMINATOR® combination master link and chain shortener shall not be used in a manner other than that for which it is intended.
- The sling may be shortened by use of the cradle slot/slots (see Fig. C).
- In shortening applications, the Crosby ELIMINATOR® can be used without any reduction to the Working Load Limit.
- Never terminate (i.e. place a load bearing chain sling hook), or reeve load bearing chain through Crosby ELIMINATOR® bail (see Fig. B).
- Never exceed the rated capacity shown on sling's identification tag.
- Attach lifting device to ensure free fit of Crosby ELIMINATOR® bail (see Fig. D). Never allow lifting device to apply forces on side of bail (see Fig. E), as this condition will damage and reduce the capacity of the Crosby ELIMINATOR®.
- The Crosby ELIMINATOR® is intended for tension or pull. Side loading must be avoided, as it exerts additional force or loading which the product is not designed to accommodate (see Fig. F).



Figure B

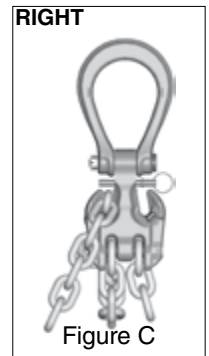


Figure C

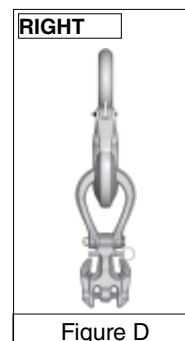


Figure D

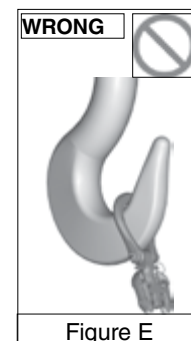


Figure E

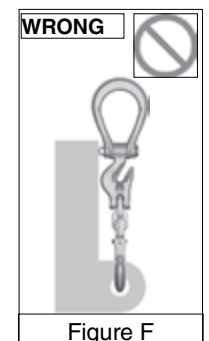


Figure F

- Never use a Crosby ELIMINATOR® where the bail shows signs of deformation or overloading (see Table 1).
- Read and understand the other sections of the ALLOY STEEL CHAIN SLINGS Warning, Selection, Use & Maintenance Information.

TABLE 1 Crosby ELIMINATOR® Bail Dimensions						
Chain Size (in)	Frame I.D. Code	Inside Length (in)	Inside Width (in)	Jaw Width (in)	QUIC-CHECK® Dim (in)	
1/4 - 5/16	7 - 8	2	3.88	3.00	.94	3.50
3/8	10	3	4.81	3.50	1.13	4.00
1/2	13	4	6.00	4.13	1.31	5.00
5/8	16	5	6.88	4.75	1.63	6.00

- A Crosby ELIMINATOR® under load shall be allowed to self-align itself about the hinge pin.
- The use of a latch may be mandatory by regulations or safety codes; e.g. OSHA, MSHA, ASME B30.10 and B30.9.
- If Crosby latch pin is present, it should fit and function properly, and show no signs of distortion or bending.
- Always make sure the chain is seated in the cradle slot, and the cradle supports the load. The latch pin must never support the load.
- Latch pins are not intended to be an anti-fouling device.
- Use only genuine Crosby repair and latch pins parts.

A-1361 Single Leg Crosby ELIMINATOR®

- The A-1361 single leg Crosby ELIMINATOR® is designed to support a single leg vertical load. The cradle slot may be used to make a loop in the leg (see Fig. G). However, the Working Load Limit is still limited to the single leg values shown in Table 4 (Grade 100) and Table 5 (Grade 80).
- To produce a single basket hitch and achieve the full Working Load Limit, use only one length of chain with both ends terminated into the load pins of two A-1361 single leg Crosby ELIMINATOR® fittings (see Fig. H). Basket may be shortened with cradle slot.
- Never exceed the single leg Working Load Limit shown in Table 4 (Grade 100) and Table 5 (Grade 80) for an individual A-1361 Crosby ELIMINATOR® fitting.



A-1362 Double Leg Crosby ELIMINATOR®

- The A-1362 double leg Crosby ELIMINATOR® is designed to support symmetrically loaded double leg slings at 60, 45, and 30 degree horizontal angles. The cradle slots may be used to make loops in the legs (see Fig. J). However, the Working Load Limit is limited to the double leg values shown in Table 4 (Grade 100) and Table 5 (Grade 80).
- To produce a single basket hitch, and achieve the full Working Load Limit, use only one length of chain with both ends terminated into the load pin (see Fig. K). Basket may be shortened with the cradle slot or slots.
- To produce a double basket hitch and achieve the full Working Load Limit, two A-1362 double leg Crosby ELIMINATOR® fittings must be used, with both being terminated at their load pin (see Fig. L).
- Never exceed the double leg / single basket Working Load Limit on an individual A-1362 Crosby ELIMINATOR® fitting.



Alloy Fittings Application and Information

HOW TO ASSEMBLE AN S-1325 COUPLER LINK ONTO MASTER LINK



1. Slide Coupler Link over Engineered Flat of Master Link.



2. Rotate Coupler Link so that clevis fitting is to the outside of Master Link and attach to chain sling.

HOW TO ASSEMBLE A CROSBY CLEVIS TYPE FITTING



1. Place chain link into clevis of chain coupler. Insert pin fully into the clevis ears.



2. Place the coupler link on its side and using a hammer, drive the locking pin into the clevis ear until it is flush with the outside surface.

HOW TO ASSEMBLE A LOK-A-LOY® CONNECTING LINK



1. Place the locking sleeve between the assembled half link forgings.



2. Drive the pin through the assembled link ends and sleeve until the end of the pin is flush with the outside of the connecting link halves.

HOW TO ASSEMBLE LOAD PIN IN CROSBY ELIMINATOR® FITTINGS



1. Place both chain links into clevis slots of fitting, insert pin fully into the two-leg clevis.



2. Place Eliminator assembly on a firm surface. Using a hammer, drive the locking pin into the two-leg clevis until it is flush with the top of the hole.

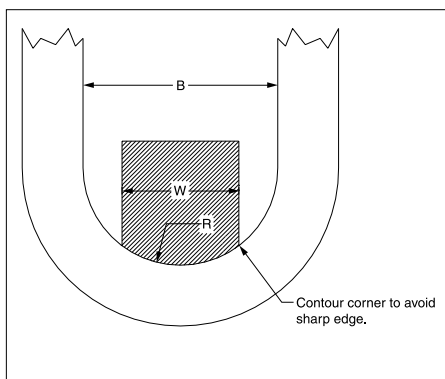


Figure 1

Crosby master links and master link assemblies are proof tested with special fixtures in accordance with ASTM A952 and EN-1677-4. The purpose of the special fixture is to prevent localized point loading during the proof test. Point loading at the proof test load may result in permanent deformation. ASTM A952 allows for a maximum proof test fixture width (W) of 60% of the inside width (B) of the master link. EN 1677-4 allows for a maximum proof test fixture width (W) of 70% of the inside width (B) of the master link. The radius of the fixture (R) is one-half of inside width of the master link. A sketch showing an example of the special fixture is shown in Figure 1. Note that the corner of the fixture should be contoured so that a sharp edge does not make contact with the master link during the loaded condition.

Over the years some master links and master link assemblies have changed dimensions and working load limits. Special consideration should be given to the actual inside width of the master link being tested and its correct allowable proof load value. If the correct allowable proof load value is in question, then Crosby Engineering should be consulted for the appropriate proof load value.

Grade 80 & 100 Alloy Chain

WORKING LOAD LIMIT

The "Working Load Limit" is the maximum load in pounds which should ever be applied to chain, when the chain is new or in as-new condition, and when the load is uniformly applied in direct tension to a straight length of chain.

PROOF TEST

The "Proof Test" is a term designating the tensile test applied to new chain for the sole purpose of detecting injurious defects in the material or manufacture. It is the load that the chain has withstood under a test in which the load has been applied in direct tension to a straight length of chain.

MINIMUM ULTIMATE LOAD

The "Minimum Ultimate Load" is the minimum load at which new chain will break when tested by applying direct tension to a straight length of chain at a uniform rate of speed in a testing machine.

ATTACHMENTS

Any attachments, such as hooks or links, should have a rated "Working Load Limit" at least equal to the chain with which it is used.

SYMMETRICAL LOADING

Rated Working Load Limit assumes symmetrical loading of all sling legs.

SPECIFICATIONS: ASME B30.9 2006

Paragraph 9-1.6.1 "Prior to initial use, all new and repaired chain and components of an alloy steel chain sling, either individually or as an assembly, shall be proof tested by the sling manufacturer or qualified person."

CAUTION

Only Crosby Alloy chain, Spectrum 8® or Spectrum 10®, should be used for overhead lifting applications.

General Usage – It must be recognized that certain factors in the usage of chain and attachments can be abusive and lessen the load that the chain or attachments can withstand. Some examples are twisting of the chain; disfigurement; deterioration by straining, usage, weathering and corrosion; rapid application of load or jerking; applying excessive loads; sharp corner cutting action and non-symmetrical loading effects.

When using chain slings in choker applications, the Working Load Limit must be reduced by 20%. Crosby recommends a minimum angle of choke of 120 degrees. Consult Crosby when planning to use an angle of choke of less than 120 degrees. If Crosby A-1338 cradle grab hooks are used at a minimum angle of choke of 120 degrees, the full sling rated WLL can be utilized.

In shortening applications, a 20% reduction of the Working Load Limit is required except when using the Crosby A-1338 Cradle Grab Hooks, S-1311 Chain Shortener Link, the A-1355 Chain Choker Hook in conjunction with the S-1325 Chain Coupler Link, or the Crosby ELIMINATOR® shortener link. They can be used without any reduction to the Working Load Limit.

Care should be taken to observe these derated applications or chain may fracture or permanently stretch at loads less than the advertised chain ultimate strength and proof load respectively.

Environmental Effects – Excessive high or low temperatures, or exposure to chemically active environments such as acids or corrosive liquids or fumes, can reduce the performance of the chain.

Temperature

- Extreme temperatures will reduce the performance of alloy steel chain slings.
- Normal operating temperature is -40° F to 400° F (-40° C to

204° C).

- See the Temperature exposure chart (Tabla 1) to determine Reducción de WLL due to operation at, and exposure to, elevated Temperaturas.

Chemically Active Environments can have detrimental effects on the performance of chain. The effects can be both visible loss of material and undetectable material degradation causing significant loss of strength.

- Usage Exposure – Exposure to chemically active environments such as acids or corrosive liquids or fumes can reduce the performance of the chain.
- Special Surface Coating/Plating/Galvanizing – Chain should not be subjected to galvanizing, or any plating process.
- If it is suspected that the chain has been exposed to chemically active environment, remove from service.



TABLE 1

Use of Crosby Alloy Chain at Elevated Temperatures

Temperature of Chain		Grade 8 (80) Chain		Grade 10 (100) Chain	
(F°)	(C°)	Temporary Reduction of Rated Load at Elevated Temperature*	Permanent Reduction of Rated Load After Exposure to Temperature**	Temporary Reduction of Rated Load at Elevated Temperature*	Permanent Reduction of Rated Load After Exposure to Temperature**
Below 400	Below 200	None	None	None	None
400	200	10%	None	15%	None
500	260	15%	None	25%	5%
600	316	20%	5%	30%	15%
700	371	30%	10%	40%	20%
800	427	40%	15%	50%	25%
900	482	50%	20%	60%	30%
1000	538	60%	25%	70%	35%
Over 1000	Over 538	OSHA 1910.184 and ASME B30.9 requires all slings exposed to temperatures over 1000° F to be removed from service.			

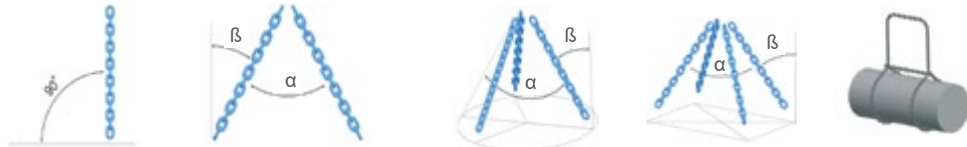
* Crosby does not recommend the use of Alloy Chain at temperatures above 800° F.

** When chain is used at room temperature after being heated to temperatures shown in the first column.

Working load limits - Europe

Based on EN 818-4:2008 WLL+25%

WLL tonnes Grade 10 GrabiQ



Sling type	1-leg	2-leg		3- and 4-leg		Choke Hitch
Condition of use	Straight	β 0-45° α 0-90°	β 45-60° α 90-120°	β 0-45° α 0-90°	β 45-60° α 90-120°	Endless sling in choke hitch
Load factor	1	1.4	1	2.1	1.5	1.6
Chain size						
6	1.4	2	1.4	3	2.12	2.24
7	1.9	2.65	1.9	4	2.8	3
8	2.5	3.55	2.5	5.3	3.75	4
10	4	5.6	4	8	6	6.3
13	6.7	9.5	6.7	14	10	10.6
16	10	14	10	21.2	15	16
18	12.5	18	12.5	26.5	19	20
19	14	20	14	30	21.2	22.4
20	16	22.4	16	33.5	23.6	25
22	19	26.5	19	40	28	30
23	21.2	28	21.2	42.5	31.5	33.5
26	26.2	37.5	26.5	56	40	42.5
28	31.5	42.5	31.5	63	45	50
32	40	56	40	85	60	63

Safety factor 4:1. Working load limits are based upon equally loaded and disposed sling legs.

WLL tonnes Grade 8 Classic

EN 818-4:2008



Sling type	1-leg	2-leg		3- and 4-leg		Choke Hitch
Condition of use	Straight	β 0-45° α 0-90°	β 45-60° α 90-120°	β 0-45° α 0-90°	β 45-60° α 90-120°	Endless sling in choke hitch
Load factor	1	1.4	1	2.1	1.5	1.6
Chain size						
6	1.12	1.6	1.12	2.36	1.7	1.8
7	1.5	2.12	1.5	3.15	2.24	2.5
8	2	2.8	2	4.25	3	3.15
10	3.15	4.25	3.15	6.7	4.75	5
13	5.3	7.5	5.3	11.2	8	8.5
16	8	11.2	8	17	11.8	12.5
18	10	14	10	21.2	15	16
19	11.2	16	11.2	23.6	17	18
20	12.5	17	12.5	26.5	19	20
22	15	21.2	15	31.5	22.4	23.6
23	16	23.6	16	35.5	25	26.5
26	21.2	30.0	21.2	45	31.5	33.5
28	25	33.5	25	50	37.5	40
32	31.5	45.0	31.5	67	47.5	50

Safety factor 4:1. Working load limits are based upon equally loaded and disposed sling legs.

Rules for correct WLL

Where choke hitch is employed, the WLL of the chain sling should be reduced by 20 % (unless the LK choker hook is used).

Asymmetrical loading conditions

For unequally loaded chain slings, the following is recommended:

- A two-legged system is treated as a single-legged system.
- A three- or four-legged system is treated as a two-legged system.

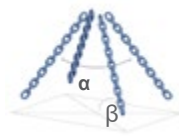
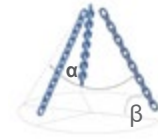
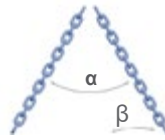
Working Load Limits - United States

WLL Ib Grade 10 GrabiQ

Working Load Limits in pounds for chain slings grade 10, according to NACM

Based on A 906/A 906M-2

1-leg	2-leg	3- and 4-leg
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Chain size (mm)	Chain size (in)	WLL (lb)	β 60° α 60°	β 45° α 90°	β 30° α 120°	β 60° α 60°	β 45° α 90°	β 30° α 120°
6	-	3300	5500	4625	3300	8400	6800	4850
7	9/32"	4300	7400	6100	4300	11200	9100	6400
8	5/16"	5700	9900	8100	5700	14800	12100	8500
10	3/8"	8800	15200	12400	8800	22900	18700	13200
13	1/2"	15000	26000	21200	15000	39000	31800	22500
16	5/8"	22600	39100	32000	22600	58700	47900	33900
20	3/4"	35300	61100	49900	35300	91700	74900	52950
22	7/8"	42700	74000	60400	42700	110900	90600	64000
26	1"	59700	103100	84100	59500	155600	126600	89250
32	1-1/4"	88160	152700	124600	88160	229000	186950	132200

Note 1: WLL for 2-leg sling and single leg basket slings = 2 x 1-leg WLL x sin of horizontal angle α

Note 2: WLL for 3- and 4-leg sling and 2-leg basket slings = 3 x 1-leg WLL x sin of horizontal angle α

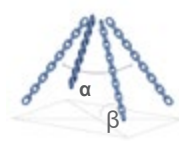
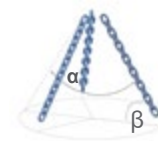
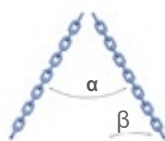
Note 3: WLL based upon equally loaded and disposed sling legs

WLL Ib Grade 8 Classic

Working Load Limits in pounds for chain slings grade 8, according to NACM

Based on A 906/A 906M-2

1-leg	2-leg	3- and 4-leg
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Chain size (mm)	Chain size (in)	WLL (lb)	β 60° α 60°	β 45° α 90°	β 30° α 120°	β 60° α 60°	β 45° α 90°	β 30° α 120°
6	-	2450	4200	3300	2425	6400	5050	3525
7	9/32"	3500	6100	4900	3500	9100	7400	5200
8	5/16"	4500	7800	6400	4500	11700	9500	6800
10	3/8"	7100	12300	10000	7100	18400	15100	10600
13	1/2"	12000	20800	17000	12000	31200	25500	18000
16	5/8"	18100	31300	25600	18100	47000	38400	27100
20	3/4"	28300	49000	40000	28300	73500	60000	42400
22	7/8"	34200	59200	48400	34200	88900	72500	51300
26	1"	47700	82600	67400	47700	123900	101200	71500
32	1-1/4"	72300	125200	102200	72300	187800	153400	108400

Note 1: WLL for 2-leg sling and single leg basket slings = 2 x 1-leg WLL x sin of horizontal angle α

Note 2: WLL for 3- and 4-leg sling and 2-leg basket slings = 3 x 1-leg WLL x sin of horizontal angle α

Note 3: WLL based upon equally loaded and disposed sling legs

Working load limits - Australia

WLL tonnes Grade 10 GrabiQ

Based on AS 3775.2:2014

Sling type	1-leg			2-, 3- and 4-leg				Basket Slings		GrabiQ home pocket loop		
Condition of use	Straight	Adjustable with no deration	Reeved sling (Choke)	Straight 60°	Straight 90°	Straight 120°	Reeved (Choke) Max angle 60°	1-leg	2-leg	1-leg α max 30°	2-,3- and 4-leg 60° α max 30°	2-,3- and 4-leg 90° α max 30°
Load factor	1	1	0.75	1.73	1.41	1	1.3	1.3	2.25	1	1.73	1.41
Chain size												
6	1.4	1.4	1.1	2.4	2	1.4	1.8	1.8	3.4	1.5	2.6	2.1
7	1.9	1.9	1.4	3.3	2.7	1.9	2.5	2.5	4.3	2	3.3	2.7
8	2.5	2.5	1.9	4.3	3.5	2.5	3.3	3.3	5.9	2.6	4.5	3.7
10	4	4	3	6.9	5.6	4	5.2	5.2	9	4	6.9	5.6
13	6.7	6.7	5	11.6	9.4	6.7	8.8	8.8	15.3	6.8	11.8	9.6
16	10	10	7.5	17.3	14.1	10	13	13	23.2	10.3	17.8	14.5
20	16	16	12	27.7	22.6	16	20.8	20.8	36	-	-	-
22	19	19	14.3	32.9	26.8	19	24.7	24.7	45	-	-	-
26	26.5	26.5	19.9	45.8	37.4	26.5	34.5	34.5	60.7	-	-	-
32	40	40	30	69.2	56.4	40	52	52	90	-	-	-

Note 1: Advice regarding the appropriate deration should be sought by the manufacturer

Note 2: The determination of the angle of the multi-leg sling is the largest angle at the apex of the configuration

Note 3: Reeved (choke) slings and basket slings, in a two leg configuration have a maximum angle for us of 60°

Note 4: In the 2-leg basket sling, the master link to be used shall be of an appropriate WLL and with intermediate links. This ensures that the factor 2,25 can be accommodated and that there is no overcrowding with back hooking.

Note 5: For engineered lifts, see Clause 7.2.2 in AS 3775.2:2014

WLL tonnes Grade 8 Classic in Australia

Based on AS 3775.2:2014

Sling type	1-leg			2-, 3- and 4-leg				2-leg
Condition of use	Straight	Adjustable with no deration	Reeved sling (Choke)	Straight β 60°	Straight β 90°	Straight β 120°	Reeved (Choke) Max angle 60°	Basket
Load factor	1	1	0.75	1.73	1.41	1	1.3	2.25
Chain size								
6	1.1	1.1	0.8	1.9	1.6	1.1	1.5	2.5
7	1.5	1.5	1.1	2.6	2.1	1.5	2	3.4
8	2	2	1.5	3.5	2.8	2	2.6	4.5
10	3.2	3.2	2.4	5.5	4.5	3.2	4.1	7.2
13	5.3	5.3	4	9.2	7.5	5.3	6.9	11.9
16	8	8	6	13.8	11.3	8	10.4	18
19	11.2	11.2	8.4	19.4	15.8	11.2	14.6	25.2
20	12.5	12.5	9.4	21.6	17.6	12.5	16.3	28.1
22	15	15	11.3	26	21.2	15	19.5	33.8
26	21.2	21.2	15.9	36.7	29.9	21.2	27.6	47.7
32	31.5	31.5	23.6	54.5	44.4	31.5	41	70.9

Note 1: Advice regarding the appropriate deration should be sought by the manufacturer

Note 2: The determination of the angle of the multi-leg sling is the largest angle at the apex of the configuration

Note 3: Reeved (choke) slings and basket slings, in a two leg configuration have a maximum angle for us of 60°

Note 4: In the 2-leg basket sling, the master link to be used shall be of an appropriate WLL and with intermediate links. This ensures that the factor 2,25 can be accommodated and that there is no overcrowding with back hooking.

Note 5: For engineered lifts, see Clause 7.2.2 in AS 3775.2:2014

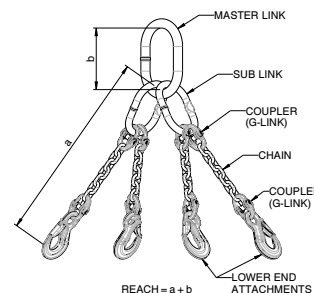
Tips for chain sling assembly

General

1. The reach of the sling is the length measured from the load bearing surface of the master link to the load bearing surface of the hook or lower terminal (as shown in illustrations).
2. A metal ID tag must always be attached to a chain sling, showing serial number, size, reach, Working Load Limit at angle of lift and manufacturer.
3. Each sling manufactured shall have a completed certificate of test provided to user.

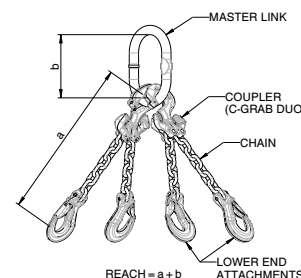
Classic chain slings

4. **Single Leg Sling**
If the required measurement falls in the middle of a link, the next link is cut.
5. **Double Leg Sling (clevis system)**
Cut chain to length and count the links. You must have an even number of links so hooks hang in the correct plane. Hooks should always point out, as shown in diagram.
6. **Triple or Quadruple Leg Sling (clevis system)**
Cut chain to length and count the links. You must have an odd number of links so hooks hang in the correct plane. Hooks should always point out, as shown in diagram. If the measurement falls in the middle of a link, the next link that produce an odd number is cut.



GrabiQ chain slings

7. It is a common practice, when possible, to keep all hooks in the same plane as the master link. This is easily accomplished on 1, 2, & 4 leg slings. It is not possible with 3-leg GrabiQ slings when single and dual fittings are mixed.
8. It is a common practice, when possible, to attach hooks so that latches point away from the master link.
9. Mixing GrabiQ fittings: Adding two additional chain links to the CL & CLD gives the same effective reach as CG & CGD. The MG & MGD have the same effective reach.
10. Normally, the master link will have a maximum of two connecting links, CG, CGD, CL, or CLD. The maximum number of connecting links that can ever be mounted on a single master link is three, when constructing a double leg basket.
11. A GrabiQ sling can never have more than four independent legs or two basket legs.
12. Attaching CG, CGD, CL, & CLD connectors to MF and MFX Master Links: Insert the connector onto the master link at the engineered flat. C-Connecting links are normally attached to the master link using the Dismountable Connecting Set type CS or the Permanent Connecting Set type CP. Each C-Connector includes one solid retainer pin, 1 larger rolled spring keeper pin and 1 smaller rolled spring keeper pin. When the dismountable connecting set is used the sling can be disassembled for repair. The permanent connecting set cannot be disassembled for repair.
 - a. CS – First install the solid retainer pin. Second drive the smaller rolled spring keeper pin through the hole provided at a right angle to the solid retainer pin. The fit should be very snug.
 - b. CP – First install the solid retainer pin. Second drive the larger rolled spring keeper pin into the same hole, directly behind solid retainer pin. The fit should be very snug.



Technical Information

Chain Manufacturing - Quality and Strength Requirements

Chains are divided into grades based on minimum nominal breaking stress.

Chain Grade	Surface treatment	Code	Minimum breaking stress N/in ²	Minimum breaking stress N/mm ²	Mean breaking stress "ksi"	Load factors			Typical use
						WLL	MPF	Breaking force	
8	Yellow U Black B	KL	31.50	800	116	1	2.5	4	General lifting (KL), Container lashing (LL). Extra heavy towing (ML), Lashing (KL, LL). Fishing (KL, ML, LL)
		ML	31.50	800	116	-	1	4	
		LL	31.50	800	116	-	1	4	
10	Blue A	KL	39.37	1000	145	1	2.5	4	General lifting

Testing and Quality Control- GrabiQ & Classic Chain (Grade 10 & 8)

In each step of the manufacturing of the chain, our systematic quality monitoring will ensure the highest safety and the longest life span in the product. Here are some especially important aspects of quality:

Material

The incoming material is supplied with test certificates only from qualified manufacturers and according to our stated material specifications.

Manufacturing

During forming and welding, the operators continuously control that the links meet the specified dimensions both before and after welding.

Single link samples are continuously mandrel tested on the weld. Shape, dimensions and deburring are then inspected visually.

Sample lengths are heat treated and then destruction load tested. Following these tests, the chain is heat treated.

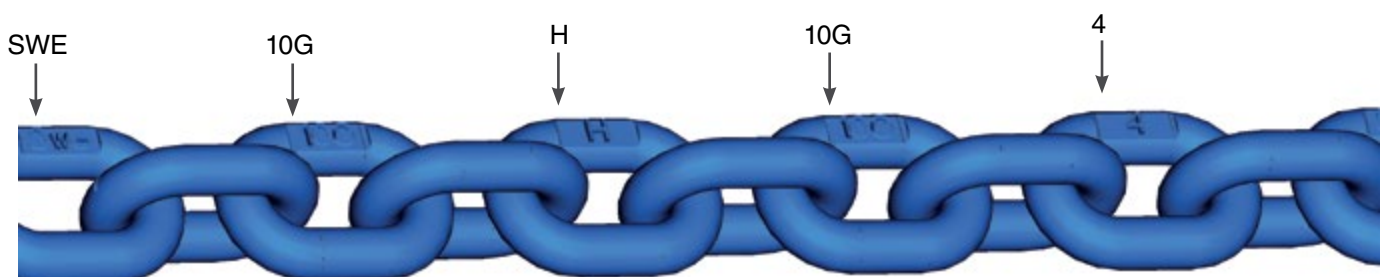
Hardening and tempering is carried out continuously in computer controlled induction furnaces with regular samplings.

Proof Force

The entire chain is test loaded. The manufacturing proof force for short link chain is 2.5 times the permitted working load limit. This gives the chain high safety in use. The chain is then visually inspected and cut into delivery lengths. A sample is taken from every length and tested to destruction. Dimensions and shape are also checked. All results are documented.

Marking and Traceability

The international standards for lifting chain require that the chain is marked with Grade and Manufacturers ID. On our chain we stamp "SWE - 10G - H - 10G - 4", where the "H" and the "4" is the combination for the traceability code. In case of the unlikely event of chain failure, we can trace the specific chain link back to the very batch and raw material as well as the year and place of manufacture. Each individual delivery length also has its unique batch number.



Use

- Never lift with a twisted chain.
- Use shortening hooks, knotting is not allowed.
- Use edge protectors to prevent sharp edges from damaging the chain.

See website or user instructions for assembly instructions.

Meets listed current specifications and standards at time of publication of this catalog.

Maintenance

Periodic thorough examination must be carried out at least every 12 months or more frequently according to local statutory regulations, type of use and past experience.

1. Overloaded chain slings must be taken out of service.
2. Chain and components including load pins which have been damaged, deformed, elongated, bent or showing signs of cracks or gouges shall be replaced. Carefully grind away small nicks and burrs.
3. Additional testing by magnetic particle inspection and/or proof loading at max. 2 x WLL may be carried out. The wear of the chain and component shall in no place exceed 10% of the original dimensions.
4. The chain link wear - max. 10% - is defined as the reduction of the mean diameter measured in two directions.

Severe Environment

Chain and components must not be used in alkaline (>pH10) or acidic conditions (<pH6). Comprehensive and regular examination must be carried out when used in severe or corrosive inducing environments. In uncertain situations consult your Gunnebo Industries dealer.

Extreme Temperature Conditions

The in service temperature effects the WLL as following :

Temperature (°F)	Reduction of WLL			Grade 8 chain & components
	Grade 10 chain (400)	Grade 10 chain (200)	Grade 10 components	
-40 to +392 °F	0 %	0 %	0 %	0 %
+392 to +572 °F	10 %	Not allowed	10 %	10 %
+572 to +752 °F	25 %	Not allowed	25 %	25 %

After short heat exposure, maximum one hour, the sling reverts to its full capacity. Upon return to normal temperature, the sling reverts to its full capacity within the above temperature range. Chain slings should not be used above or below these temperatures. **For chain grade 10(200) the maximum in service temperature is 200° C.**

Definitions

Proof force:

Each individual chain link is tested to the Manufacturing Proof Force (MPF) level before delivery. The MPF level is 2.5 times the WLL, equal to 62.5% of the Minimum Breaking Force.

Breaking force (BF):

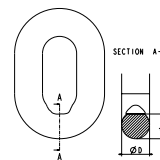
The highest static force a chain is exposed to during test loading before breaking.

Working load limit (WLL):

The maximum permitted load on a lifting chain under normal (vertical) lifting conditions.

Total ultimate elongation:

The elongation of the test item, relative to the original length, at the moment of breaking.



$$\frac{D + d}{2} > 0.9d_n$$



Scope

This procedure is provided to give instructions for installation of wire rope into the Crosby® SB-427B Spelter Button using WIRELOCK® socketing material, or zinc socketing material. **Additionally, instructions regarding the reuse of spelter buttons are included.** The spelter button is part of a socket assembly that includes a socket basket, pin, cotter pin and button. If there are any questions regarding these instructions, please contact The Crosby Group LLC at (918) 834-4611 and request technical assistance.

NOTE: Many high performance ropes require special attention to prevent rope damage during cutting, seizing and brooming in preparation for the speltering operation. Attention to the special instructions is required to ensure proper termination efficiency. Consult rope manufacturer for specific details.

Installation

Install button on the rope so that the live end of the rope extends out of small inside diameter of the button. Broomed end of rope should be pulled into button and placed completely to the "MAX FILL" line marked on the button to ensure correct length of engagement with socketing material.

Socketing using WIRELOCK® Resin Material

Seizing, cleaning, brooming and preparation of wire rope and pouring of WIRELOCK® is to be carried out per instructions provided in the *Wire Rope End Terminations User's Manual*, and *WIRELOCK® Warnings and Application Instructions* located on the WIRELOCK® Product or in the Crosby General Catalog.

Socketing Using Zinc Spelter Material

Seizing, cleaning, brooming and preparation of the wire rope, and pouring of zinc is to be carried out in accordance with recommendations of the Crosby® *Wire Rope End Terminations Manual* or other approved procedures.

Note: Before operation of the wire rope assembly, it is recommended that all poured sockets, whether with zinc or resin, be proof loaded to seat the cone.

Reuse Of Crosby® Spelter Buttons

The following are general guidelines for the reuse of a Crosby® SB-427B Button. The use and inspection of used buttons are the responsibility of the user.

Procedure For Removing Spelter Cone

- Cut the rope close ($\frac{1}{2}$ ") to the nose end of the button and press the cone out of the button.
- For metallurgical, medical and environmental reasons, we do not recommend the use of heat to remove the spelter cone.
- However, if this is the only means available for removing the zinc cone, care should be taken not to exceed 850°F (450°C) surface temperature. The preferred method would be a slow heat in a temperature controlled oven. If a torch (rosebud) is used, the heated area shall be monitored with a Tempil stick or a temperature indicator to prevent localized heating from exceeding the 850°F (450°C) limit.
- To remove a WIRELOCK® cone, heat the surface of the button to 350°F (177°C) (do not exceed the 850°F (450°C) limit for any localized hot spot). Leave for 5-10 minutes, then drive the cone out with a hammer and drift.

Selection Of Buttons For Reuse

- Use only buttons that:
- Do not show discoloration from excessive heating.
- Do not show any signs of welding.
- Select only buttons that have been cleaned and have passed a Magnetic Particle Inspection by a qualified technician (level II ASNT-SNT-TC-1A-88) per ASTM E709. Acceptance criteria shall be per ASTM E125, Types II-VIII, Degree 1. No cracks are acceptable.
- Select only buttons that do not show any signs of overloading or wear.
- Select buttons that are free from nicks, gouges and abrasions. Indications may be repaired by lightly grinding until surfaces are smooth, provided they do not reduce the dimensions by more than 10% of the nominal catalog dimension.
- Select buttons that are not distorted, bent or deformed.

NOTE: Buttons having any of the indications as outlined above shall not be reused.

CROSBY® FORGED WIRE ROPE CLIP WARNINGS & APPLICATION INSTRUCTIONS

G-450
(Red-U-Bolt®)



⚠ WARNING

- Failure to read, understand, and follow these instructions may cause death or serious injury.
- Read and understand these instructions before using clips.
- Match the same size clip to the same size wire rope.
- Prepare wire rope end termination only as instructed.
- Do not use with plastic coated wire rope.
- Apply first load to test the assembly. This load should be of equal or greater weight than loads expected in use. Next, check and retighten nuts to recommended torque (See Table 1).
- The reuse of clips is discouraged. As recommended by Crosby, have qualified personnel inspect product before use.

Efficiency ratings for wire rope end terminations are based upon the minimum breaking force of wire rope. The efficiency rating of a properly prepared loop or thimble-eye termination for clip sizes 1/8" through 7/8" is 80%, and for sizes 1" through 3-1/2" is 90%.

The number of clips shown (see Table 1) is based upon using RRL or RLL wire rope, 6 x 19 or 6 x 37 Class, FC or IWRC; IPS or XIP, XXIP. If Seale construction or similar large outer wire type construction in the 6 x 19 Class is to be used for sizes 1 inch and larger, add one additional clip. If a pulley (sheave) is used for turning back the wire rope, add one additional clip.

The number of clips shown also applies to rotation-resistant RRL wire rope, 8 x 19 Class, IPS, XIP, XXIP sizes 1-1/2 inch and smaller; and to rotation-resistant RRL wire rope, 19 x 7 Class, IPS, XIP, XXIP sizes 1-1/2 inch and smaller.

For other wire rope manufacture designs not mentioned above, we recommend contacting Crosby Engineering at the address or telephone number on the back cover to ensure the desired efficiency rating.

The style of wire rope termination used for any application is the obligation of the user.

For OSHA (Construction) applications, see OSHA 1926.251.

1. Refer to Table 1 following these instructions. Turn back specified amount

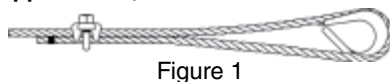


Figure 1

of rope from thimble or loop. Apply first clip one base width from dead end of rope. Apply U-Bolt over dead end of wire rope – live end rests in saddle (Never saddle a dead horse!). Use torque wrench to tighten nuts evenly, alternate from one nut to the other until reaching the recommended torque (See Figure 1).

2. When two clips are required, apply the second clip as near the loop or thimble as possible. Use torque wrench to tighten nuts evenly, alternating until reaching the recommended torque. When more than two clips are required, apply the second clip as near the loop or thimble as possible, turn nuts on second clip firmly, but do not tighten. (See Figure 2)

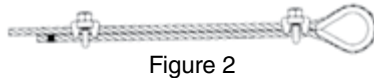


Figure 2

When three or more clips are required, space additional clips equally between first two – take up rope slack – use torque wrench to tighten



Figure 3

nuts on each clip evenly, alternating from one nut to the other until reaching recommended torque (See Figure 3).

4. If a pulley (sheave) is used in place of a thimble, add one additional clip. Clip spacing should be as shown.

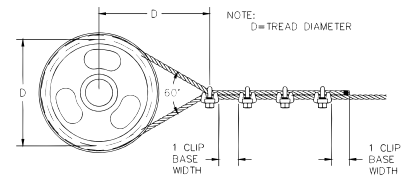


Figure 4

(See Figure 4)

5. WIRE ROPE SPLICING PROCEDURES:

The preferred method of splicing two wire ropes together is to use inter-locking turnback eyes with thimbles, using the recommended number of clips on each eye



Figure 5

(See Figure 5).

An alternate method is to use twice the number of clips as used for a turnback termination. The rope ends are placed parallel to each other,

overlapping by twice the turnback amount shown in the application instructions. The minimum number of clips should be installed on each dead end

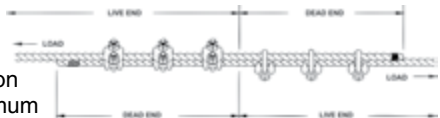


Figure 6

(See Figure 6). Spacing, installation torque, and other instructions still apply.

6. IMPORTANT

Apply first load to test the assembly. This load should be of equal or greater weight than loads expected in use. Next, check and use torque wrench to retighten nuts to recommended torque.

In accordance with good rigging and maintenance practices, the wire rope end termination should be inspected periodically for wear, abuse, and general adequacy.

Table 1

Rope Size		Minimum No. of Clips	Amount of Rope to Turn Back in inches	*Torque in ft·lbf
(in)	(mm)			
1/8	3-4	2	3-1/4	4.5
3/16	5	2	3-3/4	7.5
1/4	6-7	2	4-3/4	15
5/16	8	3	5-1/4	30
3/8	9-10	3	6-1/2	45
7/16	11-12	3	7	65
1/2	13	3	11-1/2	65
9/16	14-15	3	12	95
5/8	16	3	12	95
3/4	18-20	4	18	130
7/8	22	4	19	225
1	24-25	5	26	225
1-1/8	28-30	6	34	225
1-1/4	33-34	7	44	360
1-3/8	36	7	44	360
1-1/2	38-40	8	54	360
1-5/8	41-42	8	58	430
1-3/4	44-46	8	61	590
2	48-52	8	71	750
2-1/4	56-58	8	73	750
2-1/2	62-65	9	84	750
2-3/4	68-72	10	100	750
3	75-78	10	106	1200
3-1/2	85-90	12	149	1200

If a pulley (sheave) is used for turning back the wire rope, add one additional clip. See Figure 4.

If a greater number of clips are used than shown in the table, the amount of turnback should be increased proportionately.

*The tightening torque values shown are based upon the threads being clean, dry, and free of lubrication.

CROSBY® FIST GRIP® CLIPS

WARNINGS & APPLICATION INSTRUCTIONS



New Style Fist Grip®
3/16" - 5/8"



Fist Grip® Clips
3/4" - 1-1/2"

WARNING

- Failure to read, understand, and follow these instructions may cause death or serious injury.
- Read and understand these instructions before using clips.
- Match the same size clip to the same size wire rope.
- Do not mismatch Crosby clips with other manufacturer's clips.
- Prepare wire rope end termination only as instructed.
- Do not use with plastic coated wire rope.
- Apply first load to test the assembly. This load should be of equal or greater weight than loads expected in use. Next, check and retighten nuts to recommended torque (See Table 1).
- The reuse of clips is discouraged. As recommended by Crosby, have qualified personnel inspect product before use.

Efficiency ratings for wire rope end terminations are based upon the minimum breaking force of wire rope. The efficiency rating of a properly prepared loop or thimble-eye termination for clip sizes 1/8" through 7/8" is 80%, and for sizes 1" through 3-1/2" is 90%.

The number of clips shown (see Table 1) is based upon using RRL or RLL wire rope, 6 x 19 or 6 x 37 Class, FC or IWRC; IPS or XIP, XXIP. If Seale construction or similar large outer wire type construction in the 6 x 19 Class is to be used for sizes 1 inch and larger, add one additional clip. If a pulley (sheave) is used for turning back the wire rope, add one additional clip.

The number of clips shown also applies to rotation-resistant RRL wire rope, 8 x 19 Class, IPS, XIP, XXIP sizes 1-1/2 inch and smaller; and to rotation-resistant RRL wire rope, 19 x 7 Class, IPS, XIP, XXIP sizes 1-1/2 inch and smaller.

For other wire rope manufacture designs not mentioned above, we recommend contacting Crosby Engineering at the address or telephone number on the back cover to ensure the desired efficiency rating.

The style of wire rope termination used for any application is the obligation of the user.

For OSHA (Construction) applications, see OSHA 1926.251.

1. Refer to Table 1 in following these instructions. Turn back specified amount of rope from thimble or loop.

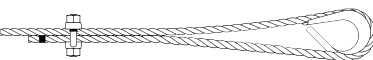


Figure 1

Apply first clip one base width from dead end of rope. Use torque wrench to tighten nuts evenly, alternating from one nut to the other until reaching the recommended torque (See Figure 1).

2. When two clips are required, apply the second clip as near the loop or thimble as possible. Use torque wrench to tighten nuts evenly, alternating until reaching the recommended torque. When more than two clips are required, apply the second clip as near the loop or thimble as possible, turn nuts on second clip firmly, but do not tighten. (See Figure 2)

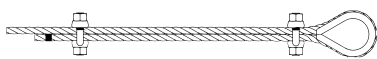


Figure 2

3. When three or more clips are required, space additional clips equally between first two – take up rope slack – use torque wrench to tighten nuts on each clip evenly, alternating from one nut to the other until reaching recommended torque (See Figure 3).

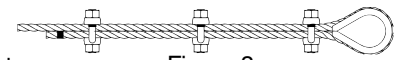


Figure 3

4. If a pulley (sheave) is used in place of a thimble, add one additional Fist Grip. Fist Grip spacing should be as shown. (See Figure 4)

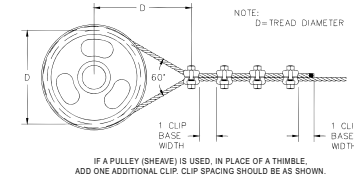


Figure 4

5. WIRE ROPE SPLICING PROCEDURES:

The preferred method of splicing two wire ropes together is to use inter-locking turnback eyes with thimbles, using the recommended number of clips on each eye (See Figure 5).



Figure 5

An alternate method is to use twice the number of clips as used for a turnback termination.

The rope ends are placed parallel to each other, overlapping by twice the turnback amount shown in the application instructions. The minimum number of clips should be installed on each dead end (See Figure 6). Spacing, installation torque, and other instructions still apply.

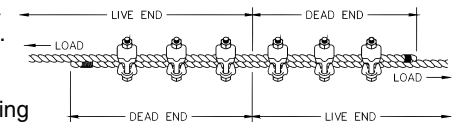


Figure 6

6. IMPORTANT

Apply first load to test the assembly. This load should be of equal or greater weight than loads expected in use. Next, check and use torque wrench to retighten nuts to recommended torque.

In accordance with good rigging and maintenance practices, the wire rope end termination should be inspected periodically for wear, abuse, and general adequacy.

Table 1

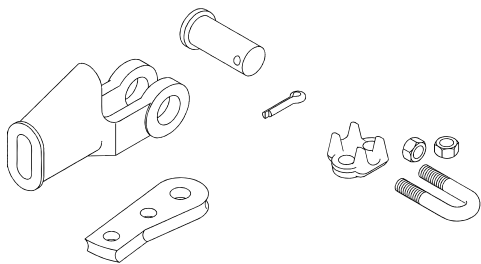
Clip Size/ Rope Size		Minimum No. of Clips	Amount of Rope to Turn Back in Inches	* Torque in ft•lbf
(in)	(mm)			
3/16	5	2	4	30
1/4	6-7	2	4	30
5/16	8	2	5	30
3/8	9-10	2	5-1/4	45
7/16	11-12	2	6-1/2	65
1/2	13	3	11	65
9/16	14-15	3	12-3/4	130
5/8	16	3	13-1/2	130
3/4	18-20	3	16	225
7/8	22	4	26	225
1	24-25	5	37	225
1-1/8	28-30	5	41	360
1-1/4	32-34	6	55	360
1-3/8	36	6	62	500
1-1/2	38-40	7	78	500

If a pulley (sheave) is used for turning back the wire rope, add one additional clip. See Figure 4.

If a greater number of clips are used than shown in the table, the amount of turnback should be increased proportionately.

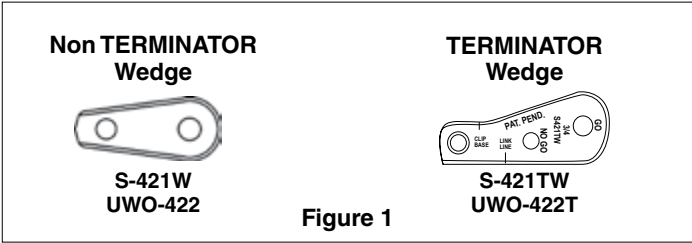
*The tightening torque values shown are based upon the threads being clean, dry, and free of lubrication.

CROSBY TERMINATOR
WARNINGS & APPLICATION INSTRUCTIONS



S-421T / US-422T
CROSBY TERMINATOR

NOTE: The design of the basket for the S-421T 1-1/4" TERMINATOR® Wedge Socket does not allow proper fit to the old style Crosby S-421W wedge (see Fig. 1). **Do not assemble or use.** The design of the basket for each US-422T TERMINATOR Wedge Socket does not allow proper fit to the old style UWO-422 wedge (See Fig. 1). **Do not assemble or use.** All S-421T and US-422T TERMINATOR baskets are marked with a capital "T" or TERMINATOR.



QUIC-CHECK® "Go" and "No-Go" features cast into wedge. The proper size wire rope is determined when the following criteria are met:
1. The wire rope shall pass thru the "Go" hole in the wedge.
2. The wire rope shall NOT pass thru the "No-Go" hole in the wedge.

Important Safety Information – Read and Follow
Inspection/Maintenance Safety

- Always inspect socket, wedge and pin before using.
- Do not use part showing cracks.
- Do not use modified or substitute parts.
- Repair minor nicks or gouges to socket or pin by lightly grinding until surfaces are smooth. Do not reduce original dimension more than 10%. Do not repair by welding.
- Inspect permanent assemblies annually, or more often in severe operating conditions.
- Do not mix and match wedges or pins between models or sizes.
- Always select the proper wedge and socket for the wire rope size.

Assembly Safety

- Use only with standard 6 to 8 strand wire rope of designated size. For intermediate size rope, use next larger size socket. For example: When using 9/16" diameter wire rope use a 5/8" size Wedge Socket Assembly. Welding of the tail on standard wire rope is not recommended. Seizing of the tail is preferred following the recommended practices of the wire rope manufacturer. The tail length of the dead end should be a minimum of 6 rope diameters but not less than 6" (See Figure 2).
- **To use with Rotation Resistant wire rope** (special wire rope constructions with 8 or more outer strands) ensure that the dead end is welded, brazed or seized before inserting the wire rope into the wedge socket to prevent core slippage or loss of rope lay. Seizing of the tail is preferred following the recommended practices of the wire rope manufacturer. The tail length of the dead end should be a minimum of 20 rope diameters but not less than 6" (See Figure 2).
- Properly match socket, wedge and clip (See Table 1) to wire rope size.

- Align live end of rope, with center line of pin (See Figure 2).
- Secure dead end section of rope (See Figure 2).
- Tighten nuts on clip to recommended torque (See Table 1).
- Do not attach dead end to live end or install wedge backwards (See Fig. 3).
- Use a hammer to seat Wedge and Rope as deep into socket as possible before applying first load.

⚠ WARNING

- Loads may slip or fall if the Wedge Socket is not properly installed.
- Load misapplied in direct contact with the wedge can dislodge the wedge and cause loss of load.
- A falling load can seriously injure or kill.
- Read and understand these instructions before installing the Wedge Socket.
- Do not side load the Wedge Socket.
- Apply first load to fully seat the Wedge and Wire Rope in the socket. This load should be of equal or greater weight than loads expected in use.
- Do not interchange wedges between S-421T and US422T or between sizes.
- Do not assemble an old style 1-1/4" (30-32mm) S-421W wedge into an S-421T 1-1/4" (30-32mm) TERMINATOR basket.
- Do not assemble an old style UWO-422 wedge into a US-422T TERMINATOR basket.
- The reuse of clips is discouraged. As recommended by Crosby, have qualified personnel inspect product before use.

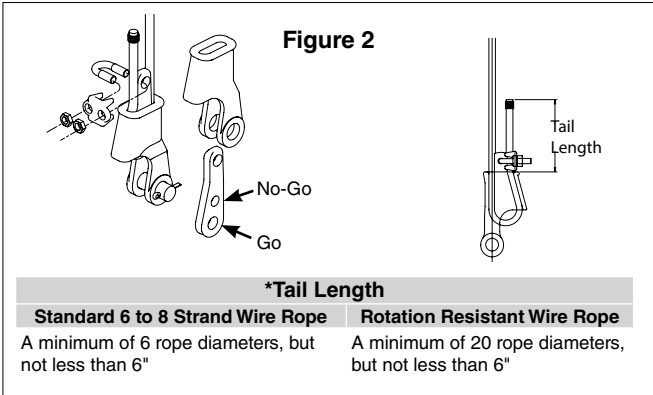
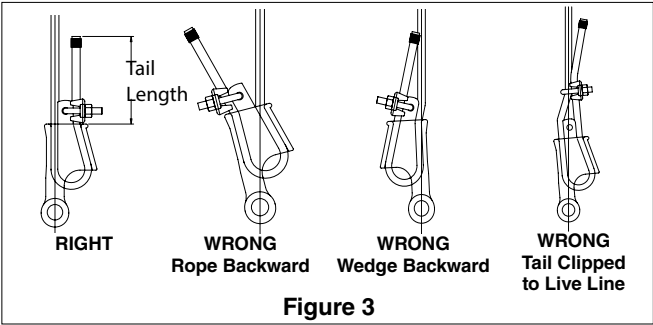


TABLE 1								
Rope Size (in)	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4
Clip Size (in)	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4
* Torque ft•lbf	45	65	95	130	225	225	225	360

* The tightening torque values shown are based upon the threads being clean, dry, and free of lubrication.



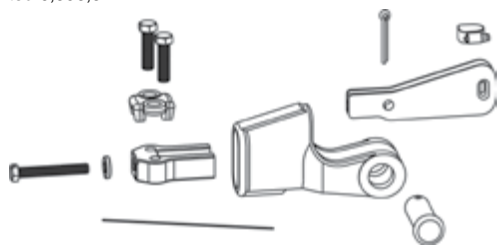
Operating Safety

- Apply first load to fully seat the Wedge and Wire Rope in the socket. This load should be of equal or greater weight than loads expected in use.
- Efficiency rating of the Wedge Socket termination is based upon the catalog breaking strength of Wire Rope. The efficiency of a properly assembled Wedge Socket is 80%.
- During use, do not strike the dead end section or wedge with any other elements of the rigging (Called two blocking).
- Do not allow a direct load to contact the wedge.

SUPER TERMINATOR WEDGE SOCKET

WARNINGS & APPLICATION INSTRUCTIONS

US Patented 6,898,827.



S-423T SUPER TERMINATOR

The intended purpose of the SUPER TERMINATOR is to offer a Wedge Socket termination, which when assembled properly with high performance, high strength, compacted strand, rotation resistant wire rope will achieve an 80% termination efficiency. Due to the unique construction of these ropes, Crosby cannot make a broad general statement that all current and future designed ropes, when properly assembled with a SUPER TERMINATOR, will achieve a minimum 80% termination efficiency. (To determine the efficiency rating for a specific rope, contact Crosby Engineering at 918-834-4611.).

The SUPER TERMINATOR may be purchased as a complete Wedge Socket assembly or the Wedge assembly may be purchased for retrofit onto your Crosby S-421T wedge socket basket.

The Crosby S-423T SUPER TERMINATOR Wedge is designed to be assembled only into the Crosby S-421T socket basket. For the 1-1/4" S-423T, assemble only on to S-421T basket marked TERMINATOR.

Important Safety Information - Read and Understand Inspection/Maintenance Safety

- Always inspect socket, wedge and pin before using.
- Do not use part showing cracks.
- Do not use modified or substitute parts.
- Repair minor nicks or gouges to socket or pin by lightly grinding until surfaces are smooth. Do not reduce original dimension more than 10%. Do not repair by welding.
- Inspect permanent assemblies annually, or more often in severe operating conditions.
- Do not mix and match wedges or pins between models or sizes.
- Always select the proper wedge and socket for the wire rope size.

Assembly Safety

- Properly match socket and wedge assembly to wire rope size.
- Ensure the dead end is properly seized before inserting the wire rope into the wedge socket basket. High performance, high strength, compacted strand, rotation resistant wire ropes are sensitive to seizing methods. For specific seizing procedures, contact the wire rope manufacturer.
- The tail length of the dead end should be a minimum of 20 rope diameters but not less than 10" (See Fig. 1).
- Mount wedge socket basket in vice.
- Insert live end of wire rope into wedge basket, aligning live end of rope with center line of pin. Make a loop and return (See Figure 2).
- Pull on live line to remove excess out of loop, leaving enough room to properly insert wedge into basket (See Figure 3).
- Secure rope to SUPER TERMINATOR Wedge with clamp (See Figure 4).
- Pull Wedge and rope into basket until tensioner bolt, with washers properly applied, can engage threads in nose of wedge. Auxiliary power may be required to fully pull wedge and rope into basket (See Figure 5).
- Use torque wrench to tighten tensioner bolt to recommended torque value, properly seating wedge and rope into basket. Reference Table 1 for recommended Torque in Ft Lbs.
- Secure dead end section of rope with clip base. Tighten bolts to recommended torque values (See Table 1).
- Properly install wire to securely lock tensioner bolt to tensioner. (See Figure 6).
- Do not attach dead end to live end or install wedge backwards. (See Figure 7).

Operating Safety

- Proper application of the Super TERMINATOR eliminates the "first load" requirement of conventional wedge socket terminations.
- Efficiency rating of the Wedge Socket termination is based upon the catalog breaking strength of Wire Rope. The efficiency of a

properly assembled Super Terminator on most high performance, high strength, compacted strand, rotation resistant ropes will achieve 80% of catalog breaking strength of rope, depending on the unique construction of these ropes (To determine the efficiency rating for a specific rope, contact Crosby Engineering at 918-834-4611.).

- During use, do not strike the dead end section or wedge with any other elements of the rigging (Called two blocking).
- The SUPER TERMINATOR wedge socket may also be used with standard 6 to 8 strand and rotation resistant wire rope (special wire rope constructions with 8 or more strands).
- Do not allow direct load to contact the wedge.

⚠ WARNING

- Loads may slip or fall if the Wedge Socket is not properly installed.
- A falling load can seriously injure or kill.
- Load misapplied in direct contact with the wedge can dislodge the wedge and cause loss of load.
- Read and understand these instructions before installing the Wedge Socket.
- Do not side load the Wedge Socket.
- Apply recommended torque to tensioner and clip bolts, and properly install wire to securely lock tensioner bolt to tensioner.
- Do not assemble the S-423 Wedge in any brand or model socket basket other than the Crosby S-421T TERMINATOR.
- The size is marked on the socket basket and wedge, do not interchange wedge between sizes.
- The reuse of clips is discouraged. As recommended by Crosby, have qualified personnel inspect product before use.

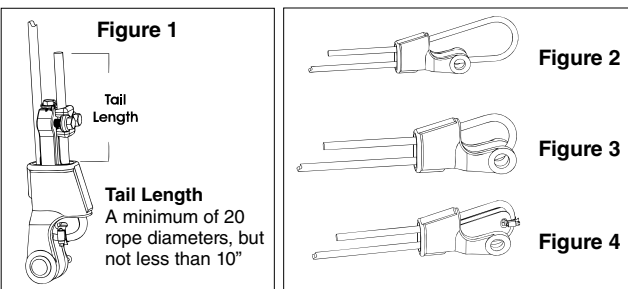
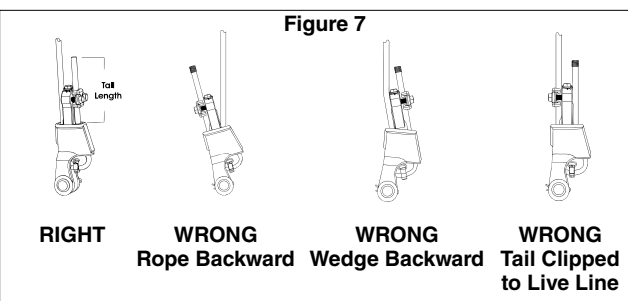
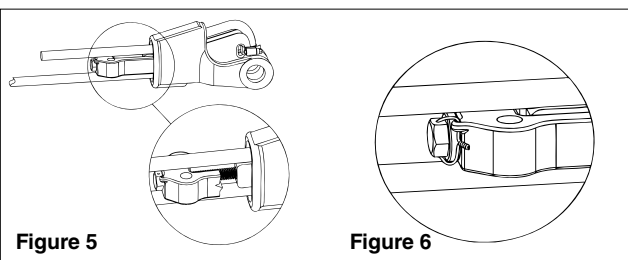


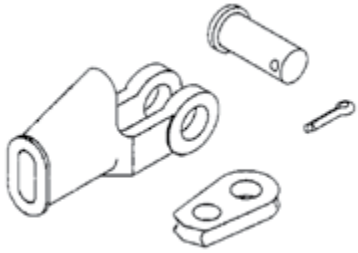
TABLE 1 S-423T Torque Value Table		
Wedge Size (in)	Tensioner Bolt Torque ft • lbf*	Clip Bolts Torque ft • lbf*
5/8	110	95
3/4	150	130
7/8	380	225
1	380	225
1-1/8	600	225
1-1/4	900	360

* The tightening torque values shown are based upon the threads being clean, dry, and free of lubrication.



WEDGE SOCKET

WARNINGS & APPLICATION INSTRUCTIONS



S-421 / US-422

Important Safety Information - Read and Follow Inspection/Maintenance Safety

- Always inspect socket, wedge and pin before using.
- Do not use part showing cracks.
- Do not modify or substitute parts.
- Repair minor nicks or gouges to socket or pin by lightly grinding until surface are smooth. Do not reduce original dimension more than 10%. Do not repair by welding.
- Inspect permanent assemblies annually, or more often in severe operating conditions.
- Do not mix and match wedges or pins between models or sizes.
- Always select the wedge and socket for the wire rope size.

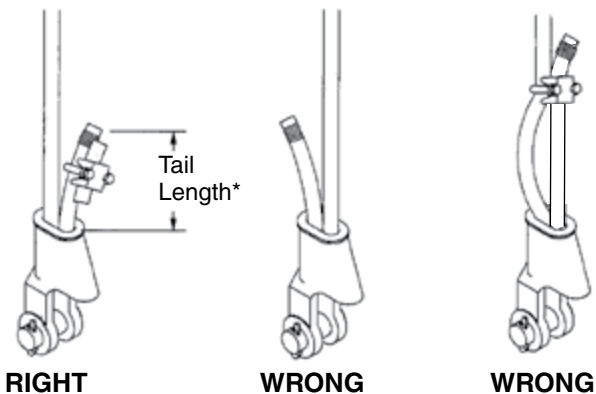
Assembly Safety

- Use only with standard 6 to 8 strand wire rope of designated size. For intermediate size rope, use next larger size socket. For example: When using 9/16" diameter wire rope use a 5/8" size Wedge Socket Assembly. Welding of the tail on standard wire rope is not recommended. Seizing of the tail is preferred following the recommended practices of the wire rope manufacturer. The tail length of the dead end should be a minimum of 6 rope diameters but not less than 6".
- Align live end of rope, with center line of pin (See Figure 1).
- Secure dead end section of rope (See Figure 1).
- DO NOT ATTACH DEAD END TO LIVE END (See Figure 1).
- Use a hammer to seat Wedge and Rope as deep into socket as possible before applying first load.
- To use with Rotation Resistant wire rope (special wire rope constructions with 8 or more outer strands) ensure that the dead end is welded, brazed or seized before inserting the wire rope into wedge socket to prevent core slippage or loss of rope lay. The tail length of the dead end should be a minimum of 20 rope diameters but not less than 6" (Figure 1).

⚠ WARNING

- Loads may slip or fall if the Wedge Socket is not properly installed.
- Load misapplied in direct contact with the wedge can dislodge the wedge and cause loss of load.
- A falling load can seriously injure or kill.
- Read and understand these instructions before installing the Wedge Socket.
- Do not side load the Wedge Socket.
- Do not interchange Crosby wedge socket, wedge or pin with non Crosby Wedge socket, wedge or pin.
- Apply first load to fully seat the Wedge and Wire Rope in the socket. This load should be of equal or greater weight than loads expected in use.
- Do not interchange wedge between S-421 and US-422 or between sizes.
- The reuse of clips is discouraged. As recommended by Crosby, have qualified personnel inspect product before use.

Figure 1



*Tail Length
Standard 6 to 8 strand wire rope
A minimum of 6 rope diameters, but not less than 6"
(i.e. - For 1" rope: Tail Length = 1" x 6 = 6")

Rotation Resistant Wire Rope
A minimum of 20 rope diameters, but not less than 6"
(i.e. - For 1" rope: Tail Length = 1" x 20 = 20")

Operating Safety

- Apply first load to fully seat the Wedge and Wire Rope in the socket. This load should be of equal or greater weight than loads expected in use.
- Efficiency rating of the Wedge Socket termination is based upon the catalog breaking strength of Wire Rope. The efficiency of properly assembled Wedge Socket is 80%.
- During use, do not strike the dead end section with any other elements of the rigging (Called two-blocking).
- Do not allow a direct load to contact the wedge.

WIRELOCK®

WARNINGS & APPLICATION INSTRUCTIONS

⚠ WARNING

- **WIRELOCK®** should be stored in a cool dry place (10°C to 24°C/ 50°F to 75°F)
- **Incorrect use of WIRELOCK® can result in an unsafe termination which may lead to serious injury, death, or property damage.**
- **Do not use WIRELOCK® with stainless steel rope in salt water environment applications.**
- **Use only soft annealed iron wire for seizing.**
- **Do not use any other wire (copper, brass, stainless, etc.) for seizing.**
- **Never use an assembly until the WIRELOCK® has gelled and cured.**
- **Remove any non-metallic coating from the broomed area.**
- **Non Crosby sockets with large grooves need to have those grooves filled before use with WIRELOCK®.**
- **Read, understand, and follow these instructions and those on product containers before using WIRELOCK®.**

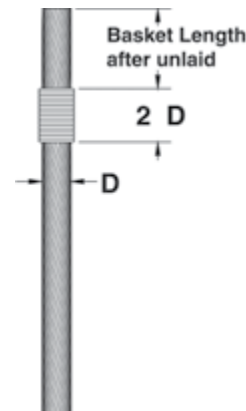
The following simplified, step-by-step instructions should be used only as a guide for experienced, trained users. **For full information, consult Crosby's Wire Rope End Terminations Manual, API (American Petroleum Institute) Recommended Practice 9B, ISO Standards, Wire Rope Manufacturers Catalogs, and Wire Rope Sling Users Manual.**

STEP 1 – SOCKET SELECTION

1. **WIRELOCK®** is recommended for use with Crosby 416-417 Spelter Sockets. Structural strand requires a socket with the basket length approximately 5 times the strand diameter or fifty (50) times the wire diameter, whichever is greater, to achieve 100% efficiency. Consult the Wire Rope End Terminations Manual for proper selection of Wire Rope or Structural Strand sockets.
2. For use with sockets other than Crosby 416-417 consult the socket manufacturer or Crosby Engineering.
3. Sockets used with **WIRELOCK®** shall comply with Federal or International (CEN, ISO) Standards.
4. **WIRELOCK®**, as with all socketing media, depends upon the wedging action of the cone within the socket basket to develop full efficiency. A rough finish inside the socket may increase the load at which seating will occur. Seating is required to develop the wedging action.

STEP 2 – MEASURE AND SEIZE

The rope ends to be socketed should be of sufficient length so that the end of the unlaidd wires (from the strands) will be at the top of the socket basket. Seizing should be placed at a distance from the end equal to the length of the basket of the socket.



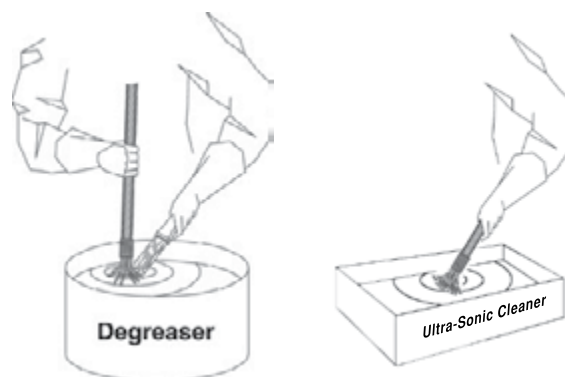
STEP 3 – BROOMING

1. Unlay the individual strands and fully broom out the wires of the wire rope and IWRC as far as the seizing. The wires should be separated but not straightened.
2. Cut out any fiber core.
3. Unlay the individual wires from each strand, including the IWRC, completely, down to the seizing.
4. Remove any plastic material from broomed area.



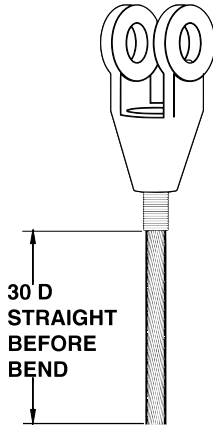
STEP 4 – CLEANING

1. The method of cleaning will depend on the lubriant and/or coating on the wire.
2. The methods and materials used for cleaning should comply with the current EPA or local regulations.
3. Consult your Wire Rope supplier or Wire Rope manufacturer for recommended material and methods. Follow the solvent supplier's recommendations for cleaning the broomed end.
4. Allow the broom to dry thoroughly.



STEP 5 – POSITIONING OF SOCKET

1. Position socket over the broom until it reaches the seizing on the wire rope. The wires should be **LEVEL** with the top of the socket basket.
2. Clamp rope and socket vertically ensuring alignment of their axes.
3. **CAUTION: DO NOT USE OVERSIZED SOCKETS FOR WIRE ROPE.**



STEP 6 – SEAL SOCKET

Seal the base of the socket with putty or plasticine to prevent leakage of the **WIRELOCK®**.



STEP 7 – WIRELOCK® KITS

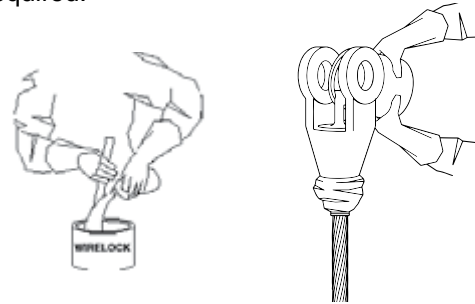
1. **WIRELOCK®** kits are pre-measured and consist of two (2) containers – one (1) with resin and one (1) with granular compound.
2. Use the complete kit – **NEVER MIX LESS THAN THE TOTAL CONTENTS OF BOTH CONTAINERS.**
3. Each kit has a shelf life clearly marked on each container and this must be observed. **NEVER USE OUT-OF-DATE KITS.**

⚠ CAUTION

- **WIRELOCK®** resin, in liquid state, is flammable.
- Chemicals used in this product can give off toxic fumes and can burn eyes and skin.
- Never use out-of-date material.
- Use only in well-ventilated work areas.
- Never breathe fumes directly or for extended time.
- Always wear safety glasses to protect eyes.
- Always wear gloves to protect hands.
- Avoid direct contact with skin anywhere.

STEP 8 – MIXING AND POURING

1. Mix and pour **WIRELOCK®** within the temperature range of 48° to 110° F. Booster kits are available for reduced temperatures.
2. Wirelock is set up to gel in 20 minutes at 65° F. For every 18° F rise in temperature the gel time will halve. At 83° F the gel time will be 10 minutes and at 101° F it will be 5 minutes. To give extra working time of pot life it is worth considering refrigerating the kits for two hours prior to mixing and pouring. The socket should also be as cool as possible - out of direct sunlight, as an example.
3. Pour all the resin into a container containing all the granular compound and mix thoroughly for two (2) minutes with a flat paddle.
4. The **WIRELOCK®** will turn a green blue color. If it does not turn a green blue after mixing, **DO NOT USE.**
5. Immediately after mixing, slowly pour the mixture down one side of the socket until the socket basket is full.
6. Check for leakage at nose of socket, add putty if required.



STEP 9 – CURING

1. **WIRELOCK®** will gel in approximately 20 minutes, in a temperature range 65° F (18° C) to 75° F (24° C).
2. The socket must remain undisturbed in the vertical position for an additional ten (10) minutes after gel is complete.
3. The socket will be ready for service 60 minutes after gelling.
4. Never heat sockets to accelerate gel or curing.



STEP 10 – RE-LUBRICATION

Re-lubricate wire rope as required.

STEP 11 – PROOF LOADING

Whenever possible, the assembly should be proof loaded. In accordance with ASME B30.9.

ALTERNATE SEIZING AND BROOMING METHOD

Reference the **Wire Rope End Terminations User's Manual** from Crosby for an alternative socketing method.

NATIONAL DIE INFORMATION

⚠ CAUTION

- **Improper die selection could result in significant loss of efficiency in the termination.**

National dies and die holders are made solely for swaging properly designed fittings on wire rope, and any other uses are prohibited.

The swaging operation results in a high degree of cold metal flow. The movement that occurs between the fitting and the dies will cause wear of the dies. Therefore, to prolong the life of the dies, it is important to always lubricate die faces and cavities between each pass with a light weight oil or high pressure grease.

When scores appear in the die cavities, the dies should be removed from service.

NEVER EXCEED THE WORKING LOAD LIMIT OF DIES OR DIE HOLDERS.

All National Standard dies 1/4" through 1" include an open channel die cavity and a tapered die cavity in the same die block.

Dies for S-505 Standard Steel Sleeves (Flemish Eyes)*Die sizes for 1/4" through 1"*

Swaging 1/4" through 1" Standard Steel S-505 sleeves on Flemish Eye terminations requires the use of the taper cavity only. Refer to the *Wire Rope End Termination User's Manual* for proper die selection.

Die sizes for 1-1/8" and above

Swaging 1-1/8" and larger Standard Steel S-505 sleeves on Flemish Eye terminations requires using 2 sets of open channel dies (1st stage and 2nd stage) for each size. Beginning with the 1st stage die and finishing with the 2nd stage die will achieve proper after swage dimensions. Dies for S-505 Sleeves 1-1/8" and larger are single cavity with open channel. Refer to the *Wire Rope End Termination User's Manual* for proper die selection.

Using S-505 Sleeves with Metric Ropes

Although Crosby National S-505 Standard Steel sleeves are designed to be used with most metric ropes, there are selected "intermediate" sizes of metric ropes that when swaged in standard National dies utilizing Crosby National S-505 sleeves do not achieve required after swage dimensions and efficiencies. To ensure all 505 sleeves achieve the required efficiency when used with metric ropes, Crosby provides special National swaging dies to be used in conjunction with selected size metric ropes. These new dies will produce the required efficiencies and after swage dimensions.

The table found in the *Wire Rope End Termination User's Manual* identifies the new dies that are required to properly swage the selected intermediate size wire ropes not covered in the standard product offering found on page 24 of the manual.

Dies for 6mm through 26mm (except 12mm, 20mm and 24mm)

Swaging on 6mm through 26mm metric ropes for Flemish Eye slings requires the selection of the proper S-505 Standard Steel sleeve and the use of the tapered cavity only. Refer to page 24 of the *Wire Rope End Termination User's Manual* for proper sleeve and die selection.

Dies for 12mm, 20mm and 24mm

Swaging on 12mm, 20mm and 24mm metric ropes for Flemish Eye slings requires the selection of the proper S-505 Standard Steel sleeve and the use of both the open cavity and tapered cavity in special dies. Refer to page 25 of the *Wire Rope End Termination User's Manual* for proper sleeve and die selection.

Dies for 28mm and larger

Swaging on 28mm and larger metric ropes for Flemish Eye slings requires the selection of the proper S-505 Standard Steel sleeve and the use of 2 sets of open channel dies (1st stage and 2nd stage) for each size. Beginning with the 1st stage die and finishing with the 2nd stage die will achieve proper after swage dimensions. Dies for S-505 sleeves 28mm and larger are single cavity with open channel. Refer to page 24 of the *Wire Rope End Termination User's Manual* for proper sleeve and die selection.

Important: If the specific size metric rope required is not listed on page 24 of the *Wire Rope End Termination User's Manual* refer to Intermediate Metric Die Chart on page 25 of the manual for proper sleeve and die selection.

Dies for QUIC-PASS® Swaging System – 1/4" through 1-1/2"

The QUIC-PASS® swaging system allows "Flemish style" wire rope terminations to be swaged in only two passes. This is accomplished while maintaining currently published efficiency ratings and utilizing National Swage S-505 Standard "COLD TUFF"® Steel Sleeves.

The special design of the QUIC-PASS® dies allows the swaging process to be completed in just two passes, resulting in a 50-75% reduction in the number of passes required with conventional swaging systems. Unlike standard round dies, the QUIC-PASS® dies close completely with each pass, resulting in an increase in overall swaging process efficiencies (the job can be performed quicker), a reduction in the complexity of swaging (the concern for excess flashing between dies has been eliminated) and a reduction in training time needed for operators (more user friendly).

The finished sleeve has a "Hex" appearance that provides a QUIC-CHECK® look to determine if the termination has been swaged and provides a flat surface that allows for ease of I.D. stamping on the finished sleeve. Refer to page 24 of the *Wire Rope End Termination User's Manual* for proper die selection.

Dies for S-501 & S-502 Swage Sockets

Swaging all S-501 & S-502 Swage Sockets requires the use of single cavity die. This is a special die designed with a relief for swage sockets and extra length to swage the full length of the shank. Refer to pages 36 and 37 of the *Wire Rope End Termination User's Manual* for proper die selection.

Swage Sockets for Spiral Strand Rope

Our tests indicate that if the spiral strand is 1 x 19 or greater, and the ultimate strength does not exceed Table 1 of ASTM A586, you can use dies for size swage sockets up to the 1-1/4". For sizes greater than 1-1/4" the following will apply:

1. Closed S-502 Sockets: One (1) socket size larger with shank modified for actual strand diameter 1-3/8" through 2".
2. Open S-501 Sockets: One (1) socket size larger with shank modified for actual strand diameter 1-3/8" through 2".
3. If the strand is of greater strength than Table 1 of ASTM A586 or has less metallic area, we must recalculate the design and test for adequacy.

Dies for S-506 Turnback Sleeves

Turnback eye terminations using 5/16" through 1" S-506 Sleeves utilize the S-505 Standard Steel Sleeve die (1st Stage open channel die only). The 1-1/4" S-506 Sleeve utilizes the 1-3/8" socket (S-501 and S-502) die. Refer to page 46 of the *Wire Rope End Termination User's Manual* for proper die selection.

Dies for S-409 Buttons

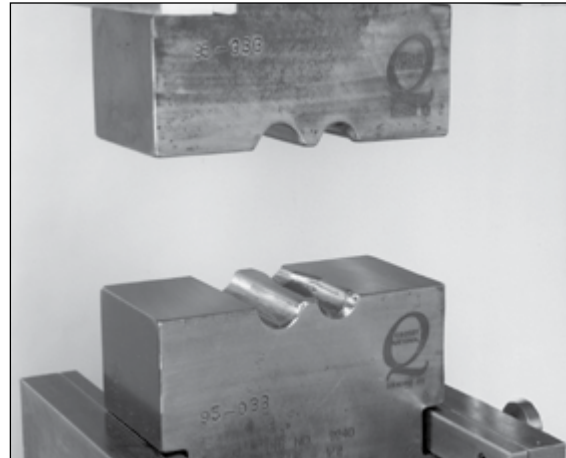
Buttons are swaged in open channel dies. Refer to page 42 of the *Wire Rope End Termination User's Manual*.

Specific recommended swaging practices can be found in each product section of this catalog. The proper die selection and the recommended maximum after swage dimensions are referenced in the section of this catalog that contains the product you are swaging. This information can also be found in the National Swage Die Guide, or by referring to the National Swage Die Chart.

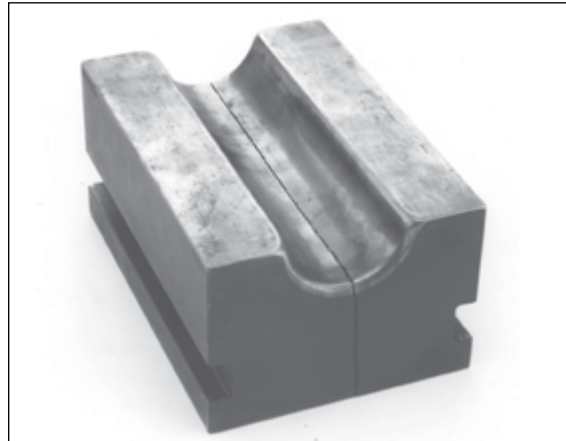
Dies and die adapters to fit other type swaging machines are available upon request (Refer to page 19 of the *Wire Rope End Termination User's Manual*).



Single Cavity Die



Two Cavity Die



Never use dies that are cracked, worn or abraided (galled).

After Swage Inspection Procedures

⚠ WARNING

- Read, understand, and follow these instructions before using the National QUIC-PASS® Swaging System.
- Improper after swage dimensions can result in sling failure resulting in property damage, serious injury or death.
- Always gauge or measure the after swage dimensions to ensure proper sling performance.
- Using National Swaging System with ropes and termination styles other than shown in these procedures may reduce the performance of the termination and lead to premature failure.
- When using rope constructions other than shown in this procedure, the termination must be destructive tested and documented to prove adequacy of the assembly to be manufactured.
- The QUIC-PASS® Swaging System is designed only for “Flemish Eye” terminations using National S-505 Standard Steel Sleeves.
- The QUIC-PASS® Swaging System is not designed for Cable-Laid wire rope slings.

Checking Swaging Dimensions

One of the important considerations in producing a quality termination is the overall diameter of the fitting after the swaging process is complete. Since all dies wear, and the swaged fitting used in terminations has spring back, the results of swaging should be checked periodically to determine the wear condition of the die as well as to ensure the fitting is swaged to proper dimensions.

Key Facts About After Swage Dimensions:

1. In addition to worn dies, not achieving the proper after swage dimension can also be due to the die not being fully closed during swaging. Dies showing excessive wear should be replaced.
2. The effective swaging that dies can accomplish stops when the die lands touch each other. Any continued swaging adds needless wear and strain on the dies and swaging machine.
3. By placing a light oil on the die faces and in the cavity, the dies will be lubricated as well as protected.
4. The oozing of the oil from the faces of the dies as they touch will indicate when the dies have closed. At this point, stop the swaging cycle.
5. Additional swaging adds needless wear and strain to the dies and swaging machine.
6. Never use dies that are cracked, worn or abraded (galled).
7. The Crosby Group does not recommend the checking of die dimensions as an acceptable method of determining the quality of a swage sleeve, button, ferrule, or socket.
8. It is our recommendation that the checking of the after swage dimension of the swaged fitting is the most accurate indicator of a properly swaged termination. Measuring the die cavity only is not an acceptable process control check.
9. If the die cavity wears, the dies are not closed completely during swaging. If an inadequate number of presses are used, it could be quickly identified by checking the after swage dimension of the part.
10. Swaging Machine not producing sufficient tonnage will affect after swage dimensions.

No-Go Gauge Information

To assist in checking the after swage dimensions of the fitting, the Crosby Group provides the National No-Go Gauges. When used correctly the National No-Go Gauges can determine if the fittings were swaged to the proper diameter. We would recommend that all Crosby products or product swaged in Crosby dies be checked with the proper gauge to determine the acceptability of the swaging process.

- Gauges are made of hardened alloy steel and machined to strict tolerances.
- Gauge can be used to verify that all fittings have been swaged properly.
- After swage dimensions not within the maximum limits may result from worn dies or improper swaging techniques.
- Other type gauges are available upon request.
- National No-Go Gauges are available for a variety of products (See Table 1).
- **No-Go Gauges and QUIC-PASS® No-Go Gauges are not interchangeable.**

Table 1 - Standard Round No-Go Gauges

Fitting	Size	Part No.
505 Sleeve	1/4 - 7/8	1095512
505 Sleeve	1 - 1-1/2	1095521
505 Sleeve	1-3/4	1095530
505 Sleeve	2	1095549
505 Sleeve	2-1/4	1095558
505 Sleeve	2-1/2	1095567
505 Sleeve	2-3/4	1095576
505 Sleeve	3	1095585
505 Sleeve	3-1/2	1095594
505 Sleeve	3-3/4	1095601
505 Sleeve	4	1095610
501/502 Socket	1/4 - 1	1095647
501/502 Socket	1-1/8 - 1-3/4	1095656
501/502 Socket	2	1095665

Using No-Go Gauges

When swaged properly, the gauge will go up and down (see Figure 1) and around the full length of the fitting (see Figure 2).

For the proper after swage dimensions, see the section in this publication for the specific product you are swaging.

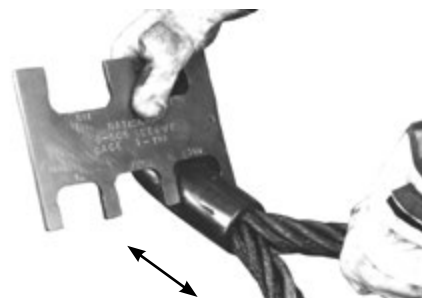


Figure 1



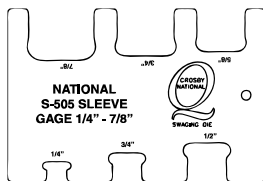
Figure 2

QUIC-PASS® No-Go Gauges

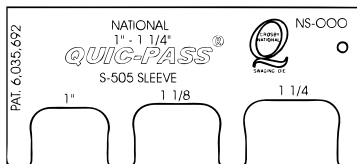
As a further aid, QUIC-PASS® No-Go gauges are available for checking the sleeve's dimensions after swaging is complete.

- Gauges are made of hardened alloy steel and machined to strict tolerances.
- Gauge can be used to verify that all sleeves have been swaged properly.
- "After Swage" dimensions not within the maximum limits may result from worn dies or improper swaging techniques.
- **No-Go Gauges and QUIC-PASS® No-Go Gauges are not interchangeable.**

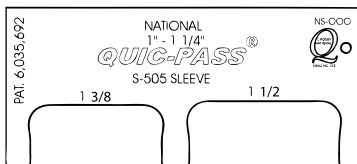
QUIC-PASS® No-Go Gauges	
Sleeve and Size	Stock No.
No-Go Gauge for S-505 1/4" - 7/8"	1923705
No-Go Gauge for S-505 1" - 1-1/4"	1923712
No-Go Gauge for S-505 1-3/8" - 1-1/2"	1923714



Stock No.
1923705

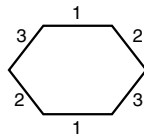


Stock No.
1923712



Stock No.
1923714

Use a National QUIC-PASS® No-Go Gauge to check the after swage dimensions to ensure that it has been swaged to the proper dimension. When swaged properly, the gauge will slide up and down the full length of the sleeve on all three sets of opposing flats.



QUIC-PASS® Maximum After Swage Dimensions

Size (in)	Maximum "After Swage" Dimension (in)
1/4	0.565
5/16 - 3/8	0.769
7/16 - 1/2	1.016
9/16 - 5/8	1.247
3/4	1.475
7/8	1.738
1	1.955
1-1/8	2.170
1-1/4	2.405
1-3/8	2.610
1-1/2	2.835

Important Safety Information

- **Crosby does not recommend** a "Texas Tuck" style termination with Crosby National S-505 "COLD TUFF®" Standard Steel Sleeves.
- Only Crosby National S-505 "COLD TUFF®" Standard Steel Sleeves are recommended when using the QUIC-PASS® Swaging System.
- National S-505 Standard Steel Sleeves, when used with the QUIC-PASS® Swaging System, are only recommended for use with one (1) part 6 X 19 or 6 X 37, IPS or XIP (EIP), XXIP (EEIP), RRL, IWRC rope.
- The condition of the swaging machine can cause sleeve "After Swage" size not to be within the proper dimensions. Example: worn bushings, loose tie rods, loose die holders, misaligned platens, worn pins, worn linkage, etc.
- Swaging dies being worn, damaged, misused, or undersized can cause sleeve "After Swage" size not to be within the proper dimension.
- Swaging die holders excessively worn, damaged, misused or loose can cause sleeve "After Swage" size not to be within the proper dimension. Only use QUIC-PASS® dies and die holders inspected and properly secured in National swaging machines.
- Always refer to Warning and Application information found in this catalog and *Wire Rope End Terminations User's Manual*.

CROSBY® THIMBLE EYE BUNDLE CLIPS

WARNING & APPLICATION INSTRUCTIONS



G-461

The Bundle Clip is utilized in a choker hitch application to maintain the shape of bundled packages after a load is placed. The Bundle Clip is attached to live line of choker hitch, but it is never to be used as a button or ferrule to carry a load in the primary load path.

Certain conditions (such as extreme variation of the choke size) or improper installation may cause the eye of the choke hitch to disengage from the Bundle Clip and allow the eye to seat away from or below the Bundle Clip (see Figure 3). If this occurs, the Bundle Clip must be removed and installed in the proper position.

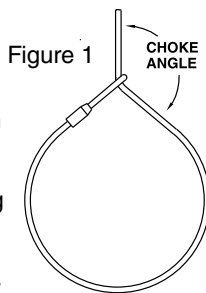
The Bundle Clip is sized to provide a grip to the live rope without reducing the efficiency of a choker hitch. This grip is adequate to keep the bundle clip in position.

These instructions are for use with thimble eyes formed with RRL or RLL wire rope, 6 x 19 or 6 x 36 Class, FC or IWRC; IPS or XIP, XXIP, and a Crosby Thimble. For other classes of wire rope not mentioned above, we recommend contacting Crosby Engineering.

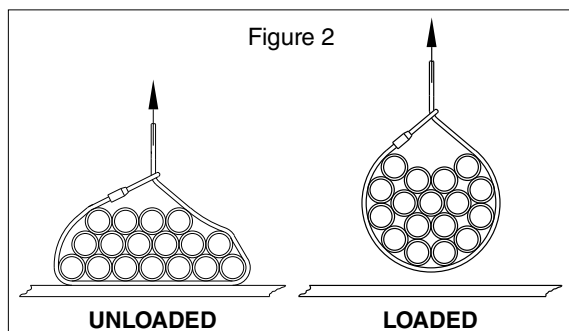
For Soft Eye applications see the Crosby G-460 Soft Eye Bundle Clip.

For OSHA (Construction) applications, see OSHA 1926.251.

1. The eye of the sling must be in the choked position (around live line). Choker hitch applications should comply with the requirements of ASME B30.9 Slings. Install the choker hitch to provide a minimum choke angle of 120 degrees (See Figure 1). Refer to ASME B30.9 for required de-rating of the sling if choke angle is less than 120 degrees.



2. Before installing Bundle Clip, apply initial load by lifting the bundle and clearing the support, producing a tight choke. Repeat as necessary until the bundle package is in the most compact position (See figure 2, Loaded). **Keep hands and feet from under load.**



⚠ WARNING

- Failure to read, understand, and follow these instructions may cause death or serious injury.
- A falling load may seriously injure or kill.
- Read and understand these instructions before using clips.
- Failure to properly position the Bundle Clip may allow the load to slip and fall.
- Match the same size clip to the same size wire rope.
- Install Bundle Clip only as instructed.
- Do not use with plastic coated wire rope.
- Do not use for lifting personnel.

3. After initial loading, install the Bundle Clip. The orientation of the Bundle Clip on the live line is not an important consideration, as the assembly is of adequate size to prevent passage through proper size Crosby Thimble and next larger size Thimble. Insert U-bolt through the Bundle Clip. Properly position the clip base over the U-bolt and install nuts (See Figure 3). Use torque wrench to tighten evenly, alternating from one nut to the other until the bundle stop bottoms out on the clip base, and the recommended torque is reached (See Table 1).

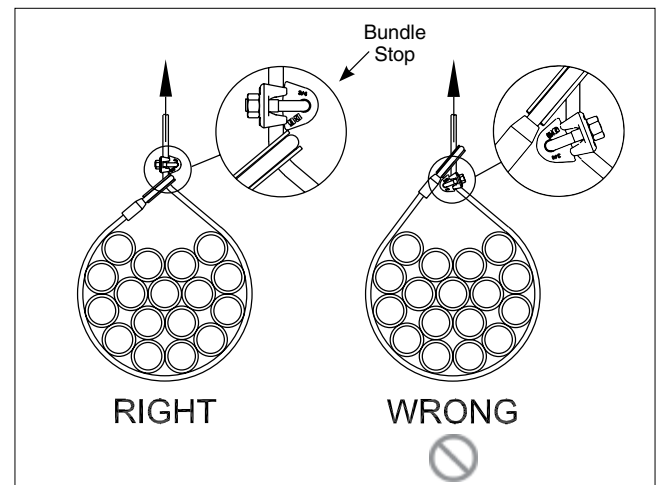


Figure 3

Table 1 – Recommended Torque

Clip Size	Rope Size (in)	Torque (Ft.-Lb.)
5/8	5/8	95
3/4	3/4	130
7/8	7/8	225

4. Before each lift, check to ensure that the choke eye has not slipped from the Bundle Clip. Repeat Step 3 if necessary.
5. When disconnecting, the load should be clear of the stable support (See figure 2, Loaded). Remove Bundle Clip. Stay clear of the load as the bundle is lowered and the load is removed from the sling.

In accordance with good rigging and maintenance, the wire rope sling should be inspected periodically for wear, abuse, and general adequacy.

CROSBY® SOFT EYE BUNDLE CLIPS

WARNING & APPLICATION INSTRUCTIONS



G-460

The Bundle Clip is utilized in a choker hitch application to maintain the shape of bundled packages after a load is placed. The Bundle Clip is attached to live line of choker hitch, but it is never to be used as a button or ferrule to carry a load in the primary load path.

Certain conditions (such as extreme variation of the choke size) or improper installation may cause the eye of the choke hitch to disengage from the Bundle Clip and allow the eye to seat away from or below the Bundle Clip (see Figure 3). If this occurs, the Bundle Clip must be removed and installed in the proper position.

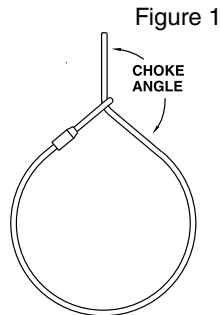
The Bundle Clip is sized to provide a grip to the live rope without reducing the efficiency of a choker hitch. This grip is adequate to keep the bundle clip in position. The eye may pull free of the Bundle Clip if not positioned properly.

These instructions are for use with soft eyes (no thimble) formed with RRL or RLL wire rope, 6 x 19 or 6 x 36 Class, FC or IWRC; IPS or XIP, XXIP. For other classes of wire rope not mentioned above, we recommend contacting Crosby Engineering.

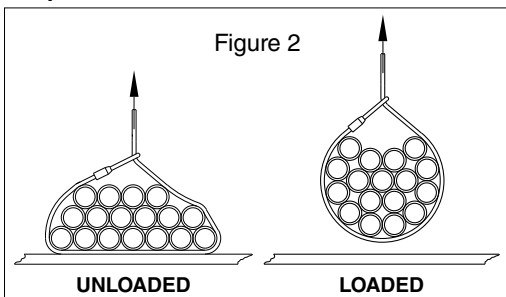
For Thimble Eye applications see the Crosby G-461 Thimble Eye Bundle Clip.

For OSHA (Construction) applications, see OSHA 1926.251.

1. The eye of the sling must be in the choked position (around live line). Choker hitch applications should comply with the requirements of ASME B30.9 Slings. Install the choker hitch to provide a minimum choke angle of 120 degrees (See Figure 1). Refer to ASME B30.9 for required de-rating of the sling if choke angle is less than 120 degrees.



2. Before installing Bundle Clip, apply initial load by lifting the bundle and clearing the support, producing a tight choke. Repeat as necessary until the bundle package is in the most compact position (See figure 2, Loaded). **Keep hands and feet from under load.**



WARNING

- Failure to read, understand, and follow these instructions may cause death or serious injury.
- A falling load may seriously injure or kill.
- Read and understand these instructions before using clips.
- Failure to properly position the Bundle Clip may allow the load to slip and fall.
- Do not use the Bundle Clip to form the choke hitch (See Figure 3).
- Match the same size clip to the same size wire rope.
- Install Bundle Clip only as instructed.
- Do not use with plastic coated wire rope.
- Do not use for lifting personnel.

3. After initial loading, install the Bundle Clip in proper orientation, with curved portion (Bundle Clip tip) over the eye of the sling. Insert U-bolt through the Bundle Clip. Properly position the clip base over the U-bolt and install nuts (See Figure 3). Use torque wrench to tighten evenly, alternating from one nut to the other until the curved portion bottoms out on the clip base, and the recommended torque is reached (See Table 1).

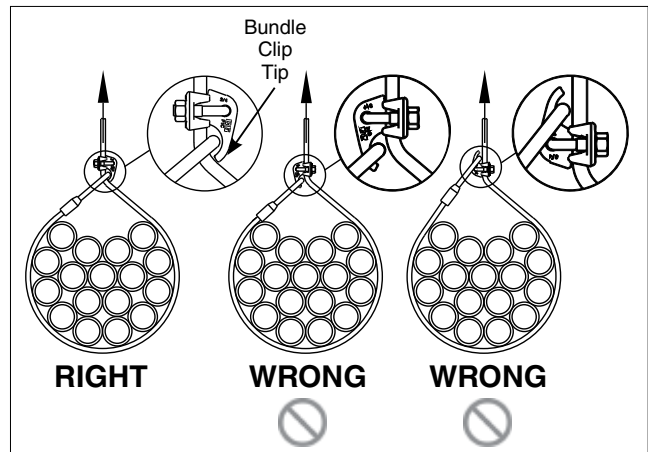


Figure 3

Table 1 – Recommended Torque

Clip Size	Rope Size (in)	Torque (Ft.-Lb.)
5/8	5/8	95
3/4	3/4	130
7/8	7/8	225

4. Before each lift, check to ensure that the choke eye has not slipped from the Bundle Clip tip. Repeat Step 3 if necessary.
5. When disconnecting, the load should be clear of the stable support (See figure 2, Loaded). Remove Bundle Clip. Stay clear of the load as the bundle is lowered and the load is removed from the sling.

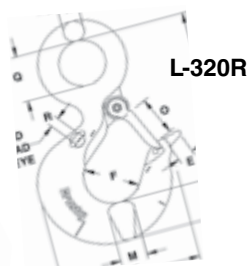
In accordance with good rigging and maintenance, the wire rope sling should be inspected periodically for wear, abuse, and general adequacy.

Crosby® ROV HOOKS

WARNINGS & APPLICATION INSTRUCTIONS



L-562A



L-320R

QUIC-CHECK® Hoist hooks incorporate markings forged into the product which address two (2) **QUIC-CHECK®** features:

**Deformation Indicators – Two**

strategically placed marks, one just below the shank or eye and the other on the hook tip, which allows for a **QUIC-CHECK®** measurement to determine if the throat opening has changed, thus indicating abuse or overload.

To check, use a measuring device (i.e., tape measure) to measure the distance between the marks. The marks should align to either an inch or half-inch increment on the measuring device. If the measurement does not meet criteria, the hook should be inspected further for possible damage.

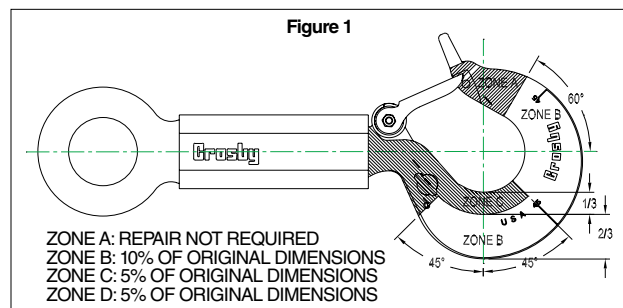
Angle Indicators – Indicates the maximum included angle which is allowed between two (2) sling legs in the hook. These indicators also provide the opportunity to approximate other included angles between two sling legs.

IMPORTANT SAFETY INFORMATION - READ & FOLLOW

- A visual periodic inspection for cracks, nicks, wear, gouges and deformation as part of a comprehensive documented inspection program, should be conducted by trained personnel in compliance with the schedule in ASME B30.10 and/or regulations governing your industry or jurisdiction.
- For ROV hooks used in frequent load cycles or pulsating loads, the ROV hook components (hoist hook, eye bolt and hexagon body) and their threads should be periodically inspected by Magnetic Particle or Dye Penetrant (Disassembly will be required).
- Disassemble the eye bolt and shank hook from hexagon body (sizes up to and including 31.5t WLL). This requires removing the 2 spiral pins and unscrewing the eye bolt and hoist hook.
- Always use new spiral pins when re-assembling the ROV Hook.
- After reassembly, Crosby recommends a proof test equal to 2 times the ROV hook's stated WLL.
- Never use a hoist hook whose throat opening has been increased, or whose tip has been bent more than 10 degrees out of plane from the hook body, or is in any other way distorted or bent. Note: A latch will not work properly on a hook with a bent or worn tip.
- Never use a hoist hook that is worn beyond the limits shown in Figure 1.
- Remove from service any hoist hook with a crack, nick or gouge. Hoist hooks with a nick or gouge shall be repaired

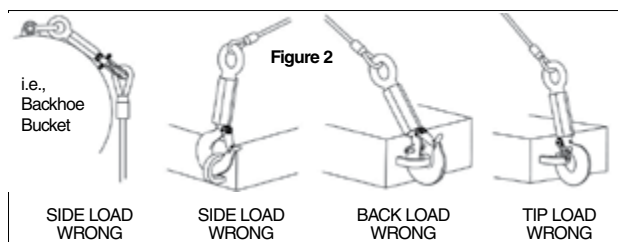
⚠ WARNING

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- Hook must always support the load. The load must never be supported by the latch.
- Read and understand these instructions before using hook and latch.



by grinding lengthwise, following the contour of the hook, provided that the reduced dimension is within the limits shown in Figure 1. Contact Crosby Engineering to evaluate any cracks.

- Never repair, alter, rework, or reshape an ROV hook by welding, heating, burning, or bending.
- Remove from service a hoist hook or eye bolt which has threads corroded more than 20% of the hexagon body engagement length.
- Never side load, back load, or tip load the hoist hook, eye bolt or hexagon body. (Side loading, back loading and tip loading are conditions that damage and reduce the capacity of the ROV hook.) (See Figure 2)
- The use of a latch may be mandatory by regulations or safety codes. Follow the regulations governing your industry or jurisdiction.



- Always make sure the hook supports the load. The latch must never support the load.
- When multileg slings are placed in the base (bowl/saddle) of the hook, the maximum included angle between sling legs shall be 90 deg. The maximum sling leg angle with respect to the hook centerline for any rigging arrangement shall be 45 degrees. A collector ring, such as a link or shackle, should be used to maintain in-line load when more than two legs are placed in a hook or for angles greater than 45 degrees with respect to hook centerline. When more than two legs are placed in the hook bunching of the legs shall be avoided.
- See ASME B30.10 "Hooks" for additional information.
- Remove from service any eye bolt with a crack, nick or gouge. Eye bolt with a nick or gouge shall be repaired by grinding lengthwise, following the contour of the eye bolt, provided that the reduced dimension is no greater than 5% of original dimension. Contact Crosby Engineering to evaluate any cracks.

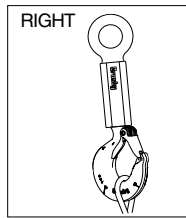


Figure 3

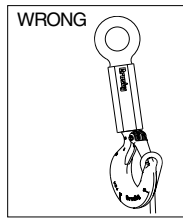


Figure 4

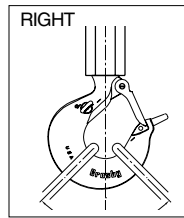


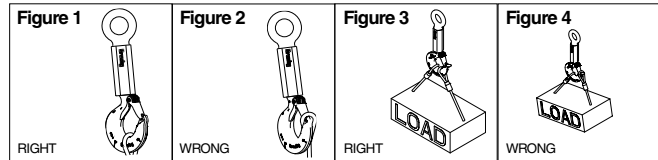
Figure 5

- Never use an eye bolt if eye or shank is bent or elongated.
- Remove from service the hexagon body if internal threads are corroded beyond 20% of the eye bolt or hoist hook shank's threaded engagement lengths.
- Hexagon body with nicks or gouges may be repaired by grinding lengthwise.
- Inspect the spiral pin holes on the hoist hook, hexagon body and eye bolt. At assembly, the spiral pin must engage with a press fit.

Warning and Application Instructions for Crosby® Hook Latch

Important Safety Information – Read & Follow

- Always inspect hook and latch before using.
- Never use a latch that is distorted or bent.
- Always make sure spring will force the latch against the tip of the hook.
- Always make sure hook supports the load. The latch must never support the load (See Figures 1 & 2).
- When placing two (2) sling legs in hooks, make sure the angle between the legs is less than 90° and if the hook or load is tilted, nothing bears against the bottom of this latch (See Figures 3 & 4).
- Latches are intended to retain loose sling or devices under slack conditions.
- Latches are not intended to be an anti-fouling device.

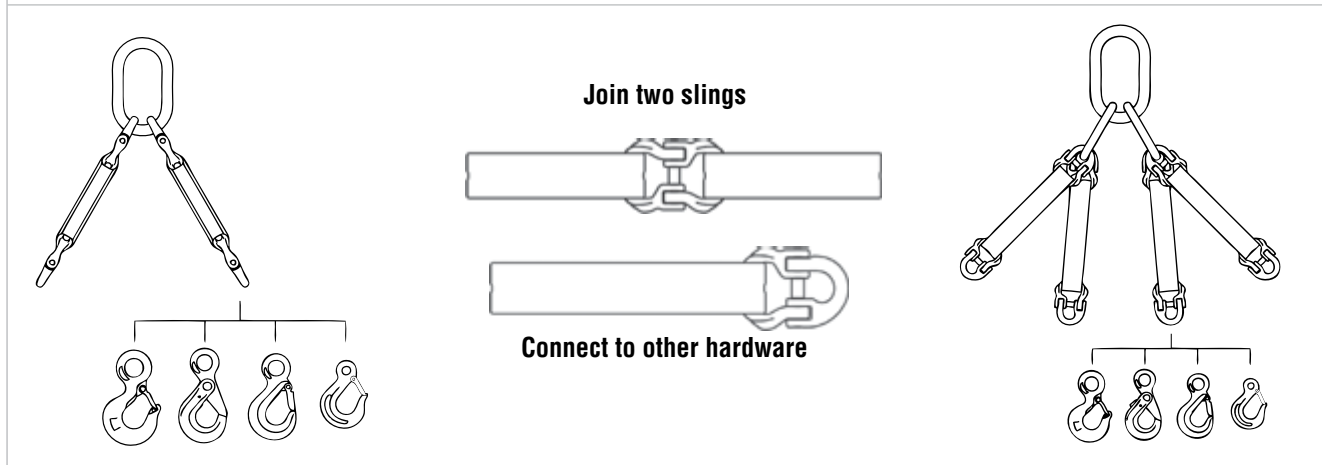


⚠ WARNING

- Loads may disengage from hook if proper procedures are not followed.
- A falling load may cause serious injury or death.
- See OSHA Rule 1926.550 (g)(4)(iv)(B) for personnel hoisting for cranes and derricks. Only a Crosby or McKissick hook with a PL Latch attached and secured with bolt, nut and cotter (or Crosby Toggle Pin) or a Crosby hook with a S-4320 Latch attached and secured with a cotter pin, or a Crosby SHUR-LOC® hook in the locked position may be used for any personnel hoisting. A hook with a Crosby SS-4055 latch attached shall NOT be used for personnel lifting.
- Hook must always support the load. The load must never be supported by the latch.
- Read and understand these instructions before using hook and latch.








Typical Application

The S-237 and S-238 connectors have been designed to easily adapt to other Crosby fittings to develop complete systems for high performance Synthetic Slings.

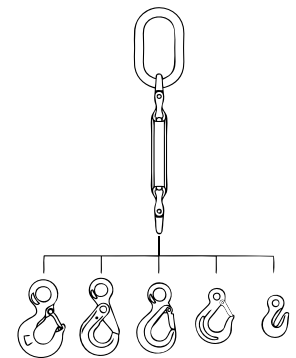


These easy-to-use charts are designed to allow you to quickly determine the Crosby Fitting required for your high performance sling.








Single Leg Sling

S-237 Frame	Working Load Limit (lb)*							
		A-1337 Lok-A-Loy (in)	A-342 (in)	A-344 (in)	L-320A L-320AN† (t) Frame	S-1316 (in)	S-315A (in)	L-1327 (in)
5	5000	3/8	1	7/8	†7 JA	5/8	5/8	5/8
10	10000	5/8	1	7/8	†7 JA	5/8	5/8	5/8
15	15000	3/4	1-1/4	1	†11 KA	3/4	—	3/4
25	25000	7/8	1-1/2	1-1/4	†15 LA	7/8	—	7/8
30	30000	7/8	1-1/2	1-1/4	†15 LA	7/8	—	7/8
40	40000	1	1-3/4	—	†22 NA	1	—	—
60	60000	1-1/4	2	—	30 OA	—	—	—

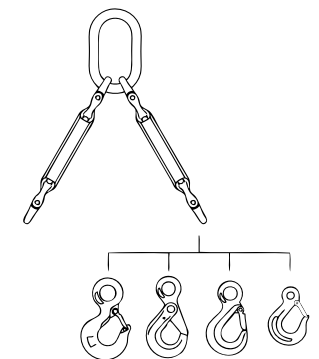
* Ultimate load is 5 times the Working Load Limit. † L-320AN Style Hook.



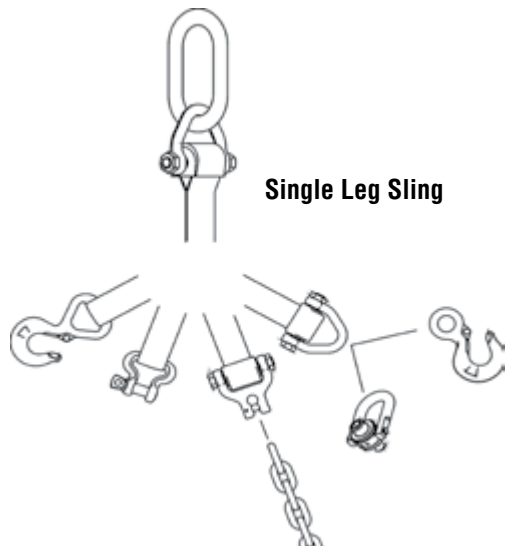
Double Leg Sling

S-237 Frame	Working Load Limit (lb)*							
		A-1337 Lok-A-Loy (in)	A-342 (in)	A-344 (in)	L-320A L-320AN† (t) Frame	S-1316 (in)	S-315A (in)	L-1327 (in)
5	5000	3/8	1-1/4	1-1/4	†7 JA	5/8	5/8	5/8
10	10000	5/8	1-1/4	1-1/4	†7 JA	5/8	5/8	5/8
15	15000	3/4	1-1/2	—	†11 KA	3/4	—	3/4
25	25000	7/8	1-3/4	—	†15 LA	7/8	—	7/8
30	30000	7/8	1-3/4	—	†15 LA	7/8	—	7/8
40	40000	1	2	—	†22 NA	1	—	—
60	60000	1-1/4	2-1/4	—	30 OA	—	—	—

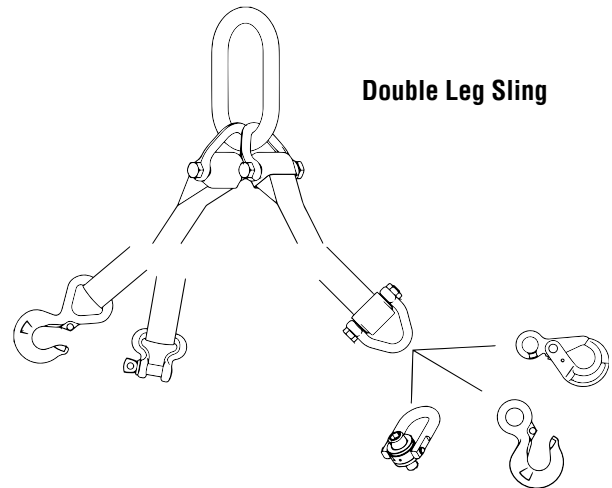
* Ultimate load is 5 times the Working Load Limit. † L-320AN Style Hook.



For Triple and Quad leg slings, contact Crosby Engineering at (918) 834-4611




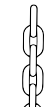





Single Leg Sling










Double Leg Sling

These easy-to-use charts are designed to allow you to quickly determine the fitting required to create the Web Sling or Round Sling you need.

Single and Double Leg Slings Component Recommendations based on Type III, (Eye & Eye), Class 7, 2 Ply web slings.

S-280 Web Connector S-281 Web Sling Shackle					S-280 Web Connector						
Web Sling											
Round Sling Size (No.)	Web Width (in)	Eye Width (in)	Ply.	S-280 S-281 Working Load Limit (tons)	Web Sling Hook WSL-320 (t)	Spectrum 8® Chain Size (in) – (mm)	Eye Hoist Hook L-320AN (t)	Eye SHUR-LOC® S-1316A (in)	Swivel Hoist Ring HR-125 (lb)	Master Link A-342 Single Leg (in)	Master Link A-342 Double Leg (in)
1 & 2	2	2	2	3-1/4	3	3/8 - 10	3	1/2	7,000	5/8	3/4
3	3	1.5	2	4-1/2	5	1/2 - 13	5	5/8	10,000	3/4	1
4	4	2	2	6-1/2	—	5/8 - 16	7	5/8	15,000	1	1
5 & 6	6	3	2	8-1/2	—	—	11	—	24,000	1	1-1/4

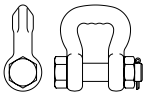





Triple and Quad Leg Slings Component Recommendations based on Type III, (Eye & Eye), Class 7, 2 Ply web slings.

S-280 Web Connector S-281 Web Sling Shackle					S-280 Web Connector							
Web Sling												
Round Sling Size (No.)	Web Width (in)	Eye Width (in)	Ply.	S-280 S-281 Working Load Limit (tons)	Web Sling Hook WSL-320 (t)	Spectrum 8® Chain Size (in) – (mm)	Eye Hoist Hook L-320AN (t)	Eye SHUR-LOC® S-1316 (in)	Swivel Hoist Ring HR-125 (lb)	Master Link A-342 Triple Leg (in)	Master Link A-342 Quad Leg (in)	
1 & 2	2	2	2	3-1/4	3	3/8 - 10	3	1/2	7,000	1	1	
3	3	1.5	2	4-1/2	5	1/2 - 13	5	5/8	10,000	1	1-1/4	
4	4	2	2	6-1/2	—	5/8 - 16	7	5/8	15,000	1-1/4	1-1/2	
5 & 6	6	3	2	8-1/2	—	—	11	—	24,000	1-1/2	1-3/4	

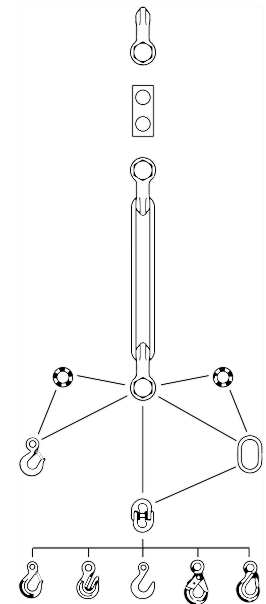
Easily Integrated into Synthetic Sling System

The Synthetic Sling Saver shackles line has been designed to easily adapt Crosby Sling fittings in the development of complete systems for synthetic slings.

Single Leg Slings

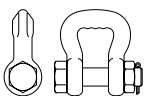





										LOK-A-LOY® Link* A-1337 				
Web Sling Eye Width (in)	Working Load Limit (T)	Sling Saver Shackle Spool S-255 (in)	Sling Saver Shackle Link Plate S-256 (in)	Eye Hoist Hook L-320AN† L-320A (t)	Alloy Master Link A-342 (in)	Master Link Assy. A-345 (in)	Sling Hook L-1327 (in)	Eye Grab Hook A-1328 (in)	Eye Foundry Hook A-1329 (in)	Eye SHUR-LOC® S-1316A (in)	Eye Latching S-315A (in)			
1	3-1/4	1	1	†5	3/4	—	3/8	3/8	3/8	3/8	3/8			
1.5	6-1/2	1.5	1.5	†7	1	—	5/8	5/8	5/8	5/8	5/8			
2	8-3/4	2	2	†11	1	—	5/8	5/8	5/8	5/8	5/8			
3	12-1/2	3	3	†15	1-1/4	—	3/4	3/4	3/4	—	3/4			
4	20-1/2	4	4	†22	1-3/4	—	—	3/4	—	3/4	—			
5	35	5	5	37	2	—	—	3/4	—	—	—			
6	50	6	6	60	2-1/4	—	—	3/4	—	—	—			

* LOK-A-LOY® size same as hook size. † New 320N Eye Hook.

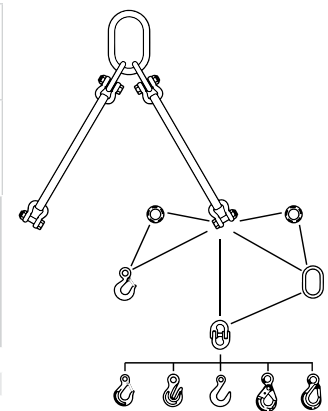


Single Leg Sling

Double Leg Slings

										LOK-A-LOY® Link* A-1337 				
Web Sling Eye Width (in)	Working Load Limit (T)	Sling Saver Shackle Spool S-255 (in)	Sling Saver Shackle Link Plate S-256 (in)	Eye Hoist Hook L-320AN† L-320A (t)	Alloy Master Link A-342 (in)	Master Link Assy. A-345 (in)	Sling Hook L-1327 (in)	Eye Grab Hook A-1328 (in)	Eye Foundry Hook A-1329 (in)	Eye SHUR-LOC® S-1316A (in)	Eye Latching S-315A (in)			
1	3-1/4	1	1	†5	3/4	1	3/8	3/8	3/8	3/8	3/8			
1.5	6-1/2	1.5	1.5	†7	1	1-1/4	5/8	5/8	5/8	5/8	5/8			
2	8-3/4	2	2	†11	1	1-1/4	5/8	5/8	5/8	5/8	5/8			
3	12-1/2	3	3	†15	1-1/4	1-1/2	3/4	3/4	3/4	—	3/4			
4	20-1/2	4	4	†22	1-3/4	1-3/4	—	3/4	—	—	—			
5	35	5	5	37	2	—	3/4	—	—	—	—			
6	50	6	6	60	2-1/4	—	3/4	—	—	—	—			

* LOK-A-LOY size same as hook size. † New 320N Eye Hook.



Double Leg Sling



Inspection Information

WEB SLINGS

Shall not be constricted or bunched between the ears of a clevis or shackle, or in a hook.

ROUND SLINGS

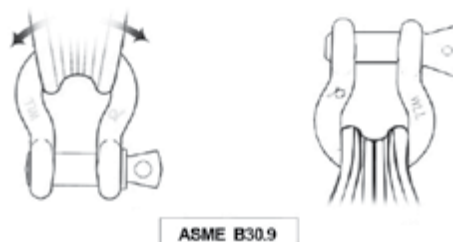
Shall not be constricted or bunched between the ears of a clevis or shackle, or in a hook.

The opening of fittings shall be proper shape and size to ensure that the fitting will seat properly on the round sling.

When a round sling is used with a shackle, it is recommended that it be used (rigged) in the bow of the shackle.

SYNTHETIC SLINGS RATED LOAD

Folding, bunching or pinching of synthetic slings, which occurs when used with shackles, hooks or other application will reduce the rated load.



When connecting Web or Round Slings, use conventional fittings with:
1. Large Radius. 2. Straight Pins. 3. Pads or use special fittings designed for Synthetic Slings.

SYNTHETIC SLING CONNECTIONS AND HITCHES

WEB SLING IDENTIFICATION INCLUDES:

SLING TYPE:

TC – TRIANGLE CHOKER
TT – TRIANGLE TRIANGLE
EE – EYE AND EYE
EN – ENDLESS

NUMBER OF PLIES: 1 OR 2

WEBBING GRADE: 9 OR 6

SLING WIDTH (INCH)

EE 2-9 04 x 12 ← SLING LENGTH (INCH)

ROUND SLING IDENTIFICATION INCLUDES:

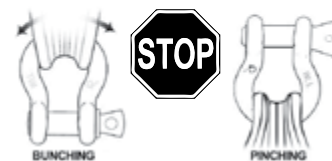
SLING NUMBER: 1-13

Sling numbers are for reference only. some round slings have different ratings.

SLING COLOR: PURPLE, GREEN, YELLOW, TAN, RED, WHITE, BLUE, ORANGE

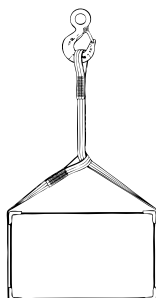
Sling color is not followed by all manufacturers, and some colors have more than one rated load.

Folding, bunching or pinching of synthetic slings, which occurs when used with shackles, hooks or other applications will reduce the rated load.



CHOKER CAPACITY

A choker hitch has 80% of the capacity of a single leg sling only if the angle of choke is 120 degrees or greater. a choke angle less than 120 degrees will result in a capacity as low as 40% of the single leg.



BASKET HITCH CAPACITY

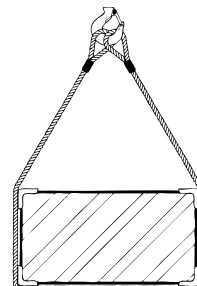
HORIZON-TAL ANGLE	CAPACITY % OF SINGLE LEG
90	200%
60	170%
45	140%
30	100%

A true basket hitch has twice the capacity of a single leg only if the legs are vertical.

MULTIPLE LEG SLINGS

TRIPLE LEG SLINGS have 50% more capacity than double leg slings (at same sling angle) only if the center of gravity is in the center of connection points and legs adjusted properly (they must have an equal share of the load).

QUAD (4-LEG) SLINGS offer improved stability but provide increased capacity only if all legs share an equal share of the load.



ALWAYS SELECT AND USE WEB SLINGS AND ROUND SLINGS BY THE RATED LOAD SHOWN ON THE SLING IDENTIFICATION TAG, NEVER BY WIDTH, COLOR OR SLING NUMBER.

FORGED EYE BOLT

WARNINGS & APPLICATION INSTRUCTIONS



Regular Nut Eye
Bolt G-291

Shoulder Nut Eye
Bolt G-277

Machinery Eye Bolt
S-279 / M-279

Important Safety Information - Read & Follow

Inspection/Maintenance Safety:

- Always inspect eye bolt before use.
- Never use eye bolt that shows signs of wear or damage.
- Never use eye bolt if eye or shank is bent or elongated.
- Always be sure threads on shank and receiving holes are clean.
- Never machine, grind, or cut eye bolt.
- Do not leave threaded end of machinery eye bolt in aluminum loads for long periods of time as it may cause corrosion.

Assembly Safety:

- Never exceed load limits specified in Table 1 & Table 2.
- Never use regular nut eye bolts for angular lifts.
- Always use shoulder nut eye bolts (or machinery eye bolts) for angular lifts.
- For angular lifts, adjust working load as follows:

ANGLE FROM "IN-LINE"	ADJUSTED WORKING LOAD LIMIT
5 degrees	100% of rated working load
15 degrees	80% of rated working load
30 degrees	65% of rated working load
45 degrees	30% of rated working load
90 degrees	25% of rated working load

- Never undercut eye bolt to seat shoulder against the load.
- Always countersink receiving hole or use washers with sufficient I.D. to seat shoulder.
- Always screw eye bolt down completely for proper seating.
- Always tighten nuts securely against the load.

Table 1 (In-Line Load)	
Size (in)	Working Load Limit (lb)
1/4	650
5/16	1,200
3/8	1,550
1/2	2,600
5/8	5,200
3/4	7,200
7/8	10,600
1	13,300
1-1/8	15,000
1-1/4	21,000
1-1/2	24,000
1-3/4	34,000
2	42,000
2-1/2	65,000

⚠ WARNING

- Load may slip or fall if proper eye bolt assembly and lifting procedures are not used.
- A falling load can seriously injure or kill.
- Read and understand these instructions, and follow all eye bolt safety information presented here.
- Read, understand, and follow information in diagrams and charts below before using eye bolt assemblies.

Shoulder Nut Eye Bolt – Installation for Angular Loading

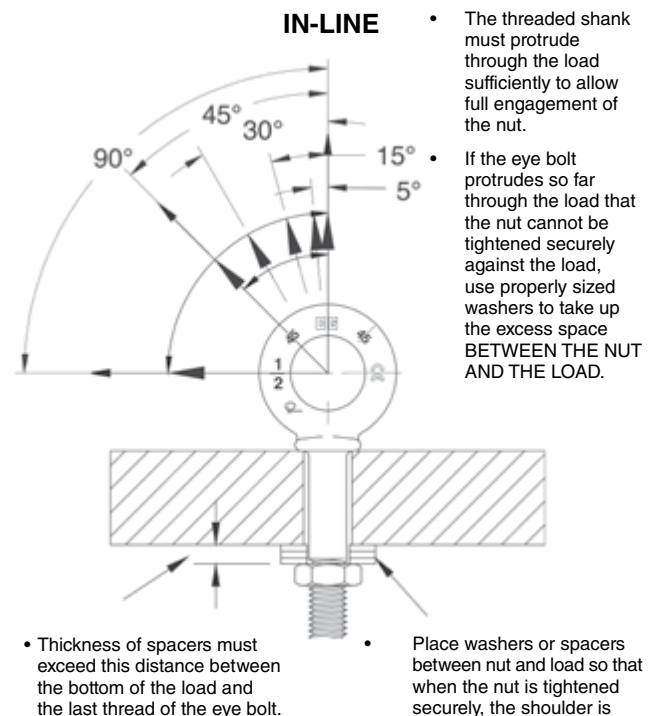
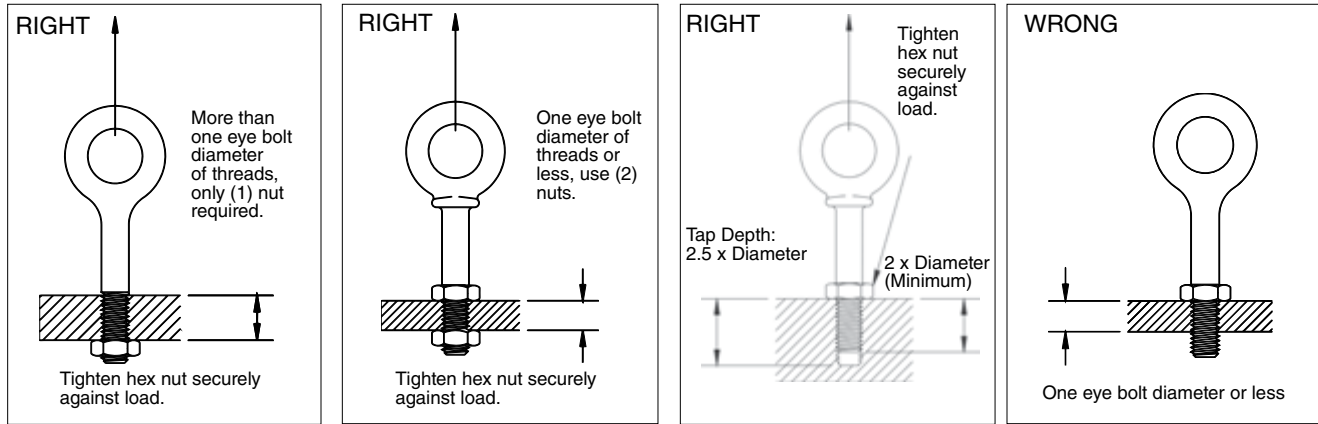


Figure 1

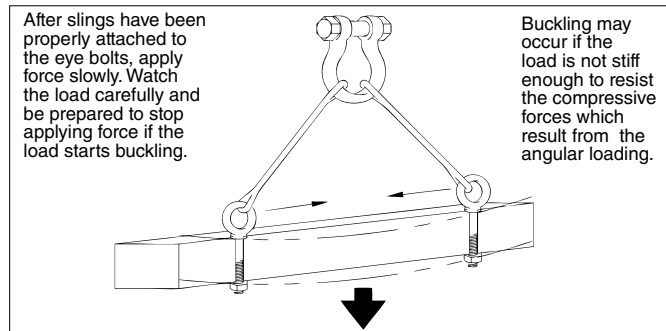
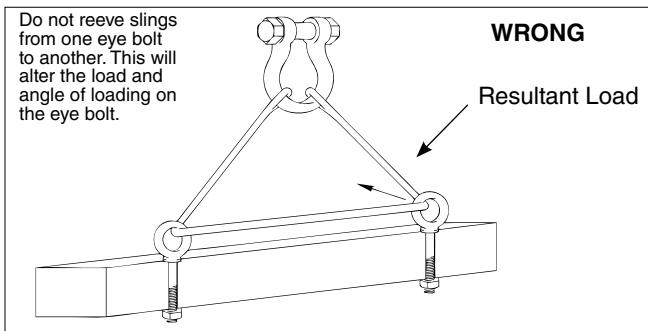
Table 2 (In-Line Load)	
Metric Size	Working Load Limit - kg
m6	200
m8	400
m10	640
m12	1000
m16	1800
m20	2500
m24	4000
m27	5000
m30	6000
m36	8500
m42	14000
m48	17300
m64	29500

Important – Read and understand these instructions before using eye bolts. Regular Nut & Shoulder Nut Eye Bolt – Installation for In-Line Loading



Operating Safety

- Always stand clear of load.
- Always lift load with steady, even pull – do not jerk.
- Always apply load to eye bolt in the plane of the eye – not at an angle.
- Never exceed the capacity of the eye bolt—see Table 1 & 2.
- When using lifting slings of two or more legs, make sure the loads in the legs are calculated using the angle from the vertical sling angle to the leg and properly size the shoulder nut or machinery eye bolt for the angular load.



Machinery Eye Bolt - Installation for In-Line & Angular Loading

These eye bolts are primarily intended to be installed into tapped holes.

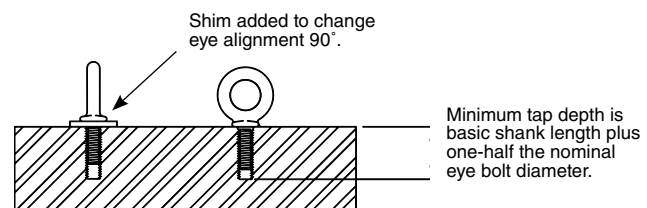
1. After the loads on the eye bolts have been calculated, select the proper size eye bolt for the job.

For angular lifts, adjust working load as follows:

Direction of Pull (from In-Line)	Adjusted Working Load
45 degrees	30% of rated working load
90 degrees	25% of rated working load

2. Drill and tap the load to the correct sizes to a minimum depth of one-half the eye bolt size beyond the shank length of the machinery eye bolt.
3. Thread the eye bolt into the load until the shoulder is flush and securely tightened against the load.
4. If the plane of the machinery eye bolt is not aligned with the sling line, estimate the amount of unthreading rotation necessary to align the plane of the eye properly.
5. Remove the machinery eye bolt from the load and add shims (washers) of proper thickness to adjust the angle of the plane of the eye to match the sling line. Use Table 3 to estimate the required shim thickness for the amount of unthreading rotation required.

Eye Bolt Size (in)	Shim Thickness Required to Change Rotation 90° (in)	Eye Bolt Size (mm)	Shim Thickness Required to change Rotation 90° (mm)
1/4	.0125	M6	.25
5/16	.0139	M8	.31
3/8	.0156	M10	.38
1/2	.0192	M12	.44
5/8	.0227	M16	.50
3/4	.0250	M20	.62
7/8	.0278	M24	.75
1	.0312	M27	.75
1-1/8	.0357	M30	.88
1-1/4	.0357	M36	1.00
1-1/2	.0417	M42	1.13
1-3/4	.0500	M48	1.25
2	.0556	M64	1.50
2-1/2	.0625	—	—



CROSBY® PIVOT HOIST RING

WARNINGS & APPLICATION INSTRUCTIONS



HR-100

Pivot Hoist Ring Application / Assembly Instructions

- Use pivot hoist ring only with ferrous metal (steel, iron) workpiece. Do not leave threaded end of hoist ring in aluminium for long periods of time due to corrosion.
- After determining the loads on each pivot hoist ring, select the proper size using the Working Load Limit (WLL) ratings in Table 1 for UNC threads.
- Drill and tap the workpiece to the correct size to a minimum depth of one-half the threaded bolt diameter plus the effective thread projection length (see Table 1, on next page). To select proper bolt and thread sizes see Table 1 on next page.
- Install the pivot hoist ring to recommended torque with a torque wrench making sure the pivot hoist ring body meets the load (workpiece) surface. See rated load limit and bolt torque requirements imprinted on top of the pivot hoist ring body (see Table 1, on next page).
- Never use spacers between the pivot hoist ring body and workpiece surface.
- Always select proper load rated lifting device for use with pivot hoist ring.
- Attach lifting device ensuring free fit to pivot hoist ring bail (lifting ring) (Figure 1).
- Apply partial load and check proper pivot. Ensure load alignment is in the direction of pivot (Figure 4). There should be no interference between load (workpiece) and pivot hoist ring bail (Figure 2).

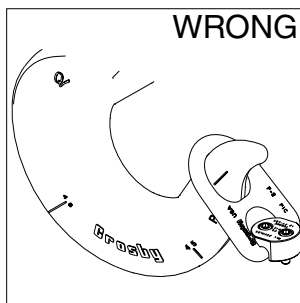


Figure 1

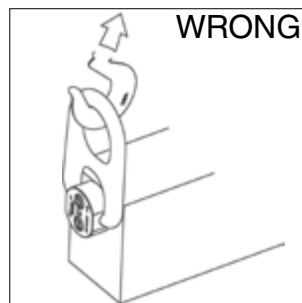


Figure 2

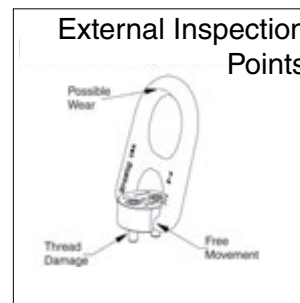


Figure 3

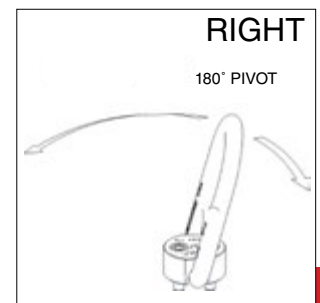


Figure 4

⚠ WARNING

- Load may slip or fall if proper Hoist Ring assembly and lifting procedures are not used.
- A falling load can seriously injure or kill.
- Do not use with damaged slings or chain. For inspection criteria see ASME B30.9.
- Never apply load except in line with the pivot direction.
- Use only genuine Crosby bolts as replacements.
- Read and understand these warnings and application instructions.

Pivot Hoist Ring Inspection / Maintenance

- Always inspect pivot hoist ring before use.
- Regularly inspect pivot hoist ring parts (Figure 3).
- Never use pivot hoist ring that shows signs of corrosion, wear or damage.
- Never use pivot hoist ring if bail is bent or elongated.
- Do not use parts showing cracks, nicks or gouges.
- Always be sure threads on bolts and receiving holes are clean, not damaged or worn, and fit properly.
- Always check with torque wrench before using an already installed pivot hoist ring.
- Always make sure there are no spacers (washers) used between pivot hoist ring body and the workpiece surface. Remove any spacers (washers) and retorquing before use.
- Always ensure free movement of the bail. The bail should pivot 180 degrees (Figure 4).
- Always be sure total workpiece surface is in contact with the pivot hoist ring body mating surface. Drilled and tapped holes must be 90 degrees to load (workpiece) surface.
- Always make sure that the load is applied in the direction of pivot.

Operating Safety

- Never exceed the capacity (WLL) of the pivot hoist ring. See Table 1 for UNC threads.
- When using lifting slings of two or more legs, make sure the forces in the legs are calculated using the angle from the horizontal sling angle to the leg and select the proper size pivot hoist ring. When using a multi-leg lifting sling, the pivot hoist ring must be mounted so that the pivot direction is inline with the load applied.

Table 1
HR-100 Pivot Hoist Rings**

Working Load Limit* (lb)	Torque in Ft • lb †	No. of Bolts	Dimensions (in)	
			Bolt Size††	Effective Thread Projection Length
2,000	7	2	5/16 - 18	0.82
2,500	12	2	3/8 - 16	0.65
5,000	28	2	1/2 - 13	1.40
12,000	28	4	1/2 - 13	1.65
20,000	60	4	5/8 - 11	1.65

* Ultimate load is 5 times the working load limit. Individually proof tested to 2-1/2 times the working load limit.

† Tightening torque values shown are based upon threads being clean, dry and free of lubrication.

** Designed to be used with ferrous workpiece only.

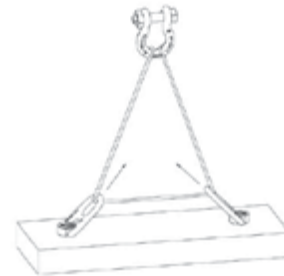
†† Only use Crosby high strength replacement bolts. Do not use any other bolts.

After slings have been properly attached to the hoist ring, apply force slowly. Watch the load and be prepared to stop applying force if the load starts buckling.



Buckling may occur if the load is not stiff enough to resist the compressive forces which result from the angular loading.

Do not reeve slings from one bail to another. This will alter the load and angle of loading on the hoist ring.



WRONG

SIDE PULL HR-1200

WARNINGS & APPLICATION INSTRUCTIONS



HR-1200

Hoist Ring Application / Assembly Instruction

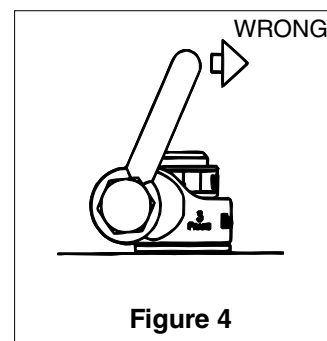
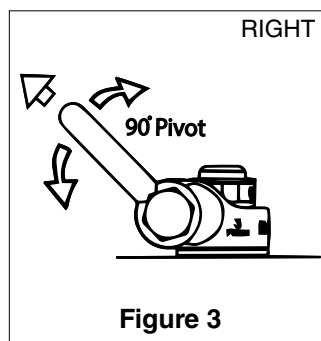
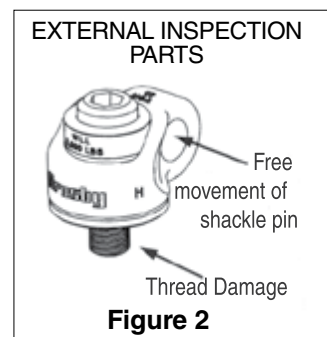
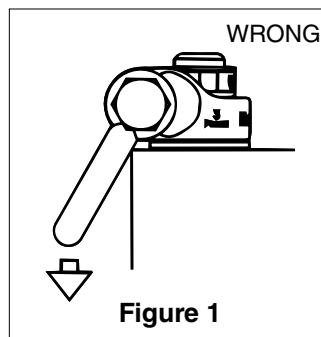
- The Crosby side pull swivel hoist ring is designed to accept standard Crosby fittings to facilitate wider slings and quick attachment. In order to use the larger fittings, the load rating on the (shackle) fitting may be greater than the hoist ring frame. **Never exceed the Working Load Limit of the hoist ring frame.**
- Use swivel hoist ring only with a ferrous metal (steel, iron) or non-ferrous (i.e., aluminum) loads (workpiece). Do not leave threaded end of hoist ring in aluminum loads for long time periods due to corrosion.
- After determining the loads on each hoist ring, select the proper size hoist ring using the Working Load Limit ratings in Table 1 for UNC threads and Table 2 for Metric threads (on next page.)
- For Subsea or Metric environment application, use the HR-1200 CT Series hoist ring only.
- Drill and tap the workpiece to the correct size to a minimum depth of one-half the threaded shank diameter plus the threaded shank length.
- Install hoist ring to recommended torque with a torque wrench making sure the bushing flange is fully supported by the load (workpiece) surface. See rated load limit and bolt torque requirements imprinted on hoist ring body (See Table 1 or Table 2).
- Never use spacers between bushing flange and mounting surface.
- Always select proper lifting device for use with Swivel Hoist Ring (See Tables 1 & 2 on next page).
- Attach lifting device ensuring free fit to hoist shackle (See Figure 3).
- Apply partial load and check proper rotation and alignment of shackle. There should be no interference between load (workpiece) and hoist shackle (See Figure 1 and Figure 4).
- The Hoist ring should rotate into normal operating position, with shackle aligned with load as shown in Figure 3. If shackle is oriented as shown in Figure 4, **DO NOT LIFT**.
- Special Note:** when a Hoist Ring is installed with a retention nut, the nut must have full thread engagement and must meet one of the following standards to develop the Working Load Limit (WLL).
 - ASTM A-563 (A) Grade D Hex Thick
 - (B) Grade DH Standard Hex
 - SAE Grade 8 - Standard Hex

Hoist Ring Inspection / Maintenance

- Always inspect hoist ring before use.
- Regularly inspect hoist ring parts (Figure 2).
- For hoist rings used in frequent load cycles or on pulsating loads, the bolt threads should be periodically inspected by magnetic particle or dye penetrant.
- Do not use part showing cracks, nicks or gouges.
- Repair minor nicks or gouges to hoist frame by lightly grinding until surfaces are smooth. Do not reduce original dimension more than 10%. Do not repair by welding.

⚠ WARNING

- Loads may slip or fall if proper Hoist Ring assembly and lifting procedures are not followed.
- A falling load may cause serious injury or death.
- Install hoist ring bolt to torque requirements listed in tables.
- The side pull hoist ring frame will be only one part of a lifting system with several components (i.e., shackles and slings). Never exceed the Working Load Limit of the hoist ring frame.
- Do not use damaged slings or chain. For inspection criteria, see ASME B30.9.
- Read and understand these instructions before using hoist ring.
- The tension of the sling must be calculated or measured and can not exceed the working load limit (WLL) of the load connection fitting.
- Use only genuine Crosby parts as replacements.
- Replacement bolt kits are available from Crosby.

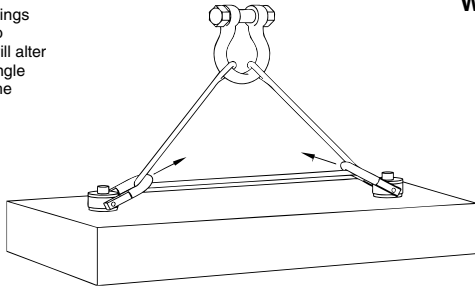


- Never use hoist ring that shows signs of corrosion, wear or damage.
- Never use hoist ring if components are bent or elongated.
- Always be sure threads on bolt and receiving tapped holes are clean, undamaged, and fit properly.
- Always check with torque wrench before using an already installed hoist ring.
- Always make sure there are no spacers (washers) used between bushing flange and the mounting surface. Remove any spacers (washers) and retorque before use.
- Always ensure free movement of shackle. The shackle should pivot 90° and the hoist ring should swivel 360° (See Figure 3).
- Always be sure total workpiece surface is in contact with hoist ring bushing mating surface. Drilled and tapped hole must be 90° to load (workpiece) surface.

OPERATING SAFETY

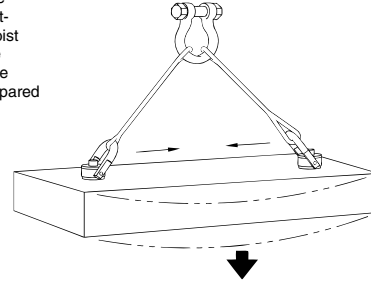
- Never exceed the capacity of the hoist ring, see Table 1 for UNC threads and Table 2 for Metric threads.
- When using lifting slings of two or more legs, make sure the forces in the legs are calculated using the angle from the horizontal sling angle to the leg and select the proper size swivel hoist ring to allow for the angular forces.

Do not reeve slings from one bail to another. This will alter the load and angle of loading on the hoist ring



WRONG

After slings have been properly attached to the hoist ring, apply force slowly. Watch the load and be prepared to stop applying force if the load starts buckling.



Buckling may occur if the load is not stiff enough to resist the compressive forces which result from the angular loading.

HR-1200 UNC Threads

TABLE 1

Frame Size	Working Load Limit * (lb)	Hoist Ring Bolt Torque in Ft • lb †	Bolt Size ‡ (in)	Effective Thread Projection Length (in)	Recommended Shackles	
					Red Pin ® Shackles 209, 210, 213 215, 2130, 2150	Red Pin ® Web Shackles S-281
1	650††	7	5/16 - 18 x 1.5	.59	1/2" - (2)	2" - (3-1/4)
	800††	12	3/8 - 18 x 1.5	.59	5/8" - (3-1/4)	
2	2000	28	1/2 - 13 x 2.0	.71		
	2000††	28	1/2 - 13 x 2.5	1.21	5/8" - (3-1/4)	2" - (3-1/4)
	3000	60	5/8 - 11 x 2.0	.71	3/4" - (4-3/4)	1-1/2" - (4-1/2)
	3000††	60	5/8 - 11 x 2.75	1.46		
3	5000	100	3/4 - 10 x 2.75	1.46		
	5000††	100	3/4 - 10 x 3.5	1.63		
	6500	160	7/8 - 9 x 2.5	.90	7/8" - (6-1/2)	2" - (6-1/4)
	6500††	160	7/8 - 9 x 3.5	1.68		
	8000	230	1 - 8 x 3.0	1.15		
	8000††	230	1 - 8 x 4.0	2.15		
4	14000	470	1-1/4 - 7 x 4.5	2.22	1" - (8-1/2) 1-1/8" - (9-1/2) 1-1/4" - (12)	3" - (8-1/2)
5	17200	800	1-1/2 - 6 x 6.5	2.88	1-3/8" - (13-1/2)	
	29000	1100	2 - 4-1/2 x 6.5	2.98	1-1/2" - (17) 1-3/4" - (25)	—

HR-1200M Metric Threads

TABLE 2

Frame Size	Working Load Limit * (kg)	Hoist Ring Bolt Torque in Nm †	Bolt Size ‡ (mm)	Effective Thread Projection Length (mm)	Recommended Shackles	
					Red Pin ® Shackles 209, 210, 213 215, 2130, 2150	Red Pin ® Web Shackles S-281
1	300	10	M8 x 1.25 x 40	16.9	1/2" - (2)	2" - (3-1/4)
	400	16	M10 x 1.5 x 40	16.9	5/8" - (3-1/4)	
2	1000	38	M12 x 1.75 x 50	17.2	5/8" - (3-1/4)	2" - (3-1/4)
	1400	81	M16 x 2.00 x 60	27.2	3/4" - (4-3/4)	1-1/2" - (4-1/2)
3	2250	136	M20 x 2.50 x 75	28.1	7/8" - (6-1/2)	2" - (6-1/4)
	3500	312	M24 x 3.00 x 80	33.1		
4	6250	637	M30 x 3.5 x 120	65.1	1" - (8-1/2) 1-1/8" - (9-1/2) 1-1/4" - (12)	3" - (8-1/2)
5	7750	1005	M36 x 4.0 x 150	60.6	1-3/8" - (13-1/2)	
	10000	1005	M42 x 4.5 x 160	70.6	1-1/2" - (17)	
	13000	1350	M48 x 5.0 x 160	70.6	1-3/4" - (25)	—

Designed to be used with Ferrous workpiece only.

* Ultimate load is 5 times the Working Load Limit. Individually proof tested to 2-1/2 times the Working Load Limit.

† Tightening torque values shown are based upon threads being clean, dry and free of lubrication.

†† Long bolts are designed to be used with soft metal (i.e., aluminum) workpiece. While the long bolts may also be used with ferrous metal (i.e., steel & iron) workpieces, short bolts are designed for ferrous workpieces only.

‡ Bolt specification is a Grade 8 Alloy socket head cap screw to ASTM A574. All threads are UNC - 3A.

‡‡ Bolt specification is a Grade 12.9 Alloy socket head cap to DIN 912. All threads are metric (ASME/ANSI B18.3.1m).

CROSBY® WELD-ON PIVOTING LINK

WARNING & APPLICATION INSTRUCTIONS



S-265

⚠ WARNING

- Loads may disengage from link if proper welding, assembly, and lifting procedures are not used.
- A falling load may cause serious injury or death.
- Do not use with damaged slings or chain. For sling inspection criteria see ASME B30.9.
- Read and understand these instructions before welding on, or using the pivoting link.

Important Safety Information - Read and Follow

- Use weld-on pivoting link only with ferrous metal (steel) workpiece.
- After determining the loads on each weld-on pivoting link, select the proper size using the Working Load Limit (WLL) ratings in Table 1 on next page.
- Always make sure the weld-on pivoting link and mounting surface is free of dirt or contaminants before installation.
- Never use spacers between the weld-on pivot link and mounting surface.
- Always select proper load rated lifting device for use with weld-on pivoting link.
- Attach lifting device ensuring free movement of weld-on pivoting link bail (Figure 1).
- Apply partial load and check proper alignment. There should be no interference between load (workpiece) and weld-on pivoting link (Figure 2).
- Always ensure free movement of bail. The bail should pivot 180 degrees (Figure 4).
- The support structure that the pivot link is attached to must be of suitable size, composition and quality to support the anticipated loads of all operating positions. The required support structure thickness for a given application is dependent on variables such as unsupported length and material strength, and should be determined by a qualified individual.
- Never repair, alter, rework or reshape the pivoting link bail by welding, heating, burning or bending.

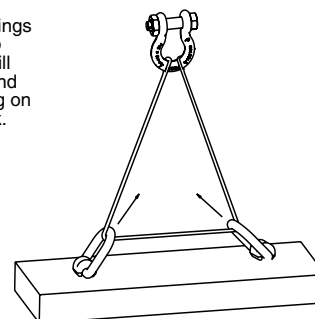
Weld-on Pivoting Link Inspection / Maintenance

- Always inspect weld-on pivoting link before use.
- Regularly inspect weld-on pivoting link parts (Figure 3).
- Never use weld-on pivoting link that shows signs of corrosion, wear or damage.
- Never use weld-on pivoting link if bail is bent or elongated.
- Do not use part showing cracks, nicks or gouges.
- Always make sure there are no spacers used between weld-on pivoting link and the mounting surface.
- Always be sure workpiece surface is in total contact with the weld-on pivoting link base mating surface.
- Always inspect the weld-on pivoting link bail and base for wear.
- A visual periodic inspection of the weld should be performed. Check the weld visually, or use a suitable NDE method if required.

Operating Safety

- Never exceed the capacity (WLL) of the weld-on pivoting link (Table 1, next page).
- Always apply load within 90° of inline, at any pivot angle (Figure 4 & 5).
- When using lifting slings of two or more legs, make sure the forces in the legs are calculated using the angle from the horizontal sling angle to the leg and select the proper size link.

Do not reeve slings from one bail to another. This will alter the load and angle of loading on the pivoting link.



WRONG

After slings have been properly attached to the pivoting link, apply force slowly. Watch the load and be prepared to stop applying force if the load starts buckling.



Buckling may occur if the load is not stiff enough to resist the compressive force which results from the angular loading.

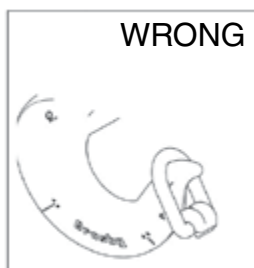


Figure 1

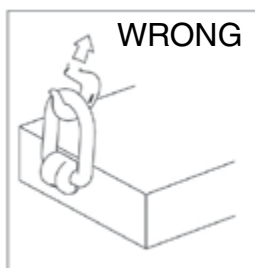


Figure 2



Figure 3

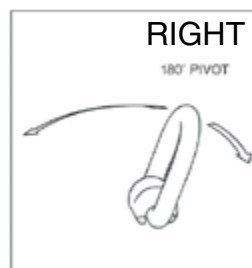


Figure 4

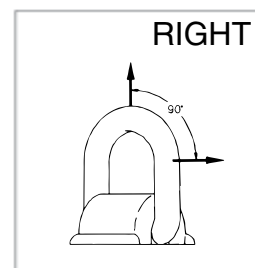


Figure 5

Weld-on Pivoting Link Welding Guidelines

1. Select the correct size weld-on pivoting link to be used. Be sure to calculate the maximum load that will be applied to the weld-on pivoting link.
2. Place the weld-on pivoting link onto the mounting surface. The bottom of the link base must be parallel and even with the mounting surface.
3. Welding is to be performed by a qualified welder using a qualified procedure in accordance with American Welding Society and/or American Society of Mechanical Engineers requirements. Always follow your country or local mandatory regulations or codes.
4. The following welding recommendations should be included in the qualified procedure for welding to low or medium carbon plate steel. For welding to other grades of steel, a qualified weld procedure must be developed.
 - A. Saddle material is equivalent to SAE/AISI 1024, EN S355J2, or DIN 1.0570.
 - B. Weld material is to have a minimum tensile strength of 70,000 PSI (such as AWS A5.1 E-7018). Observe the electrode manufacturer's recommendations. Completely fill internal fillet created between weld-on pivoting link base and mounting surface.
 - C. Before welding, all weld surfaces must be clean and free from rust, grease, paint, slag and any other contaminants.
- D. Fillet weld leg size should be minimum shown in Table 1. Weld profiles to be in accordance with AWS. Weld size is measured by length of leg.
- E. Welding should be carried out in a minimum of two passes to ensure adequate root penetration at the base of the pivoting link.
- F. Weld full length of "D" dimension on both sides of link base (Figure 5).
- G. Do not weld close to the bail. After welding, ensure bail pivots full 180° without interfering with the weld.
- H. Do not rapidly cool the weld.
- I. The ends of the weld must be ground sufficiently so that the weld-on pivoting link will fit flush against the mounting surface.
- J. A thorough inspection of the weld should be performed. No cracks, pitting, inclusions, notches or undercuts are allowed. If doubt exists, use a suitable NDE method, such as magnetic particle or liquid penetrant to verify.
- K. If repair is required, grind out the defect and re-weld using the original qualified procedure.

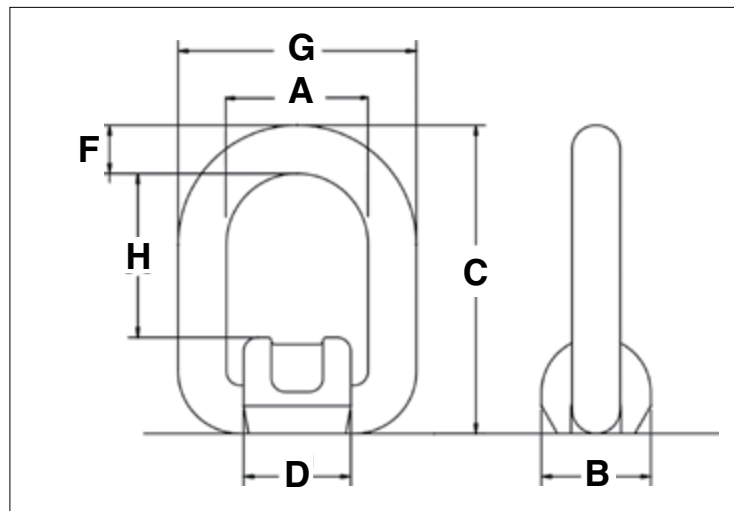


Figure 5

Table 1 S-265 Weld-on Pivoting Links*											
Stock Number	Working Load Limit (t)		Dimensions (in)								Weight Each (lb)
	Design Factor 5:1	Design Factor 4:1	A	B	C	D	F	G	H	Minimum Fillet Weld Size	
1290839	1	1.2	1.57	1.42	3.27	1.38	0.51	2.60	1.65	3/32	.88
1290848	2.5	3.2	1.77	1.73	3.90	1.65	0.71	3.19	1.89	3/32	1.32
1290857	4	5.3	2.17	1.97	4.84	1.93	0.87	3.90	2.24	1/4	2.65
1290866	6.4	8	2.76	2.52	5.67	2.52	1.02	4.80	2.64	1/4	5.29
1290875	12	15	3.82	3.54	7.60	3.39	1.34	6.50	3.70	5/16	13.01

* Designed to be used with ferrous workpiece only.

CROSBY SWIVEL HOIST RING

WARNING & APPLICATION INSTRUCTIONS



HR-125/SS-125
(Red Washer)
HR-125M
SS-125M
(Silver Washer)



HR-1000
(Red Washer)
HR-1000M
(Silver Washer)
HR-1000CT
(Blue Washer)

Hoist Ring Application Assembly Safety

- Use swivel hoist ring only with a ferrous metal (steel, iron) or soft metal (i.e., aluminum) load (workpiece). Do not leave threaded end of hoist ring in aluminum loads for long time periods due to corrosion.
- For subsea or marine environment applications, use the HR-1000CT series Hoist Ring only.
- After determining the loads on each hoist ring, select the proper size hoist ring using the Working Load Limit ratings in Tables 1, 3, and 5 for UNC threads and Tables 2, 4 and 6 for Metric threads (on next page).
- Drill and tap the workpiece to the correct size to a minimum depth of one-half the threaded shank diameter plus the threaded shank length. See rated load limit and bolt torque requirements imprinted on top of the swivel trunnion (See Table 1 through Table 6 on next page).
- When a hoist ring is used in a side load application, ensure equal loading on the pins by aligning the bail as shown in (Fig. 3).
- Always be sure total hoist ring bushing mating surface is in contact with the (workpiece) surface. Drilled and tapped hole must be 90 degrees to load (workpiece) surface.
- Install hoist ring to recommended torque with a torque wrench making sure the bushing flange meets the load (workpiece) surface.
- Never use spacers between bushing flange and mounting surface.
- Always select proper load rated lifting device for use with Swivel Hoist Ring.
- Attach lifting device ensuring free fit to hoist ring bail (lifting ring) (Fig. 1).
- Apply partial load and check proper rotation and alignment. There should be no interference between load (workpiece) and hoist ring bail (Fig. 2).
- Special Note: Recommended thru hole clearance is 1/32" for bolts smaller than 1" and 2/32" for bolts 1" and larger in diameter.

UNC NUTS

- 1. ASTM A-563**
Grade D
(Heavy Hex or Hex Thick)
Grade DH
Grade DH3
- 2. ASTM A-194**
Grade 2H
Grade 4
Grade 7
- 3. FNL**
Grade 9
- 4. SAE J995**
Grade 8

METRIC NUTS

- 1. ASTM A-563M**
Class 10S
- 2. ISO 898-2**
(EN 20898-2/DIN 267-4)
Class 10
Class 12

Minimum thread engagement length is one times thread diameter.

Hoist Ring Inspection / Maintenance

- Always inspect hoist ring before use.
- Regularly inspect hoist ring parts.
- Never use hoist ring that shows signs of corrosion, wear or damage.
- Never use hoist ring if bail is bent or elongated.
- Always be sure threads on shank and receiving hole are clean, not damaged, and fit properly.
- Always check with torque wrench before using an already installed hoist ring.
- Always make sure there are no spacers (washers) used between bushing flange and the mounting surface. Remove any spacers (washers) and retorquer before use.
- Prior to loading always ensure free movement of bail. The bail should pivot 180 degrees and swivel 360 degrees.

⚠ WARNING

- **Loads may slip or fall if proper Hoist Ring assembly and lifting procedures are not used.**
- **A falling load may cause serious injury or death.**
- **Install hoist ring bolt to torque requirements listed in tables 1, 2, 3, 4, 5, & 6 for the HR-125, HR-1000, HR-1000CT, HR-125M, HR-1000M and SS-125.**
- **Read, understand and follow all instructions and chart information.**
- **Do not use with damaged slings, chain, or webbing. For inspection criteria see ASME B30.9.**
- **The tension of the sling must be calculated or measured and can not exceed the working load limit (WLL) of the load connection fitting.**
- **Use only genuine Crosby parts as replacements.**

Operating Safety

- Never exceed the capacity of the swivel hoist ring, see Tables 1, 2 and 5 for UNC threads and Tables 3, 4 and 6 for Metric threads (See next page for tables.).
- When using lifting slings of two or more legs, make sure the forces in the legs are calculated using the angle from the horizontal sling angle to the leg and select the proper size swivel hoist ring to allow for the angular forces.

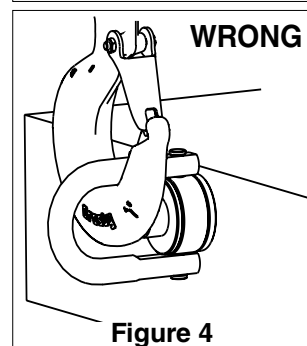
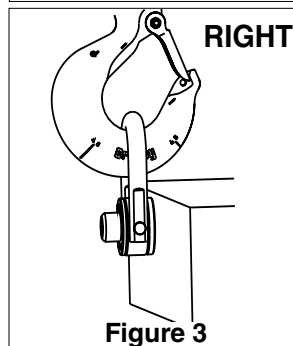
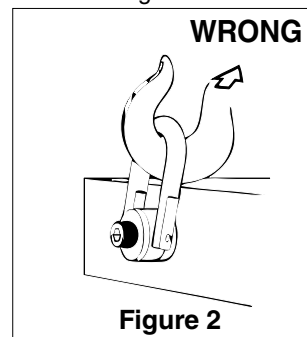
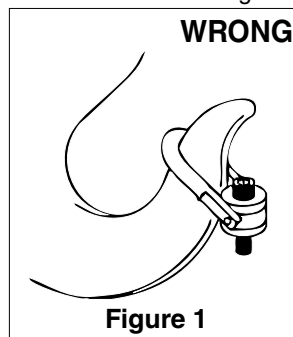
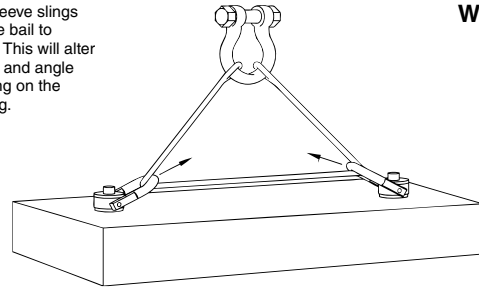


Table 1

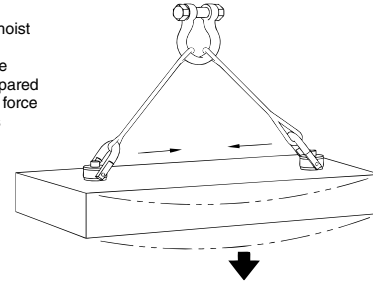
WLL* 5:1 (lb)	Hoist Ring Bolt Torque Ft•lbs †	HR-125		HR-1000	
		Bolt Size ‡ (in)	Effective Thread Projection Length (in)	Bolt Size ‡ (in)	Effective Thread Projection Length (in)
800 ††	7	5/16 - 18 x 1.50	.58	5/16 - 18 x 1.50	.52
1000 ††	12	3/8 - 16 x 1.50	.58	3/8 - 16 x 1.50	.52
2500	28	1/2 - 13 x 2.00	.70	1/2 - 13 x 2.25	.69
2500 ††	28	1/2 - 13 x 2.50	1.20	1/2 - 13 x 2.75	1.19
4000	60	5/8 - 11 x 2.00	.70	5/8 - 11 x 2.25	.69
4000 ††	60	5/8 - 11 x 2.75	1.45	5/8 - 11 x 3.00	1.44
5000	100	3/4 - 10 x 2.25	.95	3/4 - 10 x 2.50	.94
5000 ††	100	3/4 - 10 x 2.75	1.45	3/4 - 10 x 3.00	1.44
7000 Ω	100	3/4 - 10 x 2.75	.89	3/4 - 10 x 3.00	.85
7000 ††Ω	100	3/4 - 10 x 3.50	1.64	3/4 - 10 x 3.50	1.35
8000	160	7/8 - 9 x 2.75	.89	7/8 - 9 x 3.00	.85
8000 ††	160	7/8 - 9 x 3.50	1.64	7/8 - 9 x 3.50	1.35
10000	230	1 - 8 x 3.00	1.14	1 - 8 x 3.50	1.35
10000 ††	230	1 - 8 x 4.00	2.14	1 - 8 x 4.50	2.35
15000	470	1-1/4 - 7 x 4.50	2.21	1-1/4 - 7 x 5.00	2.09
24000	800	1-1/2 - 6 x 6.75	2.97	1-1/2 - 6 x 5.50	2.59
30000	1100	2 - 4-1/2 x 6.75	2.97	—	—
50000	2100	2-1/2 - 4 x 8.00	4.00	—	—
75000	4300	3 - 4 x 10.50	5.00	—	—
100000	5100	3-1/2 - 4 x 13.00	7.00	—	—

Do not reeve slings from one bail to another. This will alter the load and angle of loading on the hoist ring.



WRONG

After slings have been properly attached to the hoist ring, apply force slowly. Watch the load and be prepared to stop applying force if the load starts buckling.



Buckling may occur if the load is not stiff enough to resist the compressive forces which result from the angular loading.

Ω Ultimate Load is 4.5 times Working Load Limit for 7000# Hoist Ring when tested in 90° orientation. All sizes are individually proof tested to 2-1/2 times the Working Load Limit. *, †, ††, ‡ (See footnotes at bottom of Table 5).

Table 2

Working Load Limit (kg) ****		HR-1000MCT		
Design Factor 5:1	Design Factor 4:1	Hoist Ring Bolt Torque in (Nm) †	Bolt Size (mm) ‡	Effective Thread Projection Length (mm)
825	1030	38	M12 x 1.75 x 55	15.6
1350	1690	81	M16 x 2.00 x 65	25.5
2250	2810	136	M20 x 2.50 x 80	25.3
3175	3970	312	M24 x 3.00 x 90	35.4
5450	6810	637	M30 x 3.50 x 140	65.9
7450	9310	1005	M36 x 4.00 x 130	56.3
13250	16560	1350	M48 x 5.00 x 180	50.7

Table 3

HR-1000CT			
Working Load Limit 5:1 (lb) ****	Hoist Ring Bolt Torque in (Ft • lbs) †	Bolt Size (in) Δ	Effective Thread Projection Length (in)
1900	28	1/2 - 13 x 2.25	.70
1900	28	1/2 - 13 x 2.75	1.20
3000	60	5/8 - 11 x 2.25	.70
4800	100	3/4 - 10 x 3.00	.85
6200	160	7/8 - 9 x 3.00	.85
8300	230	1 - 8 x 3.50	1.35
12500	470	1 1/4 - 7 x 5.00	2.10
20000	800	1 1/2 - 6 x 5.50	2.60
20000	800	1 1/2 - 8 x 5.50	2.60
28000	1100	2 - 4.5 x 7.50	3.20
45000	2100	2 1/2 - 4 x 9.50	3.73

Table 4

Working Load Limit (kg)***		HR-125M		HR-1000M	
Design Factor 5:1	HR-125M Design 4:1	Hoist Ring Bolt Torque in Nm †	Bolt Size ‡ (mm)	HR-125M Effective Thread Projection Length (mm)	HR-1000M Effective Thread Projection Length (mm)
400	500	10	M 8 X 1.25 X 40	16.9	M 8 X 1.25 X 40
450	550	16	M 10 X 1.50 X 40	16.9	M 10 X 1.50 X 40
1050	1300	38	M 12 X 1.75 X 50	17.2	M 12 X 1.75 X 55
1900	2400	81	M 16 X 2.00 X 60	27.2	M 16 X 2.00 X 65
2150	2700	136	M 20 X 2.50 X 65	31.2	M 20 X 2.50 X 70
3000	3750	136	M 20 X 2.50 X 75	28.1	M 20 X 2.50 X 80
4200	5250	312	M 24 X 3.00 X 80	33.1	M 24 X 3.00 X 90
7000	8750	637	M 30 X 3.50 X 120	65.1	M 30 X 3.50 X 140
11000	13750	1005	M 36 X 4.00 X 150	60.6	M 36 X 4.00 X 150
12500	15600	1005	M 42 x 4.50 x 160	70.6	—
13500	16900	1350	M 48 x 5.00 x 160	101	—
22300	27900	2847	M 64 x 6.00 x 204	101	—
31500	39400	5830	M 72 x 6.00 x 265	132	—
44600	55800	6914	M 90 x 6.00 x 330	177	—

See Footnotes on next page.

† Tightening torque values shown are based upon threads being clean, dry and free of lubrication.

Footnotes below relate to tables 1-4

* Ultimate load is 5 times the Working Load Limit. Individually proof tested to 2-1/2 times the Working Load Limit.

** Ultimate load is 4 times the Working Load Limit. Individually proof tested to 2-1/2 times the Working Load Limit.

*** Individually proof tested to 2-1/2 times the Working Load Limit based on 4:1 design factor

**** Ultimate load is 5 times the Working Load Limit. Individually proof tested to 2 times the Working Load Limit.

†† Long bolts are designed to be used with soft metal (i.e., aluminum) workpiece. While the long bolts may also be used with ferrous metal (i.e., steel & iron) workpieces, short bolts are designed for ferrous workpieces only.

‡ Bolt specification is a Alloy socket head cap screw to ASTM A574. All threads are UNC.

‡‡ Bolt specification is a Grade 12.9 Alloy socket head cap screw to DIN 912. All threads are metric (ASME/ANSI B18.3.1m)

Δ Bolt specification is a Grade L7 or L43 Alloy socket head cap screw to ASTM A320. All threads are UNC.

‡‡‡ Tighten bolt to specified torque, then tighten nut to specified torque.

All Swivel Hoist Rings are individually proof tested.

Table 5			
SS-125 ¥¥			
Working Load Limit (lb) ¥	Torque in Ft • lbs †	Bolt Size (in) §	Effective Thread Projection (in)
400	3.5	5/16 - 18 x 1	.29
400	3.5	5/16 - 18 x 1.25	.54
500	6	3/8 - 16 x 1.25	.54
1250	14	1/2 - 13 x 2	.78
1250	14	1/2 - 13 x 2.25	1.03
1250	14	1/2 - 13 x 2.5	1.28
2000	30	5/8 - 11 x 2	.78
2000	30	5/8 - 11 x 2.25	1.03
2000	30	5/8 - 11 x 2.5	1.28
2500	50	3/4 - 10 x 2.25	1.03
2500	50	3/4 - 10 x 2.75	1.53
3500	50	3/4 - 10 x 2.75	1.04
3500	50	3/4 - 10 x 3.25	1.54
4000	80	7/8 - 9 x 2.75	1.04
4000	80	7/8 - 9 x 3	1.29
5000	115	1 - 8 x 3	1.29
5000	115	1 - 8 x 3.25	1.54
5000	115	1 - 8 x 4	2.29
7500	235	1-1/4 - 7 x 4	1.89
12000	400	1-1/2 - 6 x 5.5	2.70
15000	550	2 - 4-1/2 x 5.75	2.96
25000	1050	2-1/2 - 4 x 8	4.00
25000	1050	2-1/2 - 8 x 8	4.00
37500	2150	3 - 4 x 10.25	5.00
50000	2550	3-1/2 - 4 x 13	7.00

Table 6			
SS-125M ¥¥			
SS-125M ¥¥ Working Load Limit (kg) ¥	Torque in Lbs †	Bolt Size (mm) §§	Effective Thread Projection (mm)
200	4	M 8 x 1.25x30	13
250	8	M 10 x 1.50x35	18
525	18	M 12 x 1.75x50	19
950	40	M 16 x 2.00x60	29
1075	68	M 20 x 2.50x65	34
1500	68	M 20 x 2.50x75	32
2100	108	M 24 x 3.00x80	37
2100	108	M 30 x 3.50x110	58
3500	318	M 30 x 3.50x95	42
3500	318	M 30 x 3.50x115	62
5500	542	M 36 x 4.00x135	64
6250	542	M 42 x 4.50x155	82
6750	746	M 48 x 5.00x155	82
11150	1423	M 64 x 6.00x205	101
15750	2915	M 72 x 6.00x265	132
22300	3459	M 90 x 6.00x330	177

Footnotes below relate to Tables 5 and 6

¥ Ultimate load is 5 times the Working Load Limit. Individually proof tested to 2 times the Working Load Limit.

¥¥ All components are 316 Stainless Steel, except Bolt Retainers, which are made from 15-7 PH (UNS 15700) magnetic stainless steel.

§ Bolt specification is 316 Stainless Steel socket head cap screw to ASTM F837 Group 1 (316).

§§ Bolt specification is 316 Stainless Steel socket head cap screw to ASTM F837M (316). All threads are Metric (ASME/ANSI B18.3.1M).

CROSBY Slide-Loc® Lifting Point

WARNINGS & APPLICATION INSTRUCTIONS



SL -150 & SL-150M
Slide-Loc Lifting Point

⚠ WARNING

- Load may slip or fall if proper Lifting Point assembly and lifting procedures are not used.
- A falling load can seriously injure or kill.
- Do not use with damaged slings or chain. For inspection criteria see ASME B30.9.
- Use only genuine Crosby bolts as replacements.
- Read and understand these warnings and application instructions.
- Do not load the Lifting Point if the slide lock is in the installation position (Red QUIC-CHECK mark is visible).
- The tension of the sling must be calculated or measured and can not exceed the working load limit (WLL) of the load connection fitting.

LIFTING POINT APPLICATION / ASSEMBLY INSTRUCTIONS

- Lifting Points incorporate a red indented area on each forged bail that provides a quick indicator to determine whether the Lifting Point is in the installation position or the lifting position. If the **QUIC-CHECK** mark is visible, product is in installation mode and shall not be used for lifting.
- **To check**, look for indented surface (red) on bail. A visible **QUIC-CHECK** mark (Figure 2) means the slide lock and bolt are engaged for installation. When Lifting Point is properly installed, move slide lock to lifting position (Figure 1).
- Use Lifting Points only with a ferrous metal (i.e., steel, iron) or soft metal (e.g., aluminum) load (workpiece). Do not leave threaded end of Lifting Point in aluminum loads for long time periods due to corrosion.
- When using lifting slings of two or more legs, make sure the forces in the legs are calculated using the angle from the horizontal sling angle to the leg and select the proper size swivel hoist ring to allow for the angular forces.
- After determining the loads on each Lifting Point, select the proper size Lifting Point using the Working Load Limit ratings in Table 1 for UNC threads and Table 2 for Metric threads.
- Never exceed rated capacity of Lifting Point. See Table 1 for UNC threads, and Table 2 for metric threads.
- Drill and tap the workpiece to the correct size to a minimum depth of one-half the threaded shank diameter plus the threaded shank length.
- Install Lifting Point by hand so that the bushing flange is held tight to the mounting surface by the bolt. The bushing flange should engage the entire mounting surface.
- Never use spacers between bushing flange and mounting surface.
- Always select proper load rated lifting device for use with Lifting Points.
- Attach lifting device ensuring free fit to Lifting Point bail (Figure 6).
- Never lift load if Red **QUIC-CHECK** indicator is visible (Figure 2).
- Apply partial load and check proper rotation and alignment. The Lifting Point bail should be in-line with the direction of the load.



USING THE LIFTING POINT

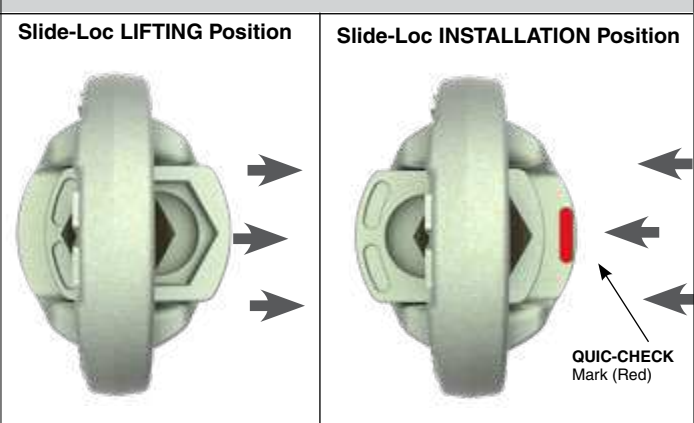


Figure 1

Figure 2

- Do not load in a direction perpendicular to the bail (Figure 5).
- Special Note: Recommended thru hole clearance is 1/32" for bolts smaller than 1" and 2/32" for bolts 1" and larger in diameter.

1. ASTM A-563

- A. Grade D Hex Thick
- B. Grade DH Standard Hex

2. SAE Grade 10.9 — Standard Hex

To place the Lifting Point:

- Move the slide lock into the installation position, such that the four flats on the bolt head are engaged (Figure 2).
- Thread the bolt of the Lifting Point into the hole of your workpiece making sure that the entire length of exposed bolt thread is engaged. If the hole on your workpiece is not threaded, ensure that the Lifting Point is secured with a nut on the opposite side of your workpiece and that that nut thread is fully engaged.

- Before applying any load, ensure that the slide lock has been moved back into the lifting position and that the bail is free to rotate (Figure 1).
- The Lifting Point can be loaded in any direction shown in Figure 4.
- Do not swivel the Lifting Point while supporting a load. The Lifting Point is a positioning device and is not intended to swivel under load.

To remove Lifting Point

- Move the slide lock into the installation position, such that the four flats on the bolt head flats are engaged (Figure 2).
- Unthread the Lifting Point from your workpiece.

Lifting Point Inspection / Maintenance

- Perform regular daily inspections as recommended.
- Always inspect Lifting Point before use.
- Regularly inspect Lifting Point parts (Figure 3).
- Never use Lifting Point that shows signs of corrosion, wear or damage.
- Never use Lifting Point if bail is bent or elongated.
- Always be sure threads on shank and receiving hole are clean, not damaged, and fit properly.
- Never use spacers (washers) between bushing flange and the mounting surface.
- Always ensure free movement of bail. The bail should swivel 360 degrees (Figure 3).
- Always be sure total workpiece surface is in contact with Lifting Point bushing mating surface. Drilled and tapped hole must be 90 degrees to load (workpiece) surface.

Table 1		
Working Load Limit 4:1 (t)	UNC Bolt Size (in)	Effective Thread Projection Length (in)
.5	3/8	.61
.75	1/2	.80
1.50	5/8	1.01
2.30	3/4	1.28
2.30	7/8	1.63
3.20	1	1.93

Table 2		
Working Load Limit 4:1 (t)	Metric Bolt Size (mm)	Effective Thread Projection Length (mm)
.5	10	14.7
.75	12	18.1
1.50	16	24.5
2.30	20	31.0
3.20	24	37.0

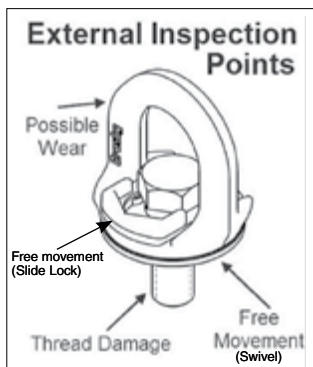


Figure 3

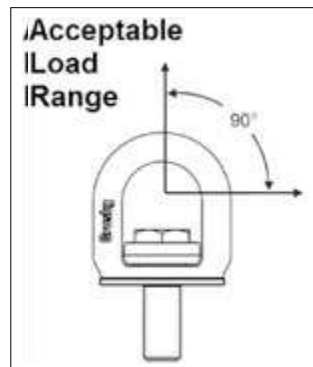


Figure 4

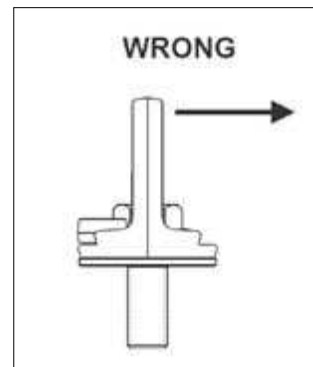


Figure 5

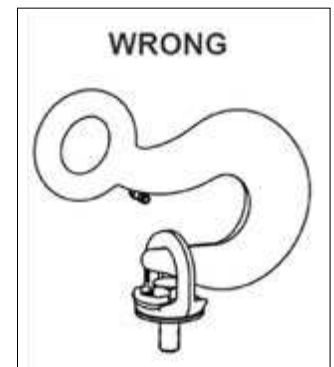
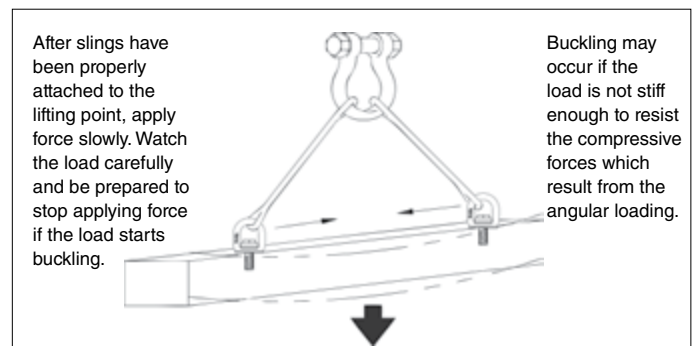
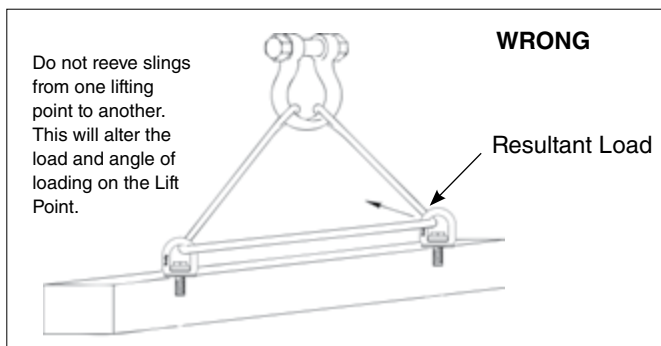


Figure 6



Technical Information

The following information aims to give advice and explain the most common questions in order to ensure correct and proper use of lifting points. This technical information refers to RELP, RLP, DLP and BLP unless other is stated. Always refer to the user instructions of the specific model of lifting point before use. It is of the most importance that this information is known to the user and in accordance with the Machinery Directive 2006/42/EC this information must be delivered to the customer. See website or user instructions for assembly instructions. Meets listed current specifications and standards at time of publication of this catalog.

General Advice

Reference should be made to relevant standards and other statutory regulations. Inspections must be carried out only by people who possess sufficient knowledge.

Before installation and before every use, visually inspect the lifting points, paying particular attention to any evidence of corrosion, wear, weld cracks or deformations. Please ensure compatibility of bolt thread and tapped hole.

The material construction, to which the lifting point will be attached, should be of adequate strength to withstand forces during lifting without deformation.

Ensure minimum thread depth, see table (d refers to bolt diameter).

Thread depth	Yield limit of base material
1 x d	For steel, yield limit >29 ksi
1.25 x d	For cast iron, yield limit >29 ksi
2.5 x d	Aluminum
	For other metal alloys or base materials consult your Gunnebo Industries distributor.

- If the bolt length needs to be adjusted the bolt should be cut with a cold saw or lathe and temperature kept as low as possible during cutting. After cutting check the shape of the threads nearest the cut with an appropriately sized die (there must not be any burrs).
- The surface facing around the thread hole shall be flat (plane), clear of dirt and smooth to ensure perfect contact with the shoulder surface of the Lifting Point.

Nut and washer

The nut and washer must be the original equipment supplied from Gunnebo Industries to ensure the correct mechanical properties. No warranty, insurance or liability will be accepted if bolts not supplied by Gunnebo Industries have been used.

Extreme Environments

The in-service temperature affects the WLL as follows:

RLP

Temperature (°F)	Reduction of WLL
-40 to +392 °F	0 %
+392 to +572 °F	10 %
+572 to +752 °F	25 %
Temperatures below -40°F or above 752 °F are not allowed.	

RELP

Temperature (°F)	Reduction of WLL
-40 to +212 °F	0 %
+212 to +392 °F	15 %
+392 to +482 °F	20%
+482 to +662 °F	25 %
Temperatures below -40 F or above 662 F are not allowed.	

BLP / DLP

Temperature (°F)	Reduction of WLL
-40 to +392 °F	0 %
Temperatures below -40° F or above 392° F are not allowed.	

Severe Environments

Lifting points must not be used in alkaline (> pH10) or in acidic condition (< pH6).

Comprehensive and regular examination must be carried out when used in severe or corrosive environments. In uncertain situations consult your Gunnebo Industries distributor.

Surface Treatment

- Hot dip galvanizing or plating is not allowed outside the control of the manufacturer.
- Acid or Alkaline cleaning is not allowed.

Protect yourself and others

- Before each use the Lifting Point should be checked for obvious damage or deterioration.
- Know the weight of the load and its center of gravity.
- Ensure the load is ready to move and that no obstacles will obstruct the lifting.
- Check the conformity of the load with the Working Load Limit.
- Prepare the landing site.
- Never overload and avoid shock loading.
- Never use an improper configuration.
- Never use a worn or damaged Lifting Point.
- Do not ever ride on the load.
- Do not ever walk or stand under a suspended load.
- Take into consideration that the load may swing or rotate.
- Watch your feet and fingers while loading/unloading.

Inspection

Periodic thorough examination must be carried out at least every 12 months or more frequently according to local statutory regulations, type of use and past experience.

- Ensure correct bolt and nut size, quality and length.
- Ensure compatibility of bolt thread and tapped hole – control of the torque.
- The lifting point should be complete.
- The working load limit and manufacturers stamp should be clearly visible.
- Check for deformation of the component parts such as body, load ring and bolt.
- Check for mechanical damage, such as notches, particularly in high stress areas.
- Wear should be no more than 10 % of cross sectional diameter.
- Evidence of corrosion.
- Evidence of cracks.
- Damage to the bolt, nut and/or thread.
- The body of the Lifting Point must be free to rotate.

Symmetric Loading Conditions

- For three and four leg lifts, the Lifting Points should be arranged symmetrically around the center of gravity and in the same plane if possible.
- The WLL for Gunnebo Industries Lifting Points is based on symmetrical loading.
- The Lifting Point must be positioned on the load in such way that movement is avoided during lifting.
- For single leg lifts, the lifting point should be vertically above the center of gravity of the load.
- For two leg lifts, the Lifting Points must be equidistant to or above the center of gravity of the load.

Asymmetric Loading Conditions

- For unequally loaded lifts we recommend that the WLL is determined as follows:
- 2-leg slings are calculated as the corresponding 1-leg sling.
- 3 and 4-leg slings are calculated as the as the corresponding 1-leg sling*

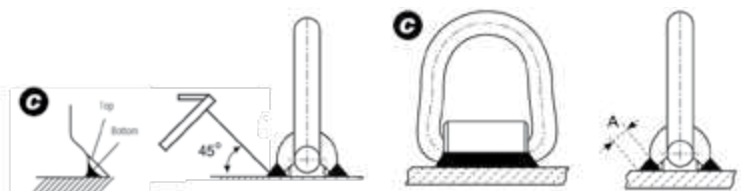
**(If 2-legs with full certainty are carrying the major part of the load, the WLL can be calculated as for the corresponding 2-leg sling).*

WLP - WELDING

Preheat the structure if the temperature is below 0°C; otherwise follow AS 1554 or other suitable national standard.

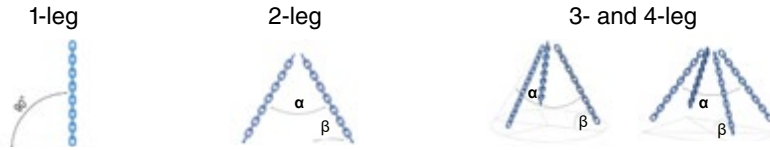
- Ensure that the WLP cannot move during welding by welding the corners of the welding block. Continue the weld around the welding block without interruption in a single operation.
- The nozzle or electrode should be at 45° (see Fig. C), so that the required penetration is obtained. The minimum throat (A) should be maintained.

Product	Min. plate gauge (Rm-181.3 ksi) tmin	Min. throat thickness
WLP 2.5 T	43"	0.43
WLP 4 T	74"	0.51
WLP 7 T	94"	0.63
WLP 10 T	1.18"	0.71
WLP 16 T	1.57"	0.79



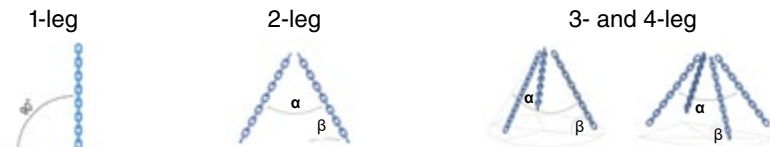
- The weld should not contain cracks or pores.
- Do not cool the weld with water. It should be left to cool naturally.

Working Load Limits (lb) for WLP



Typ	WLL lb*	α 0-90° β 45°	α 90-120° β 30°	α 0-90° β 45°	α 90-120° β 30°
WLP-2.5T	5 510	7 714	5 510	11 681	8 115
WLP-4T	8 816	12 342	8 815	18 514	13 224
WLP-7T	15 428	21 599	15 428	32 619	23 142
WLP-10T	22 040	31 076	22 040	46 725	33 060
WLP-16T	35 300	49 810	35 300	74 716	52 896

Working Load Limits (lb) for SLP



Typ	WLL lb*	α 0-90° β 45°	α 90-120° β 30°	α 0-90° β 45°	α 90-120° β 30°
SLP-1T	2 204	3 085	2 204	4 628	3 306
SLP-3T	6 612	9 256	6 612	13 885	9 918
SLP-5T	11 020	15 428	11 020	23 362	16 530

Working Load Limits (lb) for ELP



Typ	WLL (lb)*	α 0-90° β 45°	α 90-120° β 30°	α 0-90° β 45°	α 90-120° β 30°
ELP-16-8	2 204**	3 085	2 204	4 628	3 306
ELP-20-8	3 306**	4 628	3 306	6 832	4 848
ELP-24-8	4 408**	6 171	4 408	9 256	6 612
ELP-30-8	6 612**	9 256	6 612	13 885	9 918

Note: The above loads apply to normal usage and equally loaded legs. For asymmetric loaded chain slings, the following is recommended:

- A two-legged system is rated as a single-legged system.
- A three- or four-legged system is rated as a two-legged system.

** In case of 1-leg application where loading is limited to straight loading in the direction of thread (no bending force) it is possible to use ELP with four times higher WLL. Note: Threaded depths need to be at least 1xM for steel, 1.25xM for cast iron and 2xM for aluminum alloy.

Speedbinders TORQUE DRIVE LOAD BINDER

Warnings and Application Instructions

Speedbinders Torque Drive
Load BinderImportant Safety Information -
Read & Follow

For maximum safety and efficiency, load securement systems must be properly designed, used and maintained. You must understand the use of load binders in a load securement system. These instructions provide this knowledge. Read them carefully and completely.

⚠ WARNING

- **Failure to use this load binder properly may result in serious injury or even death to you or others.**
- **Do not operate load binder while standing on the load.**
- **You must be familiar with state and federal regulations regarding size and number of chain systems required for securing loads on trucks.**
- **Always consider the safety of nearby workers as well as yourself when using load binder.**
- **While under tension, the load binder must not be side loaded.**
- **Chain tension may decrease due to load shifting during transport.**
- **Do not throw these instructions away. Keep them close at hand and share them with any others who use this load binder.**
- **Care should be taken to reduce the speed of the drill as the chain becomes taut, to minimize the twist of the drill. It may be necessary to use both hands to secure the drill at high torque-even at slow speeds.**
- **Use only genuine Speedbinders parts as replacement.**

PRIOR TO USE

- Apply user preferred EP type grease to the gear set via the zerk fitting. Rotate the barrel 180° between applications for best results.
- Add preferred form of lubricant to the threaded posts. Add just enough to reduce the resistance, as overuse of lubricant can cause additional resistance during operation.

Instructions- Torque Drive Load Binder

- Position the Torque Drive load binder so it can be operated from the ground or a stable location. Be aware of ice, snow, rain, oil, etc. that can affect your footing. Make certain your footing is secure.
- Position the load binder with short portion of barrel close to the trailer attachment point, so the reaction bar rests against the floor of the trailer after tensioning. Alternately, position the reaction bar against the object being secured. **Reaction Bar must be positioned against a solid surface for proper retention.**
- Do not attempt to hold the reaction bar to prevent rotation while tensioning. Always hold the drill with two hands, one cradling the battery to prevent twist.
- Tension the Torque Drive binder using a rotation tool such as cordless drill equipped with a 14 mm socket. If the cordless drill is not available, a manual wrench or tool equipped with a 14 mm socket can be used to tighten or loosen.
- To tighten the load binder, the drill rotates the 14 mm hex head clockwise. Loosening is achieved by counterclockwise rotation of the 14 mm hex head.
- Cordless drills with approximately 800 Lb.-In. maximum torque output can be used and provide adequate tensioning for most load securement applications.
- For best results, first run down all binders in the drill's high-speed setting. Then return to each binder and finish tightening in the low-speed/high-torque setting on the drill.
- Never exceed the Working Load Limit of the load binder.
- **Do not use impact drivers**, as the torque of these devices can damage the gears and under-tension the load securement system.
- After tensioning, it should take about 15– 20 pounds of force to pull the reaction bar away from the floor or secured object. Reaction bar should return to surface immediately if pulled on.
- Chain tension may change due to load shifting during transport. Ensure the load binder remains in proper position, and retighten as required.
- When releasing the load, be aware that the load may have shifted, and may have become unstable.

**Inspection / Maintenance**

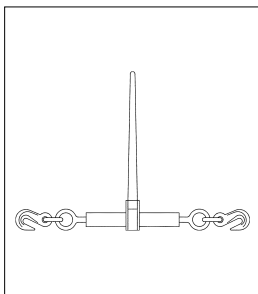
- Routinely check load binders for elongation, wear, bending, cracks, nicks, gouges or corrosion. **If bending or cracks are present – Do not use load binder.**
- Routinely (approximately every 30 cycles) grease the gear set through the grease fitting, using a medium consistency EP grease.
- Routinely clean and lubricate screw threads of load binder to extend product life and reduce friction wear.
- Inspect drive bolt head for any signs of wear.
- After approximately 600 cycles, uninstall the end fittings, clean and re-lubricate the threads, and reinstall. Also, if desired, remove side plates and clear out old grease in gear set. Replace side plates and add enough grease to fill the cavity.

Crosby® Load Binder

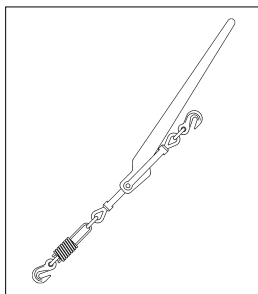
WARNINGS & APPLICATION INSTRUCTIONS

⚠ WARNING

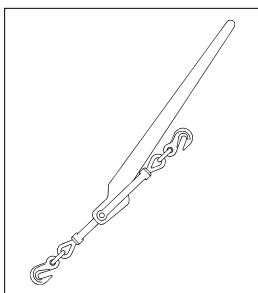
- Failure to use this load binder properly may result in serious injury or even death to you or others.
- Do not operate load binder while standing on the load.
- Move handle with caution. It may whip – Keep body clear.
- Keep yourself out of the path of the moving handle and any loose chain laying on the handle.
- You must be familiar with state and federal regulations regarding size and number of chain systems required for securing loads on trucks.
- Always consider the safety of nearby workers as well as yourself when using load binder.
- While under tension, load binder must not bear against an object, as this will cause side load.
- Do not throw these instructions away. Keep them close at hand and share them with any others who use this load binder.
- Do not use handle extender – see instructions.
- Do not attempt to close or open the binder with more than one person.



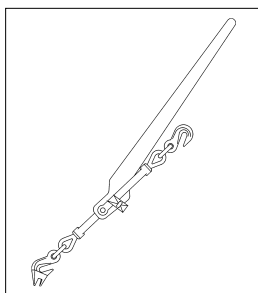
Ratchet Type



Lever Snubbing Type



Lever Type



Lever Walking Type

Mechanical Advantage

Lever Type Binder = 25 : 1

Ratchet Type Binder = 50 : 1

Example: 100 pounds of effort applied to the binder results in the following force on the binder.

Lever Type:

100 lb x 25 = 2500 lb of force

Ratchet Type:

100 lb x 50 = 5000 lb of force

Instructions – Lever Type Load Binders

- Hook load binder to chain so you can operate it while standing on the ground. Position load binder so its handle can be pulled downward to tighten chain (see photo). **Be aware of ice, snow, rain, oil, etc. that can affect your footing. Make certain your footing is secure.**
- The Crosby Group LLC specifically recommends AGAINST the use of a handle extender (cheater pipe). If sufficient leverage cannot be obtained using the lever type load binder by itself, a ratchet type binder should be used.
- If the above recommendation is disregarded and a cheater pipe is used, it must closely fit the handle and must slide down the handle until the handle projections are contacted. The pipe should be secured to the handle, for example, by a pin, so that the pipe cannot fly off the handle if you lose control and let go. The increased leverage, by using a cheater pipe, can cause deformation and failure of the chain and load binder.
- During and after tightening chain, check load binder handle position. **Be sure** it is in the locked position and that its bottom side touches the chain link.
- Chain tension may decrease due to load shifting during transport. To be sure the load binder remains in proper position: Secure handle to chain by wrapping the loose end of chain around the handle and the tight chain, or tie handle to chain with soft wire.
- When releasing load binder, remember there is a great deal of energy in the stretched chain. This will cause the load binder handle to move very quickly with great force when it is unlatched. **Move handle with caution. It may whip – Keep body clear.**
- **Never use a cheater pipe or handle extender to release handle.** Use a steel bar and pry under the handle and stay out of the path of handle as it moves upward.
- If you release the handle by hand, use an open hand under the handle and push upward. **Do not close your hand around the handle. Always keep yourself out of the path of the moving handle.**



Instructions - Ratchet Load Binders

- Position ratchet binder so it can be operated from the ground.
- **Make sure your footing is secure.**

Maintenance of All Load Binders

- Routinely check load binders for wear, bending, cracks, nicks, or gouges. **If visual wear bending or cracks are present - Do not use load binder.**
- Routinely lubricate pivot and swivel points of Lever Binders, and pawl part and screw threads of Ratchet Binders to extend product life and reduce friction wear.

Crosby® L-180 WINCHLINE TAIL CHAIN**WARNING & APPLICATION INSTRUCTIONS****L-180****WARNING**

- Loads may disengage from winchline tail chain if proper procedures are not followed.
- A falling load or disengaged winchline tail chain may cause serious injury or death.
- Inspect winchline tail chain for damage before each use.
- Wire rope should not be terminated to tail chain by the use of a knot.
- Do not attach slings or other devices in hook for overhead lifting – see operating practices.

**Important Safety Information –
Read & Follow**

- Only winchline tail chains made from alloy chain, Grade 80 or Grade 100, should be used for overhead lifting applications.
- Working Load Limit (WLL) is the maximum load in pounds which should ever be applied to winchline tail chain.
- The Working Load Limit or Design Factor may be affected by wear, misuse, overloading, corrosion, deformation, intentional alterations, sharp corner cutting action and other use conditions.
- Never repair, alter, rework, or reshape a hook or chain by welding, heating, burning or bending.
- Recommended for IPS or XIP (EIP), RRL, FC or IWRC wire rope.
- Shock loading and extraordinary conditions must be taken into account when selecting winchline tail chains.

CAUSE FOR REMOVAL FROM SERVICE

A winchline tail chain shall be removed from service if any of the following are visible on chain or hook:

- Wear, nicks, cracks, breaks, gouges, stretch, bend, weld splatter and discoloration from excessive temperature. Minimum thickness on chain link shall not be below the values listed on Table 1.
- Chain links and hook that do not hinge freely to adjacent links.
- Excessive pitting or corrosion on chain, hook or termination fitting.
- Makeshift fasteners, hooks, or links formed from bolts, rods, etc.

Table 1

L-180 Stock No.	Wire Rope Diameter (in)	Nominal Chain Size	
		(in)	(mm)
1091482	1/2 - 5/8	5/8	16
1091511	3/4 - 7/8	7/8	22
1091516	1-1-1/8	1	26
1091525	1-1-1/8	1	26
1091532	1-1/4	1-1/4	32

- Mechanical coupling links in the body of the chain.
- Other damage that would cause a doubt as to the strength of the chain.
- Winchline tail chain should not be subjected to galvanizing or any plating process. If it is suspected the chain has been exposed to chemically active environment, remove from service.
- Termination end attachments that are cracked, deformed, or worn.
- For wire rope inspection procedures and removal from service criteria refer to manufacturer's recommendations.

OPERATING PRACTICES

- Know the winch lifting/pulling systems capacity rating.
- Know the applied load on tail chain. In dragging applications, the applied load may be greater or less than its weight due to friction.
- During lifting/dragging with or without the load, personnel should be alert for possible snagging.
- WORKING LOAD LIMIT (WLL) is the maximum load in pounds which should ever be applied to winchline tail chain when the chain is new or in "as-new" condition, and when the load is uniformly applied in direct tension to a straight length of chain.

Wire Rope Diameter (in)	L-180 Stock No.	Working Load Limit 3.5 to 1 Design Factor (lb)
1/2 - 5/8	1091482	13000
3/4 - 7/8	1091511	34200
1 - 1-1/8	1091516	47700
1 - 1-1/8	1091525	47700
1-1/4	1091532	73200

5/16 thru 5/8 made from Grade 40 High Test carbon steel.

3/4 thru 1-1/4 made from Grade 80 or Grade 100 alloy steel. Only alloy tail chain should be used for overhead lifting applications.

- Wire rope termination efficiency and tail chain Working Load Limit (WLL) must be considered when selecting termination fitting and tail chain.
- Efficiency of wire rope end termination is based on the catalog breaking strength of wire rope.

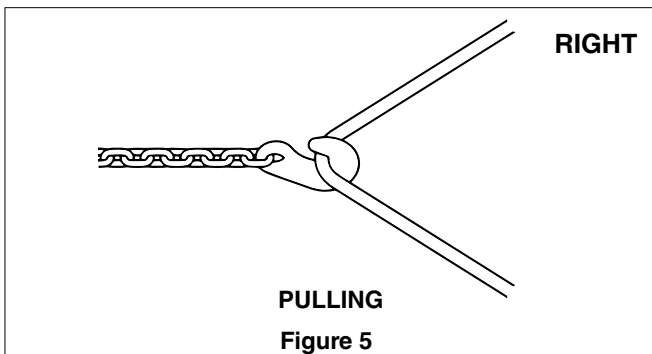
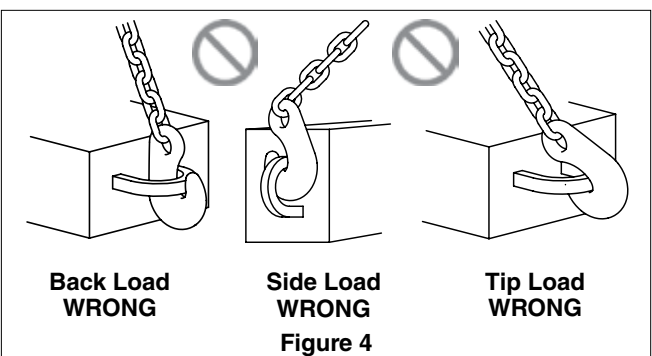
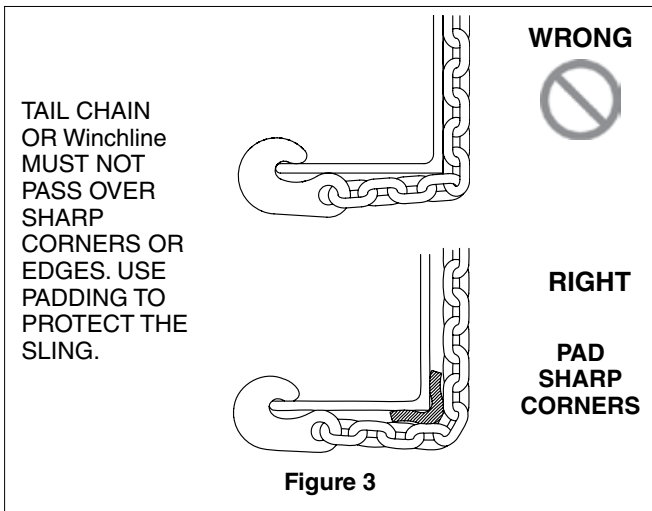
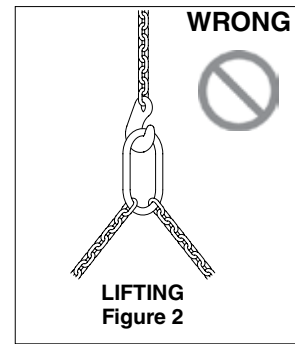
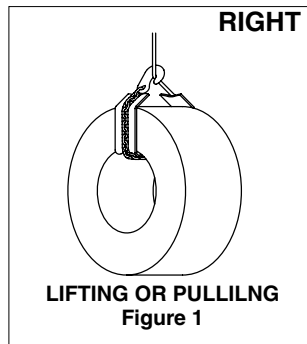
Typical Termination Method & Efficiency	
Termination	Efficiency
S-409 Swage Button	80%

- The winchline tail chain hook is designed to fit the winchline diameter when hooked or connected back to winchline (See Figure 1).
- When used to pull or drag a load, the winchline tail chain may be wrapped around the load and the hook connected to the winchline. Also, when used to pull or drag a load over the tail board roller, the tail chain hook may be attached directly to the load at a connection point authorized by a competent rigger (See Figure 5). In either case, a visual verification of proper hook engagement is required during the entire operation.
- When used in overhead lifting applications, the winchline tail chain may be wrapped around the load and the hook connected to the winchline (See Figure 1). Used in this manner, this connection provides the same load control advantages and limitations as a single leg wire rope sling basket or choker hitch. The winchline tail chain should contain and support the load from the sides, above center of gravity, so load remains under control.

- The winchline tail chain hook is designed to fit the winchline diameter when hooked or connected back to winchline (See Figure 1).
- When used to pull or drag a load, the winchline tail chain may be wrapped around the load and the hook connected to the winchline. Also, when used to pull or drag a load over the tail board roller, the tail chain hook may be attached directly to the load at a connection point authorized by a competent rigger (See Figure 5). In either case, a visual verification of proper hook engagement is required during the entire operation.
- When used in overhead lifting applications, the winchline tail chain may be wrapped around the load and the hook connected to the winchline (See Figure 1). Used in this manner, this connection provides the same load control advantages and limitations as a single leg wire rope sling basket or choker hitch. The winchline tail chain should contain and support the load from the sides, above center of gravity, so load remains under control.
A visual verification of proper hook engagement is required during the entire operation.
- The tail chain hook has no provision for a latch; therefore, The Crosby Group, LLC. specifically recommends AGAINST placing the load, slings or other devices directly into the tail chain hook for the purpose of overhead lifting. A latch may be mandatory by regulations or safety codes: e.g. OSHA, MSHA, ASME B30, insurance, etc (See Figure 2).

If the above Crosby recommendation is disregarded and slings or other devices are placed directly into the tail chain hook, as a minimum ensure:

- Personnel shall stand clear of the suspended load.
- Visual verification of proper hook engagement is required in all cases.
- The sling or device should be centered in the base (bowl/saddle) of the hook.
- The user must assure connection to the hook is secure throughout the movement of the load.
- A designated competent rigger must verify that all appropriate rigging practices are followed for attachment and control of load.
- The winchline and tail chain links should always be protected from being damaged by sharp corners (See Figure 3).
- Chain links should not be twisted or kinked.
- Winchline or tail chain should not be pulled from under loads if the load is resting on winchline or tail chain.
- Winchline or tail chain that appears to be damaged should not be used unless inspected and accepted by a designated person.
- Never side load, back load, or tip load hook (See Figure 4).
- All portions of the human body should be kept from between the winchline / tail chain and load.
- Personnel shall stand clear of the suspended load.
- Shock loading should be avoided.
- Extreme Temperatures will reduce the performance of winchline tailchain.
- Normal operating Temperature is -40°F to 400°F (-40°C to 204°C).



TACKLE BLOCK & SHEAVE ASSEMBLY

WARNINGS, USE AND MAINTENANCE INFORMATION

WARNING

- A potential hazard exists when lifting or dragging heavy loads with tackle block assemblies.
- Failure to design and use tackle block systems properly may cause a load to slip or fall – the result could be serious injury or death.
- Failure to design lifting system with appropriate sheave assembly material for the intended application may cause premature sheave, bearing or Wireline wear and ultimate failure - the result could be serious injury or death.
- A tackle block system should be rigged by a qualified person as defined by ANSI/ASME B30.26.
- Instruct workers to keep hands and body away from block sheaves and swivels – and away from “pinch points” where rope touches block parts or loads.
- Do not side load tackle blocks.
- See OSHA Rule 1926.1431(g)(1)(i)(A) and 1926.1501(g)(4)(iv)(B) for personnel hoisting by cranes and derricks, and OSHA Directive CPL 2-1.36 — Interim Inspection Procedures During Communication Tower Construction Activities. Only a Crosby or McKissick Hook with a PL latch attached and secured with a bolt, nut and cotter pin (or toggle pin) or a PL-N latch attached and secured with toggle pin; or a Crosby hook with an S-4320 latch attached and secured with cotter pin or bolt, nut and pin; or a Crosby SHUR-LOC® Hook in the locked position may be used for any personnel hoisting. A hook with a Crosby SS-4055 latch attached shall NOT be used for personnel lifting.
- Instruct workers to be alert and to wear proper safety gear in areas where loads are moved or supported with tackle block systems.
- Use only genuine Crosby parts as replacement.
- Read, understand, and follow these instructions to select, use and maintain tackle block systems.
- Do not use a block or ball that does not have a legible capacity tag.

Important:

For maximum safety and efficiency, tackle block and sheave systems must be properly designed, used, and maintained. You must understand the use of tackle block components and sheaves in the system. The responsibility for the use and application of products rests with the user. Read them carefully and completely.

Some parts of these instructions must use technical words and detailed explanations. NOTE: If you do not understand all words, diagrams, and definitions – **A block and system must be designed by a qualified person.** For further assistance, call:

In U.S.A. – Crosby Engineered Products Group at (800) 777-1555.

In CANADA – Crosby Canada, Ltd. (877) 462-7672.

In EUROPE – N.V. Crosby Europe (+32)(0) 15 75 71 25.

As you read instructions, pay particular attention to safety information in bold print.

KEEP INSTRUCTIONS FOR FUTURE USE – DO NOT THROW AWAY!

General Cautions or Warnings

Ratings shown in Crosby Group literature are applicable only to new or in “as new” products.

Working Load Limit ratings indicate the greatest force or load a product can carry under usual environmental conditions. Shock loading and extraordinary conditions must be taken into account when selecting products for use in tackle block systems. Working Load Limit ratings are based on all sheaves of tackle block system being utilized. If all sheaves are not utilized, balance must be maintained, and the Working Load Limit must be reduced proportionally to prevent overloading sheave components. Changes from full sheave reeving arrangement should be only at the recommendation of a qualified person, and incorporate good rigging practices.

In general, the products displayed in Crosby Group literature are used as parts of a system being employed to accomplish a task. Therefore, we can only recommend within the Working Load Limits, or other stated limitations, the use of products for this purpose.

The Working Load Limit or Design (Safety) Factor of each Crosby product may be affected by wear, misuse, overloading, corrosion, deformation, intentional alteration, and other use conditions. Regular inspection must be conducted to determine whether use can be continued at the catalog assigned WLL, a reduced WLL, a reduced Design (Safety) Factor, or withdrawn from service.

Crosby Group products generally are intended for tension or pull. Side loading must be avoided, as it exerts additional force or loading which the product is not designed to accommodate.

Always make sure the hook supports the load. The latch must never support the load.

Welding of load supporting parts or products can be hazardous. Knowledge of materials, heat treatment, and welding procedures are necessary for proper welding. Crosby Group should be consulted for information.

Crane component parts, i.e., the boom, block, overhaul ball, swivel, and wire ropes are metallic and will conduct electricity. Read and understand OSHA standard covering crane and derrick operations (29 CFR 1926.1501 SUBPART N) before operating proximate to power lines.

Definitions

STATIC LOAD – The load resulting from a constantly applied force or load.

WORKING LOAD LIMIT – The maximum mass or force which the product is authorized to support in general service when the pull is applied in-line, unless noted otherwise, with respect to the center line of the product. This term is used interchangeably with the following terms.

1. WLL
2. Rated Load Value
3. SWL
4. Safe Working Load
5. Resultant Safe Working Load

WORKING LOAD – The maximum mass or force which the product is authorized to support in a particular service.

PROOF LOAD – The average force applied in the performance of a proof test; the average force to which a product may be subjected before deformation occurs.

PROOF TEST – A test applied to a product solely to determine non-conforming material or manufacturing defects.

ULTIMATE LOAD – The average load or force at which the product fails, or no longer supports the load.

SHOCK LOAD – A force that results from the rapid application of a force (such as impacting and/or jerking) or rapid movement of a static load. A shock load significantly adds to the static load.

DESIGN (SAFETY) FACTOR – An industry term denoting a product's theoretical reserve capability, usually computed by dividing the catalog Ultimate Load by the Working Load Limit. Generally expressed for blocks as a ratio of 4:1.

TACKLE BLOCK – An assembly consisting of a sheave(s), side plates, and generally an end fitting (hook, shackle, etc.) that is used for lifting, lowering, or applying tension.

SHEAVE / SHEAVE BEARING ASSEMBLY – Purchased by O.E.M. or end user to be used in their block or lifting system design.

Fitting Maintenance

Fittings, including hooks, overhaul balls, shackles, links, etc., may become worn and disfigured with use, corrosion, and abuse resulting in nicks, gouges, worn threads and bearings, sharp corners which may produce additional stress conditions and reduce system load capacity.

Grinding is the recommended procedure to restore smooth surfaces. The maximum allowance for reduction of a product's original dimension due to wear or repair before removal from service is:

1. Any single direction - No more than 10% of original dimension;
2. Two directions - No more than 5% of each dimension.

For detailed instructions on specific products, see the application and warning information for that product. Any greater reduction may necessitate a reduced Working Load Limit.

Any crack or deformation in a fitting is sufficient cause to withdraw the product from service.

Selection Guide

Some of the blocks shown in Crosby Group literature are named for their intended use and selection is routine. A few examples include the "Double Rig Trawl Block" used in the fishing industry, the "Well Loggers Block" used in the oil drilling industry, and the "Cargo Hoisting Block" used in the freighter boat industry and "Derrick and Tower Block" used for hoisting personnel. Others are more generally classified and have a variety of uses. They include snatch blocks, regular wood blocks, standard steel blocks, etc. For example, snatch blocks allow the line to be attached by opening up the block instead of threading the line through the block.

This feature eliminates the use of rope guards and allows various line entrance and exit angles to change direction of the load. These angles determine the load on the block and/or the block fitting (See "Loads on Blocks."). Snatch blocks are intended for infrequent and intermittent use with slow line speeds.

A tackle block sheave assembly is one element of a system used to lift, change direction or drag a load. There are other elements in the system including the prime mover (hoist, winch, hand), supporting structure, power available, etc. All of these elements can influence the type of tackle block or sheave required. When selecting a block or sheave for the system in your specific application, you should consider the other elements as well as the features of the blocks and sheaves shown in Crosby Group literature.

To select a tackle block or sheave to fit your requirements, consider the following points:

1. Are there regulations which could affect your choice of blocks or sheaves, such as federal or state, OSHA, elevator safety, mine safety, maritime, insurance, etc.?
2. What is the weight of the load, including any dynamics of impacts that add to load value? You must know this to determine the minimum required Working Load Limit value of the block or load on sheave.
3. How many parts of line are required? This can be determined given the load to be lifted and the line pull you have available. As an alternative, you could calculate the line pull required with a given number of parts of line and a given load weight.
(See "How to Figure Line Parts.")
4. What is the size of line to be used? Multiply the available line pull by the desired safety factor for Wireline to determine the minimum catalog Wireline breaking strength; consult a Wireline catalog for the corresponding grade and diameter of Wireline to match. You should also consider fatigue factors that affect Wireline life (See "Sheave Size & Wireline Strength").
5. What is the speed of the line? This will help you determine the type of sheave bearing necessary. There are several choices of bearings suitable for different applications, including:
 - A. Common (Plain) Bore for very slow line speeds and very infrequent use (high bearing friction).
 - B. Self Lubricating Bronze Bushings for slow line speeds and infrequent use (moderate bearing friction).
 - C. Bronze Bushing with pressure lubrication for slow line speeds and more frequent use at greater loads (moderate bearing friction).
 - D. Anti-friction Bearings for faster line speeds and more frequent use at greater loads (minimum bearing friction).
6. What type of fitting is required for your application? The selection may depend on whether the block will be traveling or stationary. Your choices include single or multiple hooks with or without throat latches and shackles, which are the most secured load attachment. You should also decide whether the fitting should be fixed, swivel or swivel with lock. If it is a swivel fitting, then selection of a thrust bearing may be necessary. There are plain fittings with no bearings for positioning at no load, bronze bushed fittings for infrequent and moderate load swiveling, and anti-friction bearing equipped fittings for frequent load swiveling.
7. How will the block be reeved and does it require a dead end becket? (See "The Reeving of Tackle Blocks.")
8. How will the block be reeved and does it require a dead end becket? (See "The Reeving of Tackle Blocks.")
9. If the block is to be a traveling block, what weight is required to overhaul the line? (See "How to Determine Overhaul Weights.")
10. What is the fleet angle of the Wireline? Line entrance and exit angles should be no more than 1-1/2 degrees.
11. How will the block or sheave be maintained? Do conditions in your application require special maintenance considerations? (See "Tackle Block and Sheave Maintenance," and "Fitting Maintenance.")
12. Reference current edition of "Wireline Users Manual" for additional sheave design and maintenance information.

Tackle Block and Sheave Maintenance

Tackle Blocks and Sheaves must be regularly inspected, lubricated, and maintained for peak efficiency and extended usefulness. Their proper use and maintenance is equal in importance to other mechanical equipment. The frequency of inspection and lubrication is dependent upon frequency and periods of use, environmental conditions, and the user's good judgment.

Inspection: As a minimum, the following points should be considered:

1. Wear on pins or axles, rope grooves, side plates, bushing or bearings, cases, trunnions, hook shanks, and fittings (See Fitting Maintenance). Excessive wear may be a cause to replace parts or remove block or sheave from service.
2. Deformation in side plates, pins and axles, fitting attachment points, trunnions, etc. Deformation can be caused by abusive service or overload and may be a cause to remove block or sheave from service.
3. Misalignment or wobble in sheaves.
4. Security of nuts, bolts, and other locking methods, especially after reassembly following a tear down inspection. Original securing method should be used; e.g., staking, set screw, cotter pin, cap screw.
5. Pins retained by snap rings should be checked for missing or loose rings.
6. Sheave pin nuts should be checked for proper positioning. Pins for tapered roller bearings should be tightened to remove all end play during sheave rotation. Pins for bronze bushings and straight roller bearings should have a running clearance of .031 inch per sheave of end play and should be adjusted accordingly.
7. Hook or shackle to swivel case clearance is set at .031 to .062 at the factory. Increased clearance can result from component wear. Clearance exceeding .12 to .18 should necessitate disassembly and further inspection.
8. Deformation or corrosion of hook and nut threads. Your block's hook may be fitted with the Crosby/McKissick Patented Split Nut. Refer to the Split Nut section for proper removal, inspection and installation procedures.
9. Loss of material due to corrosion or wear on external area of welded hook and nut may indicate thread corrosion or damage. If these conditions exist, remove from service or perform load test.
10. Surface condition and deformation of hook (See Fitting Maintenance and ASME B30.10.)
11. Welded side plates for weld corrosion or weld cracking.
12. Hook latch for deformation, proper fit and operation.
13. Remove from service any bushings with cracks on inside diameter or bushing end. Bushings that are cracked and/or extended beyond sheave hub are indications of bushing overload.

LUBRICATION: The frequency of lubrication depends upon frequency and period of product use as well as environmental conditions, which are contingent upon the user's good judgment. Assuming normal product use, the following schedule is suggested when using lithium-base grease of a medium consistency.

SHEAVE BEARINGS

Tapered Roller Bearings – Every 40 hours of continuous operation or every 30 days of intermittent operation.

Roller Bearings – Every 24 hours of continuous operation or every 14 days of intermittent operation.

Bronze Bushings – (Not Self Lubricated) – Every 8 hours of continuous operation or every 14 days of intermittent operation.

Self Lubricating Bronze Bushing – are for slow line speeds and infrequent use (moderate bearing friction). Frequent inspection is required to determine the condition of bushing.

HOOK BEARINGS

Anti Friction – Every 14 days for frequent swiveling; every 45 days for infrequent swiveling.

Bronze Thrust Bushing or No Bearing Every 16 hours for frequent swiveling; every 21 days for infrequent swiveling.

Tackle Block Maintenance also depends upon proper block selection (see "Loads on Blocks"), proper reeving (see "The Reeving of Tackle Blocks"), consideration of shock loads, side loading, and other adverse conditions.

Sheave Bearing Application Information

Sheaves in a system of blocks rotate at different rates of speed, and have different loads. When raising and lowering, the line tension is not equal throughout the system. Refer to "How to Figure Line Parts" in the Sheaves Section for assistance in determining lead line loads used for bushing or bearing selection.

BRONZE BUSHINGS

Bronze Bushings are used primarily for sheave applications using slow line speed, moderate load, and moderate use. The performance capability of a bearing is related to the bearing pressure and the bearing surface velocity by a relationship known as true PV (Maximum Pressure - Velocity Factor). The material properties of the Bronze Bushings furnished as standard in Crosby catalog sheaves are:

(BP) Maximum Bearing Pressure :4500 PSI

(BV) Maximum Velocity at Bearing :1200 FPM

(PV) Maximum Pressure Velocity Factor: 55000

(It should be noted that due to material property relations, the maximum BP times the maximum BV is NOT equal to the maximum PV.)

Formula for Calculating Bearing Pressure:

$$BP = \frac{\text{Line Pull} \times \text{Angle Factor}}{\text{Shaft Size} \times \text{Hub Width}}$$

Note: Angle Factor Multipliers listed in the Sheaves Section

Formula for Calculating Bearing Velocity:

$$BV = \frac{PV}{BP}$$

Formula for Calculating Line Speed:

$$\text{Line Speed} = \frac{BV (\text{Tread Diameter} + \text{Rope Diameter})}{\text{Shaft Diameter}}$$

Calculations can be made to find the maximum allowable line speed for a given total sheave load. If the required line speed is greater than the maximum allowable line speed calculated, then increase the shaft size and/or the hub width and recalculate. Continue the process until the maximum allowable line speed is equal to or exceeds the required line speed.

Example

Using a 14 in. sheave (Stock # 917191; refer to Wireline sheave section of this Catalog for dimensions) with a 4,600 lbs line pull and an 80° angle between lines, determine maximum allowable line speed.

$$BP = \frac{4,600 \text{ lbs} \times 1.53}{1.50 \times 1.62} = 2,896 \text{ PSI}$$

(Line pull) (Angle Factor)
(Shaft Size) (Hub Width)

$$BV = \frac{55,000 \text{ (PV Factor)}}{2,896 \text{ (BP)}} = 19 \text{ FPM Allowable}$$

Line Speed =
 $[19 \times (11.75 + .75)] \div 1.50 = 158.3 \text{ FPM ALLOWABLE}$
 (BV) (Tread Dia. + Rope Size) \div (Shaft Dia.)

If the application required a line speed equal to 200 FPM, then another calculation would be necessary. Trying another 14 in. sheave (stock # 4104828) under the same loading conditions, the results are as follows:

BP = $(4,600 \text{ lbs} \times 1.53) \div (2.75 \times 2.31) = 1,108 \text{ PSI}$
BV = $55,000 \div 1,108 = 50 \text{ FPM}$

Line Speed =
 $[50 \times (11.75 + .75)] \div 2.75 = 227.3 \text{ FPM ALLOWABLE}$

COMMON (PLAIN) BORE –

Very slow line speed, very infrequent use, low load.

ROLLER BEARING –

Faster line speeds, more frequent use, greater load. Refer to manufacturer's rating. Reference appropriate bearing manufacturer's catalog for proper bearing selection procedure.

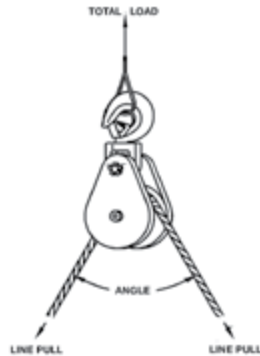
Loads on Blocks

The Working Load Limit (WLL) for Crosby Group blocks indicates the maximum load that should be exerted on the block and its connecting fitting.

This total load value may be different from the weight being lifted or pulled by a hoisting or hauling system. It is necessary to determine the total load being imposed on each block in the system to properly determine the rated capacity block to be used.

A single sheave block used to change load line direction can be subjected to total loads greatly different from the weight being lifted or pulled. The total load value varies with the angle between the incoming and departing lines to the block.

The following chart indicates the factor to be multiplied by the line pull to obtain the total load on the block.

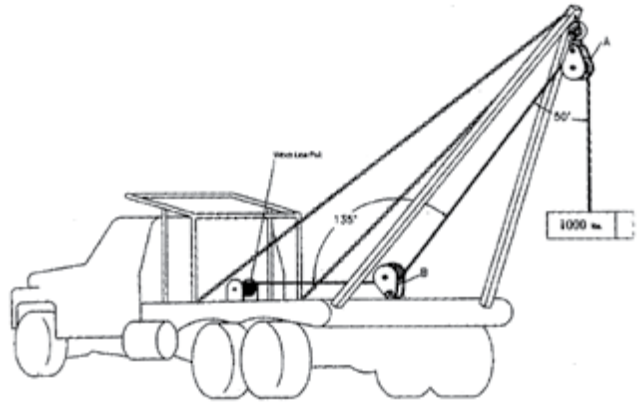


Angle Factor Multipliers			
Angle	Factor	Angle	Factor
0°	2.00	100°	1.29
10°	1.99	110°	1.15
20°	1.97	120°	1.00
30°	1.93	130°	.84
40°	1.87	135°	.76
45°	1.84	140°	.68
50°	1.81	150°	.52
60°	1.73	160°	.35
70°	1.64	170°	.17
80°	1.53	180°	.00
90°	1.41	—	—

Example A

(Calculations for determining total load value on single line system.)

A gin pole truck lifting 1,000 lbs.



There is no mechanical advantage to a single part load line system, so winch line pull is equal to 1,000 lbs or the weight being lifted.

To determine total load on snatch block A:

A = 1,000 lbs x 1.81 = 1,810 lbs
 (line pull) (factor 50° angle)

To determine total load on toggle block B:

B = 1,000 lbs x .76 = 760 lbs
 (line pull) (factor 135° angle)

Example B

(Calculation for determining total load value for mechanical advantage system.)

Hoisting system lifting 1,000 lb. using a traveling block. The mechanical advantage of traveling block C is 2.00 because two (2) parts of load line support the 1,000 lbs weight. (Note that this example is simplified for determination of resultant load on blocks. Lead line pull will be greater than shown due to efficiency losses.) (To determine single line pull for various bearing efficiency see "How to Figure Line Parts") To Determine Line Pull:

$$\text{Line Pull} = 1,000 \text{ lbs} \div 2.00 = 500 \text{ lbs}$$

To determine total load on traveling block C:

$$\text{C} = 500 \text{ lbs} \times 2.0 = 1,000 \text{ lbs}$$

(line pull)(Factor 0° angle)

To determine total load on stationary block D:

$$\text{D} = 500 \text{ lbs} \times 1.87 + 500 \text{ lbs} = 1,435 \text{ lbs}$$

(line pull) (dead-end load)
(Factor 40° angle)

To determine total load on block E:

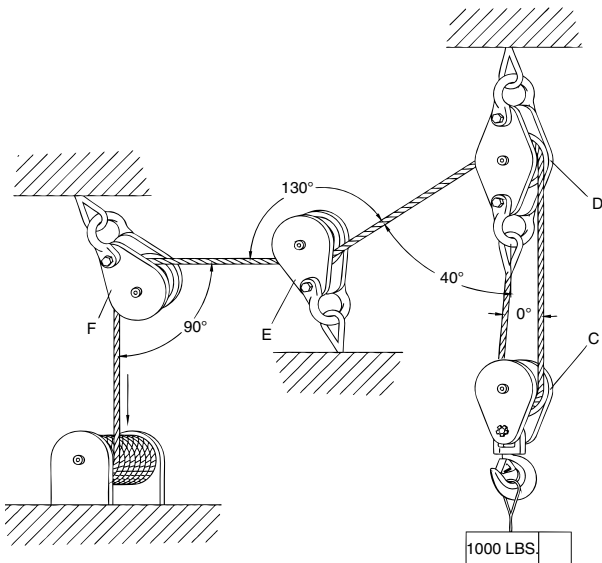
$$\text{E} = 500 \text{ lbs} \times .84 = 420 \text{ lbs}$$

(line pull) (Factor 130° angle)

To determine total load on block F:

$$\text{F} = 500 \text{ lbs} \times 1.41 = 705 \text{ lbs}$$

(line pull) (Factor 90° angle)



The Reeving of Tackle Blocks

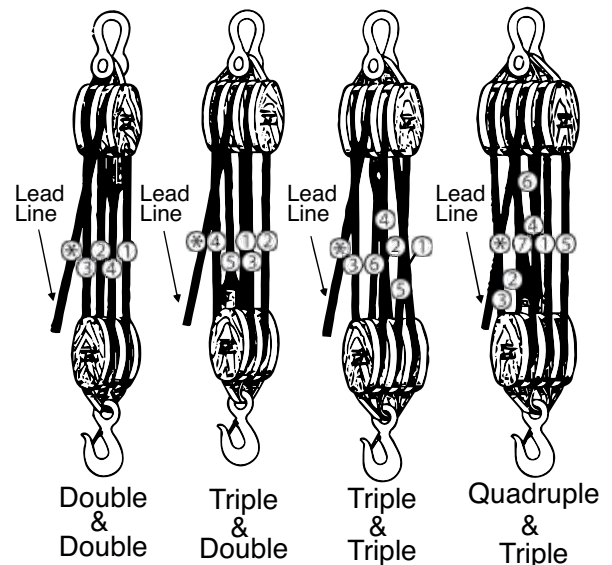
In reeving of tackle blocks, there are many methods. The method discussed below is referred to as "Right Angle" reeving. Please consult your rigging manual for other methods of reeving.

RIGHT ANGLE REEVEING

In reeving a pair of tackle blocks, one of which has more than two sheaves, the hoisting rope should lead from one of the center sheaves of the upper block to prevent toppling and avoid injury to the rope. The two blocks should be placed so that the sheaves in the upper block are at right angles to those in the lower one, as shown in the following illustrations.

Start reeving with the becket or dead end of the rope. **Use a shackle block as the upper one of a pair and a hook block as the lower one as seen below.** Sheaves in a set of blocks revolve at different rates of speed. Those nearest the lead line revolve at the highest rate of speed and wear out more rapidly. All sheaves should be kept well lubricated when in operation to reduce friction and wear.

Reeving Diagram



⚠ CAUTION

- Exercise care when block is standing in vertical position, as the potential for tipping exists. Potential causes of tipping are unstable work area, boom movement and the reeving process.
- If work area is unstable, lay block flat on side plate.



Sheave Size & Wireline Strength

Strength Efficiency

Bending Wireline reduces its strength. To account for the effect of bend radius on Wireline strength when selecting a sheave, use the table below:

Ratio A	Strength Efficiency Compared to Catalog Strength in %
40	95
30	93
20	91
15	89
10	86
8	83
6	79
4	75
2	65
1	50

$$\text{Ratio A} = \frac{\text{Sheave Diameter}}{\text{Rope Diameter}}$$

Example

To determine the strength efficiency of 1/2" diameter Wireline using a 10" diameter sheave:

$$\text{Ratio A} = \frac{10'' (\text{sheave diameter})}{1/2'' (\text{Wireline diameter})} = 20$$

Refer to ratio A of 20 in the table then check the column under the heading "Strength Efficiency Compared to Catalog Strength in %"...91% strength efficiency as compared to the catalog strength of Wireline.

Fatigue Life

Repeated bending and straightening of Wireline causes a cyclic change of stress called "fatiguing." Bend radius affects Wireline fatigue life. A comparison of the relative effect of sheave diameter on Wireline fatigue life can be determined as shown below:

Ratio B	Relative Fatigue Bending Life
30	10.0
25	6.6
20	3.8
18	2.9
16	2.1
14	1.5
12	1.1

$$\text{Ratio B} = \frac{\text{Sheave Diameter}}{\text{Rope Diameter}}$$

$$\text{Relative Fatigue Bending Life} = \frac{\text{Relative Fatigue Bending Life Sheave \#1}}{\text{Relative Fatigue Bending Life (Sheave \#2)}}$$

Example

To determine the extension of fatigue life for a 3/4" Wireline using a 22.5" diameter sheave versus a 12" diameter sheave:

$$\text{Ratio B} = \frac{22.5'' (\text{sheave diameter})}{3/4'' (\text{Wireline diameter})} = 30$$

$$\text{Ratio B} = \frac{12'' (\text{sheave diameter})}{3/4'' (\text{Wireline diameter})} = 16$$

The relative fatigue bending life for a ratio B of 16 is 2.1 (see above Table) and ratio B of 30 is 10.

$$\text{Relative Fatigue Bending Life} = \frac{10}{2.1} = 4.7$$

Therefore, we expect extension of fatigue life using a 22.5" diameter sheave to be 4.7 times greater than that of a 12" diameter sheave.

How to Determine Overhauling Weights

To determine the weight of the block or overhaul ball that is required to free fall the block, the following information is needed: size of Wireline, number of line parts, type of sheave bearing, length of crane boom, and drum friction (use 50 lbs unless other information is available).

Wireline Size (in)	Factor A – Wireline Weight (lbs per ft) 6 x 19 IWRC
3/8	.26
7/16	.35
1/2	.46
9/16	.59
5/8	.72
3/4	1.04
7/8	1.42
1	1.85
1-1/8	2.34
1-1/4	2.89

Number of Line Parts	Factor B – Overhaul Factors	
	Roller Bearing Sheaves	Bronze Bushed Sheaves
1	1.03	1.05
2	2.07	2.15
3	3.15	3.28
4	4.25	4.48
5	5.38	5.72
6	6.54	7.03
7	7.73	8.39
8	8.94	9.80
9	10.20	11.30
10	11.50	12.80

The Formula is:

Required Block Weight = [(Boom Length x Factor A) + Drum Friction] x Factor B

Example:

To determine the required block or overhaul weight using 5 parts of 7/8" diameter Wireline, a 50 ft. boom and roller bearing sheaves:

$$\begin{array}{lcl} \text{Required} & & \\ \text{Block} & = & [(50 \text{ ft.} \times 1.42) + 50 \text{ lbs}] \times 5.38 = 651 \text{ lbs} \\ \text{Weight} & & \begin{array}{l} \text{(Boom Length)} \quad \text{(Drum Friction)} \quad \text{(Factor B)} \\ \text{(Factor A)} \end{array} \end{array}$$

How to Figure Line Parts

Sheaves in a system of blocks rotate at different rates of speed, and have different loads. When raising and lowering, the line tension is not equal throughout the system. To help figure the number of parts of line to be used for a given load, or the line pull required for a given load, (for example, use Reaving Diagram in the Sheaves Section. Only numbered lines shall be used in the calculation). The following ratio table is provided with examples of how to use it. The ratios are applicable for blocks as shown on the diagram and also independent sheave systems that line is reeved through.

Ratio A Bronze Bushed Sheaves	Ratio B Anti-Friction Bearing Sheaves	Number of Line Parts
.96	.98	1
1.87	1.94	2
2.75	2.88	3
3.59	3.81	4
4.39	4.71	5
5.16	5.60	6
5.90	6.47	7
6.60	7.32	8
7.27	8.16	9
7.91	8.98	10
8.52	9.79	11
9.11	10.60	12
9.68	11.40	13
10.20	12.10	14
10.70	12.90	15
11.20	13.60	16
11.70	14.30	17
12.20	15.00	18
12.60	15.70	19
13.00	16.40	20

Ratio A or B = $\frac{\text{Total Load to be Lifted}}{\text{Single Line Pull (lb)}}$

After calculating Ratio A or B, consult table to determine number of parts of line.

Examples:

To find the number of parts of line needed when weight of load and single line pull are known, and using Bronze Bushed Sheaves.

$$\text{Ratio A} = \frac{72,180 \text{ lbs (load to be lifted)}}{8000 \text{ lbs (single line pull)}} = 9.02 \quad \text{(Ratio A)}$$

In table above refer to ratio 9.02 or next higher number, then check column under heading "Number of Line Parts" = 12 parts of line to be used for this load.

To find the single line pull needed when weight of load and number of parts of line are known, and using Anti-Friction Bearing Sheaves.

$$\text{Single Line Pull} = \frac{68,000 \text{ lbs (load to be lifted)}}{7.32 \text{ (Ratio B of 8part line)}} = 9,290 \text{ lbs}$$

9,290 lbs single line pull required to lift this load on 8 parts of line.

To find the lift capacity when the parts of line and single line pull are known, and using anti-friction bearing sheaves.

$$\begin{array}{ll} 10,000 \text{ lbs} & \text{(Single line pull)} \\ \times 4.71 & \text{(Ratio B of 5 parts of line)} \\ \hline = 47,100 \text{ lbs} & \text{(Lift Capacity)} \end{array}$$

10,000 lbs single line pull with 5 parts of line will accommodate 47,100 lbs lift capacity.

Repairs

For repair of blocks, contact the following numbers for return material authorization.

IN U.S.A. – Crosby Engineered Products Group at (800) 777-1555

IN CANADA – Crosby Canada at (877) 462-4672

IN EUROPE – N.V. Crosby Europe at (+32) (0)15 75 71 25

Your block, after receipt by Crosby, will be inspected and a free estimate of repair charges will be provided. Authorization for repairs from block owners must be given to Crosby before repairs are made. Transportation charges, both to and from factory, are to be paid by the block owner.

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Decimal and Metric Conversion Table

Fractional Equivalent (in.)	Decimal Equivalent (in.)	Metric Equivalent (mm)
1/64	.0156	.397
1/32	.0312	.794
3/64	.0469	1.191
1/16	.0625	1.588
5/64	.0781	1.984
3/32	.0938	2.381
7/64	.1094	2.778
1/8	.1250	3.175
9/64	.1406	3.572
5/32	.1562	3.969
11/64	.1719	4.366
3/16	.1875	4.762
13/64	.2031	5.159
7/32	.2188	5.556
15/64	.2344	5.953
1/4	.2500	6.350
17/64	.2656	6.747
9/32	.2812	7.144
19/64	.2969	7.541
5/16	.3125	7.938
21/64	.3281	8.334
11/32	.3438	8.731
23/64	.3594	9.128
3/8	.3750	9.525
25/64	.3906	9.922
13/32	.4062	10.319
27/64	.4219	10.716
7/16	.4375	11.112
29/64	.4531	11.509
15/32	.4688	11.906
31/64	.4844	12.303
1/2	.5000	12.700

Fractional Equivalent (in.)	Decimal Equivalent (in.)	Metric Equivalent (mm)
33/64	.5156	13.097
17/32	.5312	13.494
35/64	.5469	13.891
9/16	.5625	14.288
37/64	.5781	14.684
19/32	.5938	15.081
39/64	.6094	15.478
5/8	.6250	15.875
41/64	.6406	16.272
21/32	.6562	16.669
43/64	.6719	17.065
11/16	.6875	17.462
45/64	.7031	17.859
23/32	.7188	18.256
47/64	.7344	18.653
3/4	.7500	19.050
49/64	.7656	19.447
25/32	.7812	19.844
51/64	.7969	20.241
13/16	.8125	20.638
53/64	.8281	21.034
27/32	.8438	21.431
55/64	.8594	21.828
7/8	.8750	22.225
57/64	.8906	22.622
29/32	.9062	23.019
59/64	.9219	23.416
15/16	.9375	23.812
61/64	.9531	24.209
31/32	.9688	24.606
63/64	.9844	25.003
1	1.0000	25.400

Mass Conversions

To convert from U.S. tons to metric tons multiply by .907185

To convert from metric tons to U.S. tons multiply by 1.10231

To convert from metric tons to pounds multiply by 2204.62

To convert from metric tons to kilograms multiply by 1000

To convert from pounds to kilograms multiply by .453592

To convert from kilograms to pounds multiply by 2.20462

Temperature Conversion

To convert from degree Fahrenheit to degree Celsius use

$$T_c = 5/9 (T_f - 32)$$

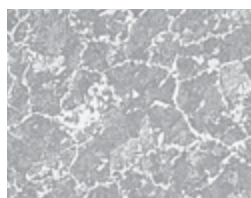
To convert from degree Celsius to degree Fahrenheit use

$$T_f = 9/5 (T_c) + 32$$

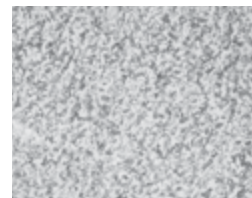
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