Basic Crane & Hoist Information

- Basic Crane & Hoist Operation
- Common Crane Signals

Basic Crane & Hoist Operation

BASIC CRANE & HOIST OPERATION AND BELOW THE HOOK RIGGING SAFETY RULES

ALWAYS REMEMBER THESE!

1 INSPECT ALL CRANES AND RIGGING GEAR PRIOR TO USE.

2 KNOW THE WEIGHT OF THE LOAD.

3 KNOW THE RATED CAPACITIES OF CRANES, HOISTS, SLINGS AND RIGGING HARDWARE.

4 ALLOW FOR REDUCED CAPACITIES WHEN LIFTING AT ANGLES!

AWRF Est. 1970

RIGGING PRODUCTS SAFETY TIPS

WEB SLING & TIE DOWN ASSOCIATION

ALLOY CHAIN SLING SAFETY TIPS

1 Inspect chain slings for proper tags, disortion and wear. Distortion means trouble.

3 Lifting angles reduce the capacity. Be aware.

2 Choose chain size, components and attachments for control and balance.*

*Only alloy (Grade 80 and above) chain and components are approved for lifting.

4 Do not bounce, jerk, force or hammer slings or attachments.

WIRE ROPE SLING SAFETY TIPS

1 Inspect slings automatically - watch for kinks, broken wires, unsafe fitting conditions, crushing and wear.

2 Use common sense, never shock, jerk, pinch, drag, heat or cut slings or components.

3 Control the load with proper hitch and components.

4 Remember to reduce sling capacities if lifting at angles other than vertical.

THESE ARE SOME GENERAL SAFETY SUGGESTIONS.
ALWAYS CONTACT THE MANUFACTURER FOR SPECIFIC OPERATING INSTRUCTIONS.

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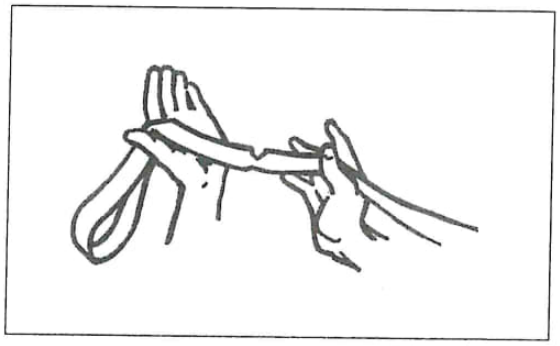
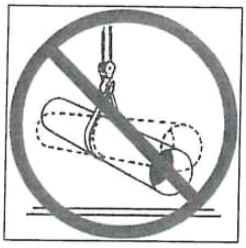
GENERAL OSHA REQUIREMENTS

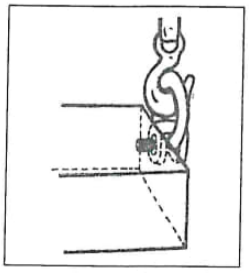
Safe Operating Practices

- **INSPECT SLINGS** prior to each use and do not use if damaged. (See specific sling type for inspection criteria.)



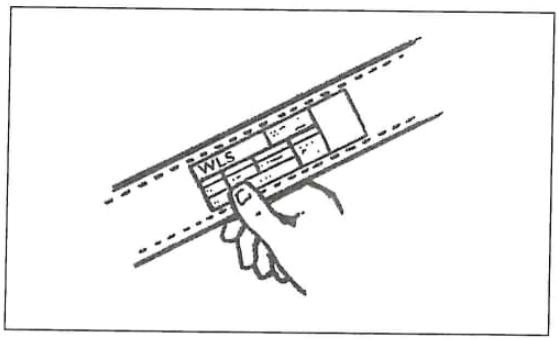


- Loads must be rigged to prevent slippage.

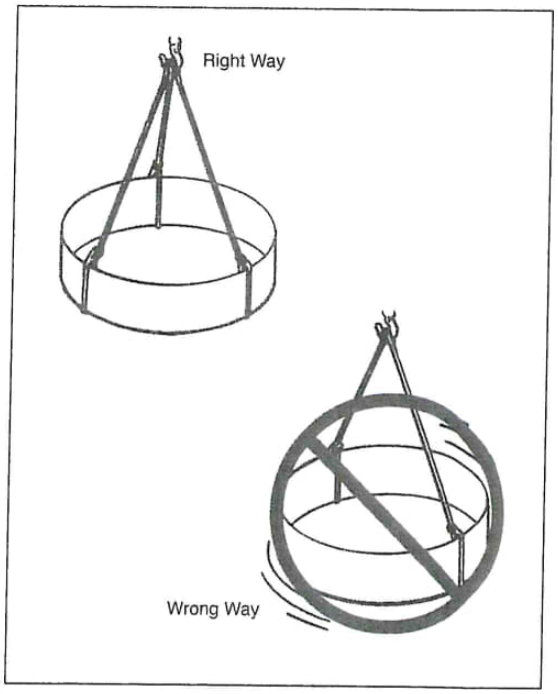


- Slings shall be securely attached to their loads

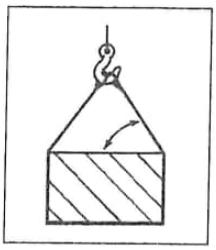
- Slings shall not be loaded in excess of their rated capacities. Rated capacities (Working Load Limits) must be shown by markings or tags attached to all slings and cranes and hoists.

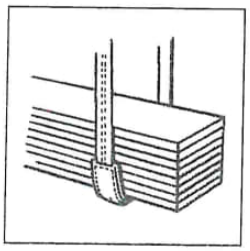


- Lift must be stable with respect to the center of gravity - balanced.



- **ANGLE OF LIFT** must be considered in all lifts. See page 5.





- Slings shall be padded or protected from the sharp edges of their loads.

DEFINITION:

⚠ WARNING

as used throughout this handout, serves to alert users to potentially hazardous situations which often occur in the use of these products. Failure to read, understand and follow the accompanying instructions on how to avoid these situations could result in death or serious injury.

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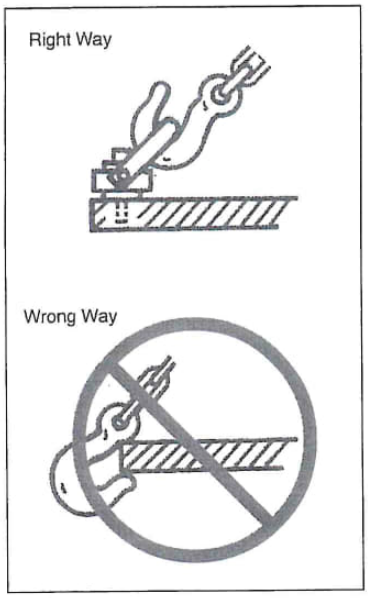
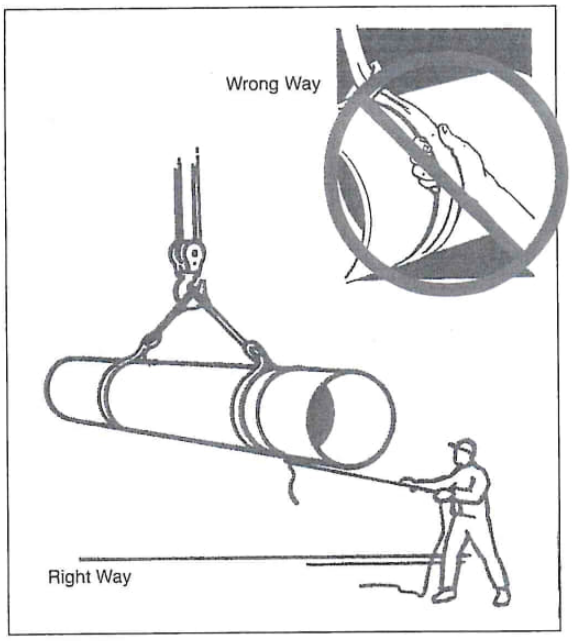
GENERAL OSHA REQUIREMENTS

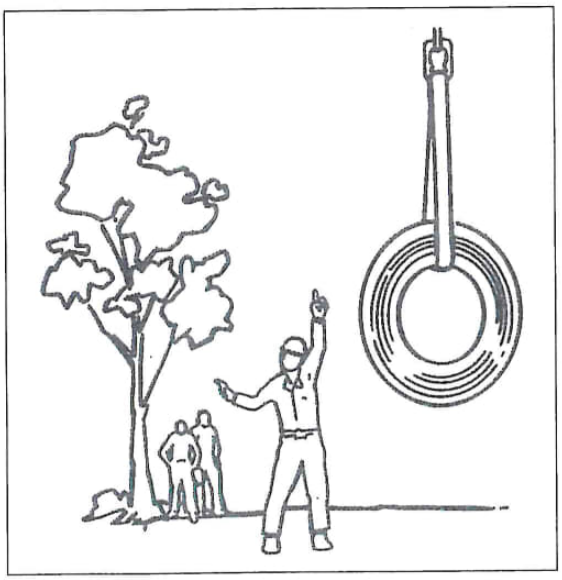
⚠ WARNING Read Definition on Page 1

- Do not point load hooks - center load in base of hook.



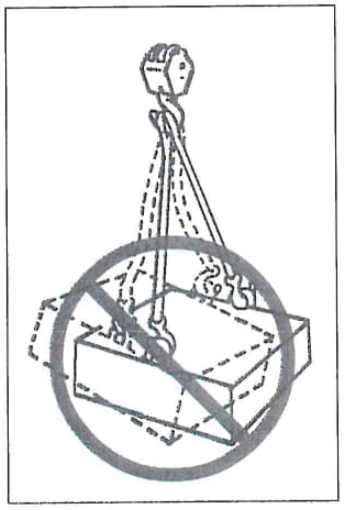
- Hands and fingers shall not be placed between the sling and load while the sling is being tightened around the load. After lifting, the load should not be pushed or guided by employees hands directly on the load. Ropes or "tag lines" should be attached for this purpose.





- Suspended loads shall be kept clear of all obstructions.
- All persons shall be kept clear of loads to be lifted, and suspended load.

• Never leave a suspended load unattended
• Never stand under a suspended load.



- Do not shock load. Jerking the load could overload the sling and cause it to fail.

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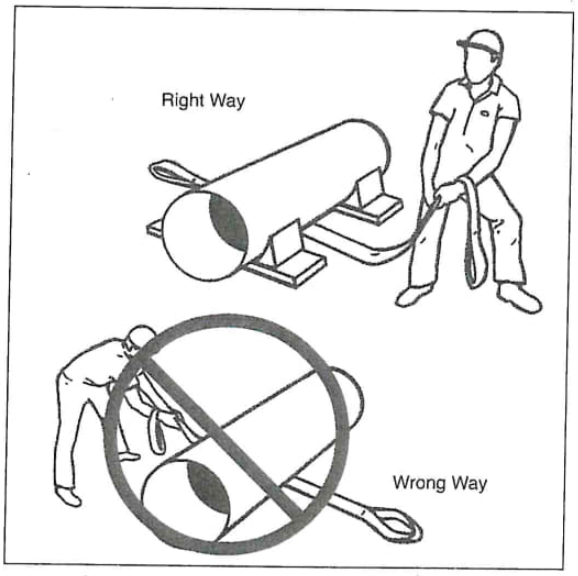
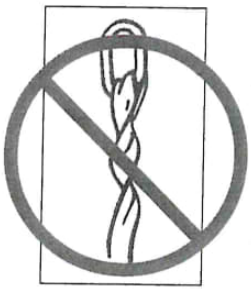
GENERAL OSHA REQUIREMENTS

⚠ WARNING Read Definition on Page 1

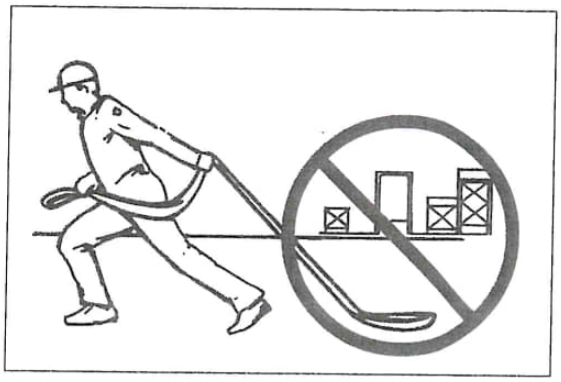
- A sling shall not be pulled from under a load when the load is resting on the sling. Before a load is lifted, a place should be prepared where it is to be put down. Lumber can be used to allow space to remove the sling and prevent shifting of the load.



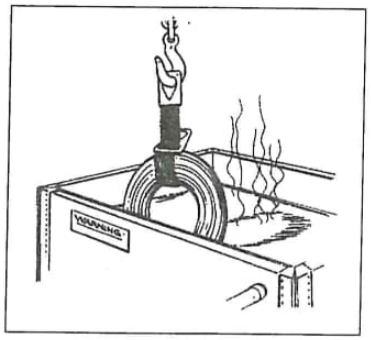


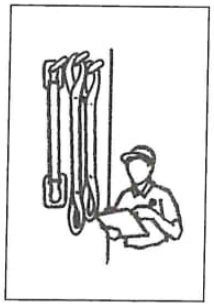
- Sling legs shall not be kinked or twisted.

- Slings shall not be dragged on floor.



- Temperature and chemical environment must be considered (see specific sling types for data).





- Slings shall be stored in cool, dark, dry areas, preferably on racks.

- Slings shall not be shortened with knots, bolts, or makeshift devices.

INSPECTION

⚠ WARNING Read Definition on Page 1

Daily Inspection

Each day before using, the crane, the slings, all fastenings and attachments shall be inspected for damage or defects by a competent person designated by the employer. Additional inspections shall be performed prior to each use where severe conditions warrant. Damaged or defective slings shall be immediately removed from service.

Periodic Inspection

OSHA specifies that alloy steel chain slings shall have a thorough periodic inspection by a competent person at least once every 12 months. WLS recommends that all slings have a thorough inspection by a competent person at least once every 12 months. These inspections must be recorded and maintained for each individual sling. The warning sheets that accompany each order must be read and understood by all sling users. See sling abuse illustrations in their respective section.

In some instances, it is possible to repair slings, proof test and return them to service. Damaged components and sections of chain or wire mesh can be replaced. Hooks, links and other components that are in good condition can be salvaged from a damaged web or round sling, rewebbed, proof tested by WLS and returned to service.

Repair

WLS strongly advises that damaged slings be repaired by the manufacturer.

PHYSICAL FACTORS

⚠ WARNING Read Definition on Page 1

Physical Factors Affecting Strength of Slings

Your care in the use and handling will prolong sling life significantly. The following physical factors should be considered when using any of the slings in this catalog:

1. Cutting of synthetic slings, Nicking or Gouging of steel slings. Probably the number one cause of sling failure. Usually caused by a sharp or small diameter load edge against the sling. It can be prevented with proper padding.
2. Improper Loading - Shock Loading, unbalanced loading, over loading and inadequate consideration for the effect of angle factors can adversely affect safety. Make sure the load weight is within the rated capacity of the sling(s) being used for both type of hitch and angle of lift. See "Effect of Angle of Lift" diagrams.
3. Temperature - Avoid loads and environments where temperatures exceed the limits of the slings being used. All slings can be damaged by excessive heat.
4. Punctures & Abrasions seriously degrade sling strength. Rough load surfaces and dragging slings on the ground will damage all slings, steel or synthetic. Use proper padding between slings and rough loads. Never drag slings on ground or concrete floors.
5. Foreign Matter - Material such as metal chips and heavy grit can damage web slings, both internally and externally. Both synthetic and steel slings can be damaged by weld spatter and heat from a welding torch. Avoid contact with foreign matter whenever possible.
6. Ultraviolet Light - Nylon and polyester web slings are adversely affected by prolonged exposure to UV light, i.e. sunlight or arc welding. Inspect and remove if slings appear bleached and stiff. Store slings properly when not in use (see No. 7 below).
7. Improper Storage - Even in storage, synthetic and steel slings can degrade if not kept in clean, dry conditions. WLS recommends hanging slings on a rack. Web sling should be stored in a dark area to avoid unnecessary sunlight/UV degradation.
8. Chemical Environment - Slings exposed to certain chemicals or the vapors of these chemicals can lose some or all of their strength. When using slings in a chemical environment, contact WLS to assure sling compatibility.

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Effect of Angle of Lift on a Sling's Rated Capacity

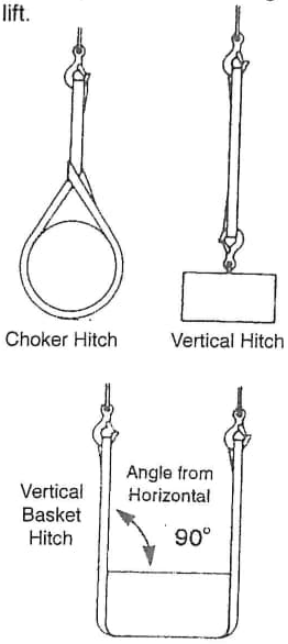
⚠ WARNING Read Definition on Page 1

Using slings at an angle **can become deadly** if that angle is not taken into consideration when selecting the sling to be used. The tension on each leg of the sling is increased as the angle of lift, from horizontal, decreases. It is most desirable for a sling to have a larger angle of lift, approaching 90°. Lifts with angles of less than 30° from horizontal are not recommended. If you can measure the angle of lift or the length and height of the sling as rigged, you can determine the properly rated sling for your lift.

What would be the rating of each sling rigged at this angle?

1. Calculate the Reduction Factor [RF].
   a. Using the angle from horizontal, read across the Angle Chart to the corresponding number of the Reduction Factor column.
   - OR -
   b. Divide sling height* [H] by sling length* [L].
2. Reduction Factor [RF] x the sling's rated capacity for the type hitch that will be used = Sling's Reduced Rating.

* Measured from a common horizontal plane to the hoisting hook.

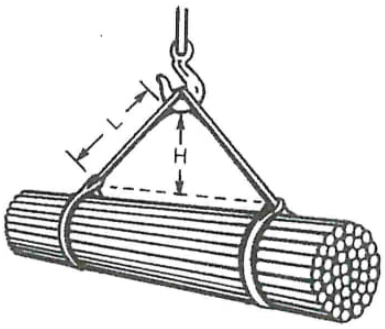


What capacity sling do I need?

1. Determine the weight that the sling will be lifting [LW].
2. Calculate the Tension Factor [TF].
   a. Using the angle from horizontal, read across the angle chart to the corresponding number of Tension Factor column.
   - OR -
   b. Divide sling length* [L] by sling height* [H].
3. Lifting Weight [LW] x the Tension Factor [TF] = Minimum Sling Rating for the type of hitch that will be used.

* Measured from a common horizontal plane to the hoisting hook.

Reduced Capacity



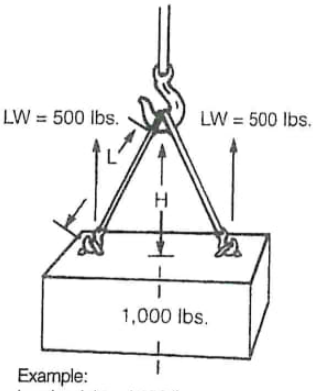
Example:
Vertical Choker rating of each sling = 6,000 lbs.
Measured Length (L) = 6 ft.
Measured Height (H) = 4 ft.
Reduction Factor (RF) = 4 (H) ÷ 6 (L) = .667
Reduced sling rating in this configuration = .667 (RF) x 6,000 lbs. = 4,000 lbs. of lifting capacity per sling

Effect of Angle Chart

Reduction Factor (RF)	Angle From Horizontal	Tension Factor (TF)
1.000	90°	1.000
0.996	85°	1.004
0.985	80°	1.015
0.966	75°	1.035
0.940	70°	1.064
0.906	65°	1.104
0.866	60°	1.155
0.819	55°	1.221
0.766	50°	1.305
0.707	45°	1.414
0.643	40°	1.555
0.574	35°	1.742
0.500	30°	2.000

Sling capacity decreases as the angle from horizontal decreases. Sling angles of less than 30° are not recommended.

Increasing Tension



Example:
Load weight = 1,000 lbs.
Rigging - 2 slings in vertical hitch
Lifting Weight (LW) per sling = 500 lbs.
Measured Length (L) = 10 ft.
Measured Height (H) = 5 ft.
Tension Factor (TF) = 10 (L) ÷ 5 (H) = 2.0
Minimum Vertical Rated Capacity required for this lift = 500 (LW) x 2.0 (TF) = 1000 lbs. per sling

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Lift Evaluation and Operating Practices or "Pre-Pick Survey"

⚠WARNING Read Definition on Page 1

Important Considerations - Before using a crane, hoist and sling, know as much as possible about the lift you will make to minimize the potential dangers to personnel, product and property. All of the following items should be evaluated.

Environment

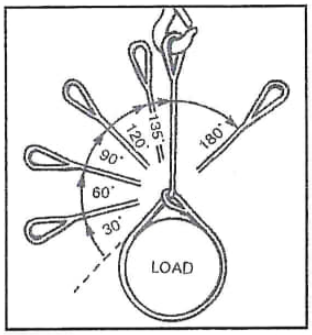
- Crane and load foundation
- Obstruction in path of travel and for head height
- Power lines or other hazards
- Chemical conditions
- Temperature of load and surroundings
- Location of people - away from danger
- Inspect all equipment

Load

- Weight of load
- Center of gravity (drain liquids)
- Pick-up point integrity, including location and number
- Edges that may damage sling
- Abrasive areas that may damage sling
- Secure or remove loose parts
- Structural integrity (bending and crushing)

Rigging

- Type of sling required, including number of legs
- Type of hitch required
- Balance of load and stability, including flexing
- Prevention of load shift and movement against sling
- Angle of lift
- Tag line and spotter requirements
- Plan and procedures



Choker Hitch Angles

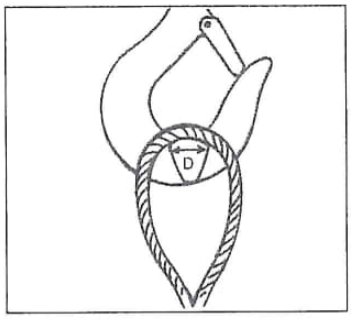
⚠WARNING
Read Definition on Page 1

When lifting and turning a load using a choker hitch, it is not uncommon to bend the body of the sling around the choker loop and have a severe bend occur around the body at this point.

For choker angles of 120° or less, the choker rating must be reduced by multiplying the corresponding factor times the slings standard choker rating.

Angle of Choke	Factor
Over 120°	1.00
90° - 120°	.87
60° - 89°	.74
30° - 59°	.62
0° - 29°	.49

Sling capacity decreases as choke angle decreases.



Effect of Anchor Shackle Pin or Crane Hook on Sling Eye

⚠WARNING Read Definition on Page 1

Damage to slings can occur if the wrong size pin or hook is used. The width of the pin or hook should never exceed the natural inside width of the eye.

The eye dimension for each type and size of sling are shown in the capacity tables of this catalog. If your pin or hook is large, request an oversized eye for the sling.

Wisconsin Lifting Specialists is dedicated to supplying products for material handling that meet or exceed current industry and government requirements (OSHA and ASME B30.9). Ultimately, the life and strength of any sling depends on those who inspect, use and maintain it.

The ASME B30.9 Sling Safety Standard can be obtained from:
ASME Order Dept. 22 Law Drive Fairfield, NJ 07007-2300
Phone: 201-882-1167
Occupational Safety and Health Administration (OSHA) "Industrial Slings" Regulations are published by the Office of the Federal Reserve, National Archives and Records Administration - Part 29 1910.184.

DO's for Crane and Hoist Users

- DO read the applicable equipment Safety Standards listed in front of this manual, and the instructions provided in the Operation and Maintenance manual.
- DO be familiar with controls, procedures, and warnings located on all lifting equipment.
- DO maintain firm footing when operating lifting equipment.
- DO make sure that the load slings or other approved single attachments are properly sized and seated in the hook saddle.
- DO use hook latches.
- DO make sure that the hook latch is closed and not supporting any part of the load.
- DO make sure that the load is free to move and will clear all obstructions.
- DO make sure that the hoist, bottom block and the hook are directly in line with the directions of loading before making a lift.
- DO make sure that the wire rope is in the sheave and drum grooves.
- DO take up all slack carefully, check the balance of the load, lift a few inches and check the load holding action before continuing.
- DO make sure that the hook, bridge, trolley, carriage or shuttle travel is in the same direction as shown on the controls.
- DO make sure that all persons stay clear of a suspended load.
- DO warn personnel of an approaching load.
- DO avoid swinging of the load or load hook.
- DO promptly report any malfunction, unusual performance or damage of lifting equipment.
- DO protect the wire rope from weld splatter or other damaging contaminants.
- DO inspect lifting equipment on a regular basis, replace damaged or worn parts, and keep appropriate maintenance records.
- DO make sure that the limit switches function properly.
- DO lower the bottom block to the ground or otherwise secure it before attempting any repairs or adjustment on the hoist units.
- DO use the equipment manufacturer's recommended replacement parts when repairing a hoist or crane.
- DO use fuses of specified size as recommended by the crane manufacturer.
- DO install wire rope clamps correctly. See the manual provided with the equipment.
- DO apply lubricant to the wire rope as recommended by the manufacturer.
- DO replace all protective guards and panels before operating the crane.

DO NOT's For Crane and Hoist Users

- **DO NOT** use damaged lifting equipment or lifting equipment which is not working properly.
- **DO NOT** use lifting equipment with twisted, kinked, damaged or worn wire rope.
- **DO NOT** use the wire rope as a sling or wrap the wire rope around the load.
- **DO NOT** operate lifting equipment unless the load is centered under the hoist.
- **DO NOT** apply the load to the tip of the hook.
- **DO NOT** lift more than the rated load.
- **DO NOT** lift a load if any binding prevents equal loading on all supporting ropes.
- **DO NOT** use the load limiting feature to measure the load.
- **DO NOT** use the crane or hoist to lift, support or transport people.
- **DO NOT** allow the wire rope or hook to be used as a ground for welding.
- **DO NOT** allow the wire rope or hook to be touched by a live welding electrode.
- **DO NOT** drag the wire ripe or hook on the floor or across other objects.
- **DO NOT** allow your attention to be diverted from operating the lifting equipment.
- **DO NOT** operate the lifting equipment beyond the limits of the wire rope travel.
- **DO NOT** lift a load unless the wire rope is properly seated in the sheaves or drum grooves.
- **DO NOT** use limit switches as routine operation stops. They are emergency devices only.
- **DO NOT** lift loads over people.
- **DO NOT** apply a sudden load to the wire rope (such as pushing a load off a ledge and allowing the wire ropes to "catch" it).
- **DO NOT** leave a suspended load unattended unless specific precautions have been taken.
- **DO NOT** allow collision between two cranes or hoists or between a crane or hoist and any obstruction.
- **DO NOT** adjust or repair lifting equipment unless qualified to perform such maintenance.
- **DO NOT** attempt to repair electrical apparatus or to make other major repairs on the crane unless specific authorization has been received and the power disconnect is locked out/tagged out.
- **DO NOT** attempt to lengthen the wire rope or repair a damaged wire rope.
- **DO NOT** change fuse sizes.
- **DO NOT** remove or obscure the warning or safety labels, plates or tags furnished on any lifting equipment.

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CHAIN SLING BASICS

WLS chain slings, available in Grades 80 and 100, are recommended for rugged industrial applications in harsh environments where flexibility, abrasion resistance and long life are required. OSHA required annual inspections can be performed by WLS trained personnel.

Note: Proof Coil Grade 30, High Test Grade 40 and Grade 70 transport tiedown chain and their fittings are not recommended for lifting or hoisting per ASME B30.9.

Features, Advantages and Benefits

Promotes Safety

- Permanent steel capacity tag is serialized for identification
- Welded slings offer the security of tamper proof assemblies

Saves Money

- Alloy Steel construction assures long life
- Can be repaired, proof tested and recertified by WLS.

Saves Time

- Easy to inspect for damage
- Stores easily

Inspection Criteria For Chain Slings

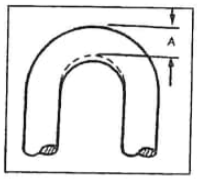
⚠ WARNING Read Definition on Page 1

Remove slings from service if any of the following are visible:

- Wear, nicks, bends, cracks, gouges or stretch
- Weld spatter on chain or attachments
- Excessive wear at bearing points - See Wear Allowance Table.
- Discoloration from excessive temperature
- End attachments, including hooks, that are cracked, deformed or obviously worn.
- Chain links should hinge freely with adjacent links.
- Capacity tag is missing or illegible.

Chain Wear Allowance

Determine wear by measuring cross section at link ends. If worn to less than the minimum thickness allowable, chain should be removed from service.



Wear Allowance Table

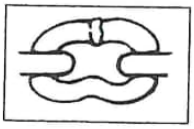
Trade Chain Size (in.)	Minimum Allowable Thickness - A (in.)
7/32 (.218)	.189
9/32 (.281)	.239
3/8 (.375)	.342
1/2 (.500)	.443
5/8 (.625)	.546
3/4 (.750)	.687
7/8 (.875)	.750
1 (1.00)	.887
1 1/4 (1.250)	1.091

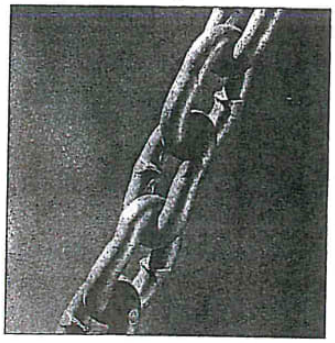
Minimum thickness based on OSHA recommendations.

Examples of Chain Sling Abuse

⚠ WARNING Read Definition on Page 1

All of these examples show sufficient damage to merit removal from service.





Bent Links

Usually caused by bending over sharp edges of a load.

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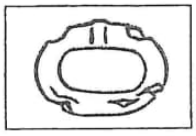
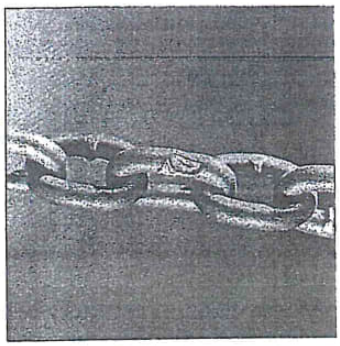
CHAIN SLING BASICS

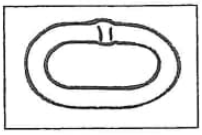
Examples of Chain Sling Abuse (Continued)

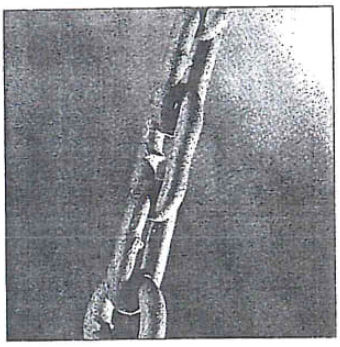




Gouged Links

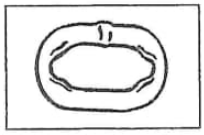
Damaged by a heavy object being dragged over or dropped on the chain.





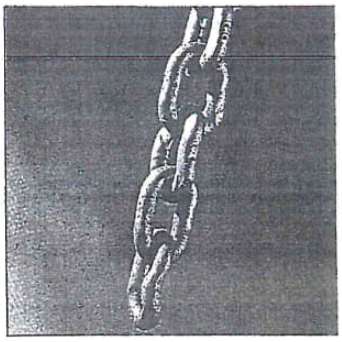
Stretched Links

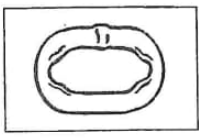
Indicates the sling has been extremely overloaded or subjected to shock loading. These links would not hinge freely with adjacent links.

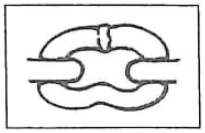


Worn Links

Excessive wear, especially at the bearing points, seriously weakens the chain.

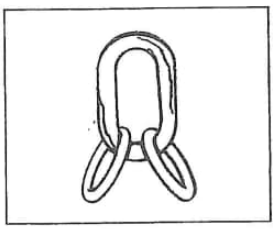


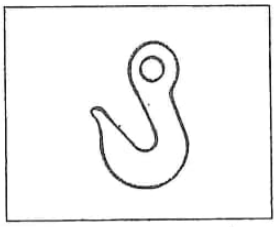


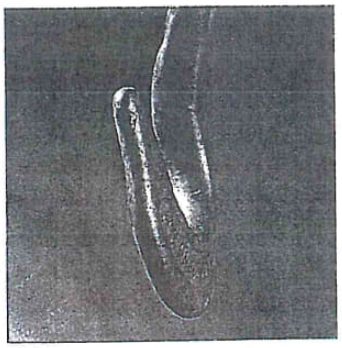


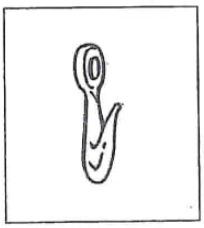
Multiple Types of Damage

Worn, gouged and bent links









Damaged Hooks and Attachments

This hook tip has been bent one direction and the eye another. The tip was probably point loaded and the eye bent by being rigged over the edge of a load.

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CHAIN SLING BASICS

Grade 80

- Proven reliability
- Available in welded or mechanically assembled slings
- Widest range of sizes and styles
- Greater temperature tolerance

See Page 2 of "Safety Guidelines" "Cautions & Warnings" for Temps!

Grade 100

- Higher capacity per chain size can be used as an increased safety factor
- Higher capacity may allow use of smaller diameter chain for your lifts, reducing sling weight and cost
- Extreme abrasion resistance - more durable
- Shot blasted and oil finished chain for distinct, uniform appearance and corrosion resistance
- Powder coated silver gray attachments for distinctinve appearance, identification and corrosion resistance
- Meets or exceeds all OSHA, ASTM and NACM standards

Rated Capacity For *LiftAlloy* Chain Slings

Size of Chain		90°	60°	45°	30°	60°	45°	30°	Nominal Dimensions (in.)		Approx. No. of Links per ft.	Approx. Weight per 100 ft. (lbs.)
(in.)	(mm)	Single Chain @ 90° (lbs.)	Double Chain Slings * (lbs.)			Triple & Quad Chain Slings * (lbs.) **			Inside Length	Inside Width		
Grade 80												
7/32	5.5	2,100	3,600	3,000	2,100	5,450	4,450	3,150	.671	.296	17.9	45
9/32	7.0	3,500	6,100	4,900	3,500	9,100	7,400	5,200	.868	.395	13.8	74
3/8	10.0	7,100	12,300	10,000	7,100	18,400	15,100	10,600	1.222	.572	9.8	146
1/2	13.0	12,000	20,800	17,000	12,000	31,200	25,500	18,000	1.404	.720	8.5	258
5/8	16.0	18,100	31,300	25,600	18,100	47,000	38,400	27,100	1.733	.854	6.9	387
3/4	20.0	28,300	49,000	40,000	28,300	73,500	60,000	42,400	2.160	1.052	5.5	622
7/8	22.0	34,200	59,200	48,400	34,200	88,900	72,500	51,300	2.250	1.137	5.3	776
1	26.0	47,700	82,600	67,400	47,700	123,900	101,200	71,500	2.664	1.348	4.5	995
1 1/4	32.0	72,300	125,200	102,200	72,300	187,800	153,400	108,400	3.250	1.656	3.7	1,571
Grade 100												
7/32	5.5	2,700	4,700	3,800	2,700	7,000	5,700	4,000	.670	.284	17.9	45
9/32	7.0	4,300	7,400	6,100	4,300	11,200	9,100	6,400	.868	.380	13.8	73
3/8	10.0	8,800	15,200	12,400	8,800	22,900	18,700	13,200	1.181	.512	9.8	148
1/2	13.0	15,000	26,000	21,200	15,000	39,000	31,800	22,500	1.535	.688	8.5	255
5/8	16.0	22,600	39,100	32,000	22,600	58,700	47,900	33,900	1.890	.819	6.9	383
3/4	20.0	35,300	61,100	49,900	35,300	91,700	74,900	53,000	2.362	1.024	5.5	625

* **⚠ WARNING** Do not exceed rated capacities. Sling capacity decreases as the angle from horizontal decreases. Slings should not be used at angles of less than 30°.

** A quad branch chain sling, especially when used on a load of rigid structure, is usually not sustaining the load evenly distributed on each of its four branches. The maximum working load limits are therefore set at the same values as for triple branch chain slings of equal quality and size and used with branches at the same angle of inclination.

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WIRE MESH SLINGS

Specialty Slings with Particular Properties and Uses

Widely used in metalworking shops and steel warehouses where loads are abrasive, hot or tend to cut web

Features, Advantages and Benefits

Promotes Safety

- Steel construction resists abrasion and cutting
- Each sling permanently stamped with capacity and serial number
- Good flexibility - grips load's contours
- Each sling proof tested and certified

Saves Money

- Grips load firmly without stretching - reduces load damage
- Resists abrasion and cutting for greater sling life
- Flexibility and low stretch reduce load damage
- Wide bearing area distributes load to help avoid load damage
- Repairable - thus very cost effective
- Alloy steel end fittings - plated for long life
- Wire mesh is galvanized - resists corrosion

Saves Time

- Width of mesh helps control and balance load
- End fittings fit most large crane hooks

Wire Mesh Sling Construction

Standard Construction: Alloy steel end fittings, zinc plated. Mesh is galvanized high tensile steel. 10 gage is standard, 12 gage is available upon request

Optional Construction: Stainless steel mesh is available for corrosive and hotter environments.

Inspection Criteria for Wire Mesh Slings

Remove the sling from service if any of the following is visible:

- A broken weld or brazed joint along the sling edge
- A broken wire in any part of the mesh
- Reduction in wire diameter of 25% due to abrasion or 15% due to corrosion
- Lack of flexibility due to distortion of the mesh
- Visible distortion or wear of either end fitting
- Cracked end fitting
- Capacity tag is missing or illegible.

⚠ WARNING

Environmental Considerations

- Wire mesh slings shall not be used at temperatures above 550°F.
- Store in a clean, dry area to avoid corrosive action

⚠ WARNING

Do not edge load. Full width of mesh must contact load.

How To Order

Specify:

1. Mesh Gage (10 or 12)
2. Mesh Width - Inches
3. Length - Feet (Bearing point to bearing point)
4. Sling Type (1 or 2)

Type 1

Type 2

Wire Mesh Width (in.)	Rated Capacity (lbs.) *		
	Vertical	Choker	Basket
10 Gage - Heavy Duty			
2 3	2,300 3,500	2,300 3,500	4,600 7,000
4 6	4,800 7,200	4,800 7,200	9,600 14,400
8 10	9,600 12,000	9,600 12,000	19,200 24,000
12 14	14,400 16,800	14,400 16,800	28,800 33,600
16 18	19,200 21,600	19,200 21,600	38,400 43,200
20	24,000	24,000	48,000
12 Gage - Medium Duty			
2 3	1,600 2,400	1,600 2,400	3,200 4,800
4 6	3,200 4,800	3,200 4,800	6,400 9,600
8 10	6,400 8,000	6,400 8,000	12,800 16,000
12	9,600	9,600	19,200

NOTE: The choker fitting must not be positioned against a load edge or directly on the triangle fitting.

Do not exceed rated capacities. Sling capacity decreases as the angle from horizontal decreases. Slings should not be used at angles of less than 30°.

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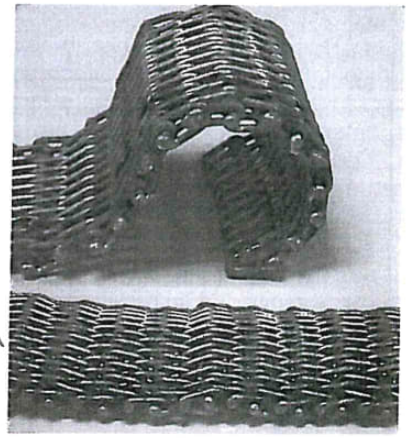
INSPECTION CRITERIA FOR WIRE MESH SLINGS

The following photos illustrate some of the common damage that occurs, indicating that the sling must be taken out of service.

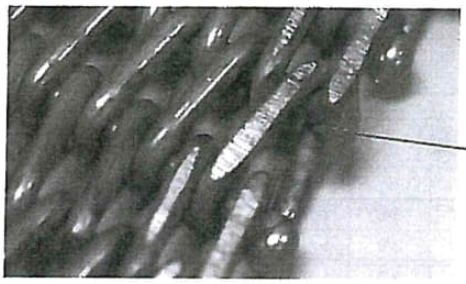
For inspection frequency requirements, see page 7.



THE DAMAGE: **Overloading / Uneven Loading**

WHAT TO LOOK FOR: Mesh does not lie flat, appears distorted and/or will not bend easily.

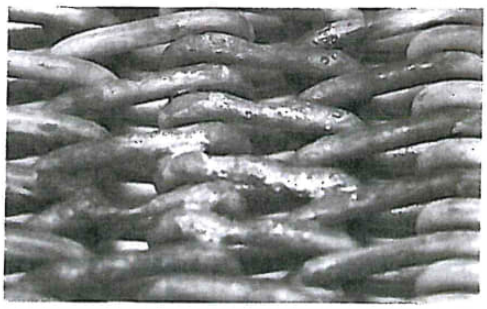
TO PREVENT: Do not load in excess of rated capacity. Load edges must be straight / flat and in contact with full width of mesh at bearing points.



THE DAMAGE: **Wear**

WHAT TO LOOK FOR: Flat areas on the individual wires. When wires have lost 25% or more of their original diameter, the sling must be taken out of service.

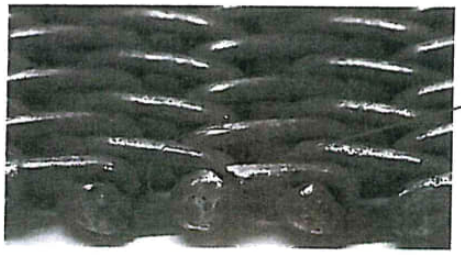
TO PREVENT: Do not drag sling on the ground and do not drag loads over slings. Pad high wear areas.



THE DAMAGE: **Corrosion / Heat Damage**

WHAT TO LOOK FOR: Areas of discoloration. Remove slings with wire diameter reduction of 15% or more. Slings exposed to temperatures of 550° F or more must be removed from service.

TO PREVENT: Hang slings for storage away from moisture. Do not use mesh slings above 550° F. Consider using stainless steel mesh.



THE DAMAGE: **Broken Weld or Brazed Joint**

WHAT TO LOOK FOR: A cracked or separation of the wire at the edge or in the body of the mesh.

TO PREVENT: Do not side load mesh. Tension on sling must be distributed evenly across the entire width of the mesh.

THE DAMAGE: **Distortion or Wear of End Fittings**

WHAT TO LOOK FOR: Fittings that do not lie flat or have obvious areas of wear.

TO PREVENT: Never lift with fitting against a load edge or set load directly onto sling. Reduce wear by keeping loads within the rated capacity of the sling.

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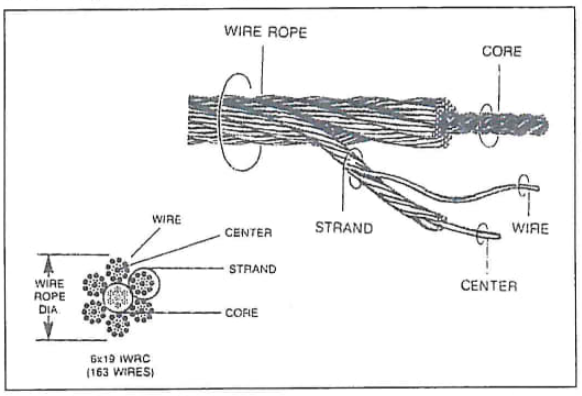
WIRE ROPE AND SLING BASICS

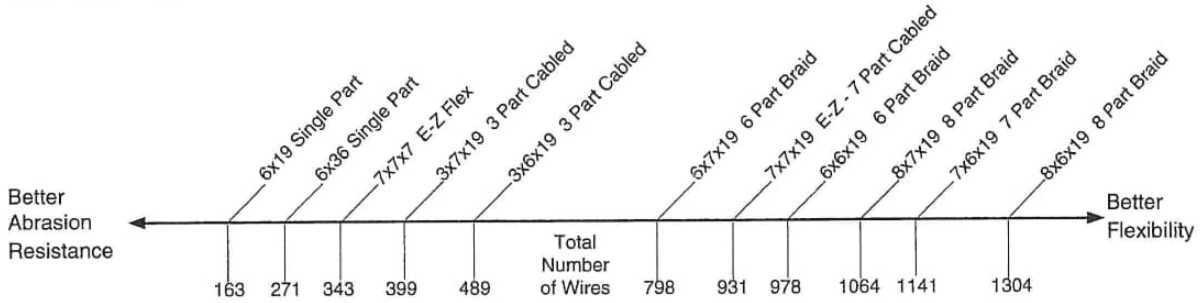
Two major and opposing characteristics of wire rope slings are flexibility and resistance to abrasion. To a great extent, these traits are a direct function of the number of wires. Fewer wires means larger diameter wires, better abrasion resistance, and reduced flexibility. More wires result in decreased wire diameter, reduced abrasion resistance, increased flexibility and kink resistance.

The scale below shows the relative position of the sling constructions shown in this catalog as they pertain to abrasion resistance and flexibility.

EIP = Extra Improved Plow (Steel)
FC = Fiber Core

Wire Rope Construction





WIRE ROPE SLINGS

Features, Advantages and Benefits

Promotes Safety

- *Tag* for capacity and serial numbered identification for traceability.

Saves Money

- Least expensive, per capacity, of all steel slings.
- Use of EIP, IWRC rope gives 15% greater capacity than IP, IWRC ropes.

Saves Time

- Countless combinations of sling terminations - hooks, chokers and thimbles are available to fit specific lift requirements.

Wire Rope & Slings

WIRE ROPE SLINGS

Inspection Criteria for Wire Rope Slings

⚠WARNING Read Definition on Page 1

Remove sling from service if any of the following are visible:

- Ten broken wires in one rope lay or five broken wires in one strand in one rope lay
- Wear or other loss of one-third of the original diameter of the individual wires
- Evidence of heat damage or corrosion of rope (internal and external) or attachments
- Kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure
- End attachments, including hooks, that are cracked, deformed or obviously worn
- Capacity tag is missing or illegible.

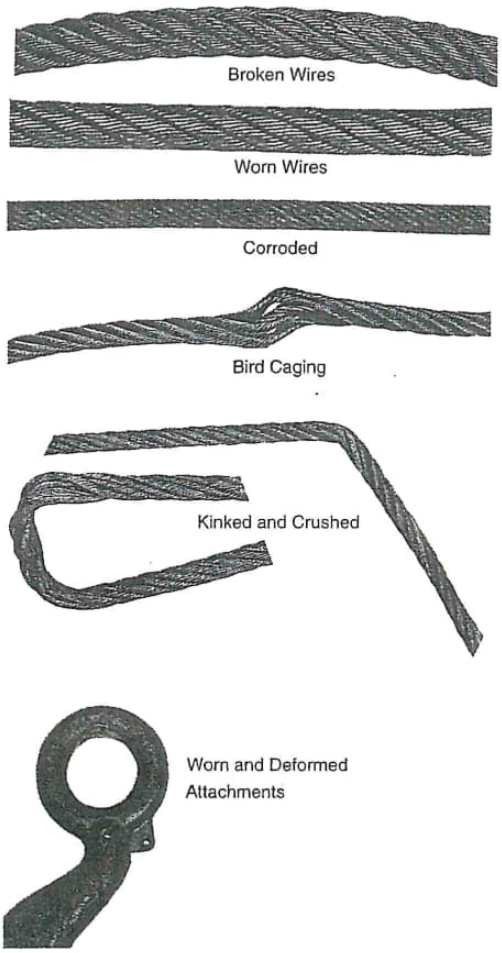
Do not inspect a sling by passing bare hands over the wire rope.

Environmental Considerations

- Wire core wire rope (IWRC) must not be used at temperatures above 400°F.
- Fiber core wire rope (FC) must not be used at temperatures above 180°F.
- Fiber core ropes should not be subjected to degreasing solvents.

⚠WARNING

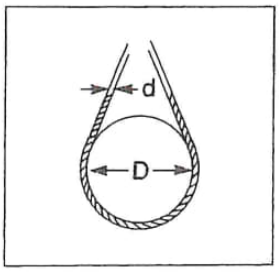
Examples of Wire Rope Sling Abuse



D/d - Basket Hitch Effect

⚠WARNING Read Definition on Page 1

Tests have shown that whenever a sling body is bent around a diameter, the strength of the sling is decreased. D/d ratio is the ratio of the diameter around which the sling is bent divided by the body diameter of the sling.



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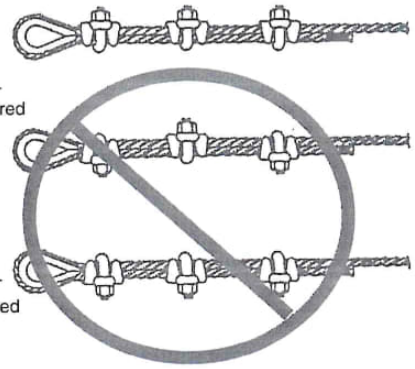
WIRE ROPE & COMPONENTS

Wire Rope Clips

The following instructions, supplied by the Wire Rope Technical Board, will result in an approximate 80% efficiency rating when the clips are applied as instructed, on GAC, SSAC, RRL or RLL, 6 x 19 class or 6 x 37 class, fiber core or IWRC, non-Seale type construction wire rope. If applied to vinyl coated ropes, vinyl must first be stripped from clip connection area.

Right Way - For Maximum Rope Strength



Wrong Way - Clips Staggered

Wrong Way - Clips Reversed

How to Apply Clips

1. Turn back the specified amount of rope from the thimble. Apply the first clip one clip width from the dead end of the wire rope (U-bolt over dead end - live end rests in clip saddle). Tighten nuts evenly to recommended torque.
2. Apply the next clip as near to the loop as possible. Turn on nuts firmly but do not tighten.
3. Space additional clips, if required, equally between the first two. Tighten on nuts - take up rope slack - tighten all nuts evenly on all clips to recommended torque.
4. NOTICE! Apply the initial load and retighten nuts to the recommended torque. Rope will stretch and be reduced in diameter when loads are applied. Inspect periodically and retighten to recommended torque.

⚠ WARNING

Failure to make a termination in accordance with aforementioned instructions, or failure to periodically check and retighten to the recommended torque, may result in death or serious injury.

Drop Forged Wire Rope Clips

Rope Dia. (in.)	Minimum Number of Clips	Rope Turn-back (in.)	Torque (ft./lbs.)	Weight Per 100 Pieces (lbs.)
1/8	2	3 1/4	4 1/2	6
3/16	2	3 3/4	7 1/2	10
1/4	2	4 3/4	15	18
5/16	2	5 1/4	30	30
3/8	2	6 1/2	45	47
7/16	2	7	65	76
1/2	3	11 1/2	65	80
9/16	3	12	95	104
5/8	3	12	95	106
3/4	4	18	130	150
7/8	4	19	225	212
1	5	26	225	250
1 1/8	6	34	225	280
1 1/4	7	44	360	415
1 3/8	7	44	360	460
1 1/2	8	54	360	530

Malleable Wire Rope Clips

Rope Dia. (in.)	Minimum Number of Clips	Rope Turn-back (in.)	Torque (ft./ lbs.)	Quantity Per Bag	Weight Per Bag (lbs.)
1/8	3	5	3	200	10
3/16	3	6	5	150	12
1/4	3	7	15	100	12
5/16	3	8	15	100	15
3/8	3	10	30	50	11

Note: Malleable clips are not to be used for overhead lifting. Use in light duty, non-critical applications only.

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HOW TO ORDER WIRE ROPE SLINGS

Prior to sling selection and use, review and understand the "Help" section.

Specify:

1. Rope Diameter - inches
2. Sling Length - Feet (Bearing point to bearing point)
3. Description of rope construction class - 6 x 19 etc.
4. Attachments - Master link, Hook, etc.

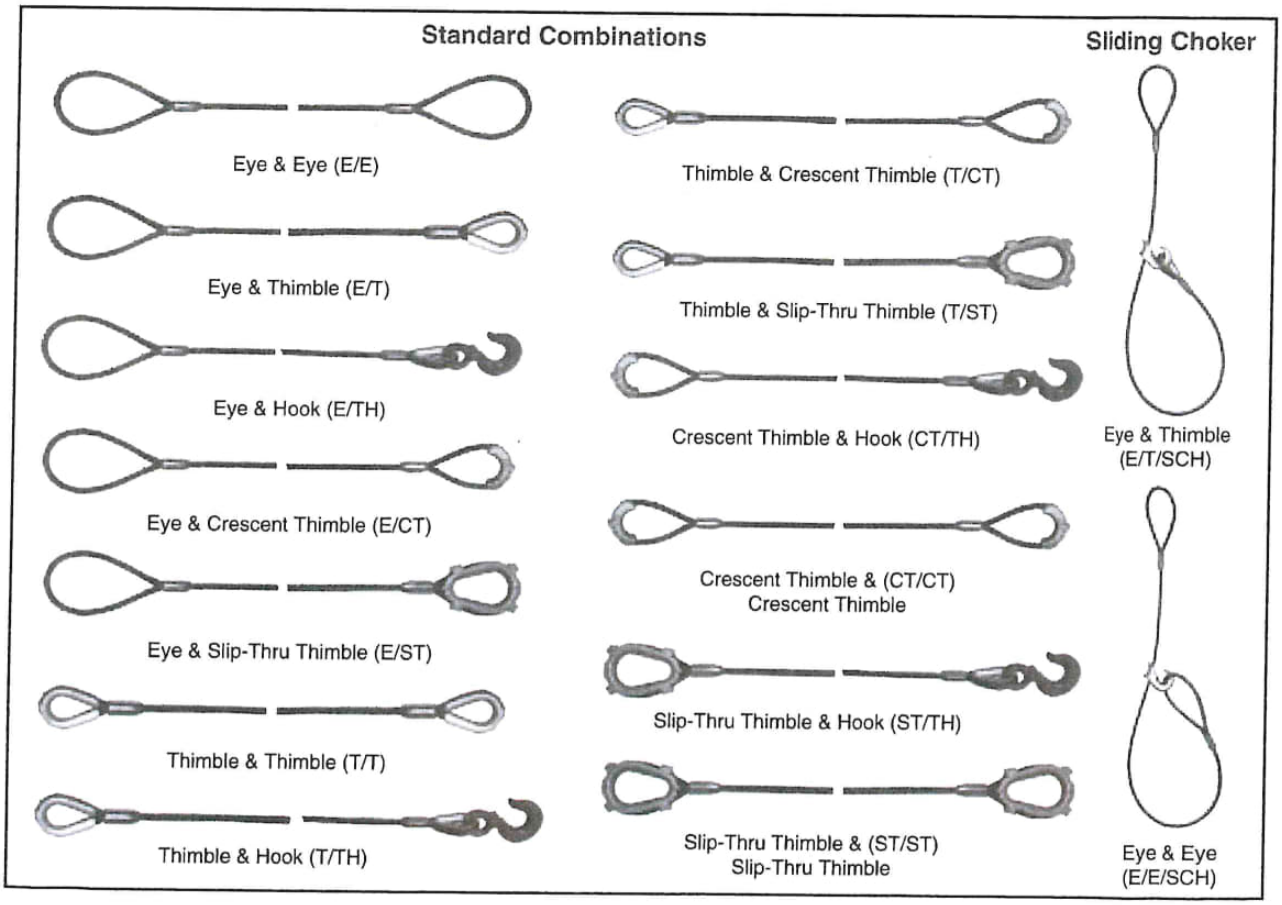
Tolerances and Minimum Lengths

Refer to tables for tolerances and minimum lengths.

Wire Rope Class

Standard rope classes are shown for each type and size of sling in the charts. Specific rope constructions are available upon request.

Note: Proof testing with certification available for all slings at an additional charge.



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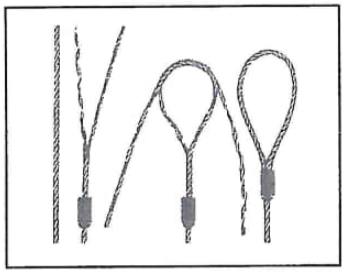
WLS WIRE ROPE SLINGS

WLS Slings are made using the flemish splice technique to form the eyes. Unlike the simple return loop method that places 100% of its strength on the swaged sleeve, These slings have reserve strength should the sleeve become damaged in use.



Features, Advantages and Benefits

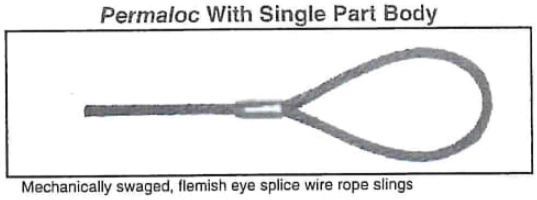
Promotes Safety

- Reserve strength - integrity of eyes not solely dependent upon steel sleeves
- IWRC resists crushing better than FC ropes

Saves Money

- When specified, thimble eyes protect wire rope from wear for increased life
- Good abrasion resistance for longer life

Permaloc With Single Part Body



Mechanically swaged, flemish eye splice wire rope slings

IWRC (Independent Wire Rope Core) **Fiber core available at reduced capacities**

Wire Rope Class	Rope Dia. (in.)	EIP, IWRC ¹ Rated Capacity (tons)* Vertical	Choker	V. Basket	² Min. Sling Length	Standard Eye Size (in.) W x L	Thimbled Eye Size (in.) W x L	Eye Hook Cap. (tons)	Crescent Thimble Eye Size (in.) W x L	Slip Thru Thimble Eye Size (in.) W x L	Sliding Choker Hook (in.)
6 x 19 EIP, IWRC	1/4	.65	.48	1.3	1' 6"	2 x 4	7/8 x 1 5/8	1	2 x 4	2 1/8 x 4 1/8	3/8
	5/16	1.0	.74	2.0	1' 9"	2 1/2 x 5	1 1/16 x 1 7/8	1	2 x 4	2 1/2 x 4 1/8	3/8
	3/8	1.4	1.1	2.9	2' 0"	3 x 6	1 1/8 x 2 1/8	1 1/2	2 x 4	2 1/2 x 4 1/8	3/8
	7/16	1.9	1.4	3.9	2' 3"	3 1/2 x 7	1 1/4 x 2 1/4	2	2 x 5	2 3/8 x 4 3/8	1/2
	1/2	2.5	1.9	5.1	2' 6"	4 x 8	1 1/2 x 2 3/4	3	2 1/4 x 6	2 3/8 x 4 3/8	1/2 **
	9/16	3.2	2.4	6.4	2' 9"	4 1/2 x 9	1 1/2 x 2 3/4	4 1/2	2 1/4 x 7	2 3/8 x 4 3/8	5/8
	5/8	3.9	2.9	7.8	3' 0"	5 x 10	1 3/4 x 3 1/4	4 1/2	2 3/4 x 7	3 3/8 x 6 5/8	5/8 **
	3/4	5.6	4.1	11	3' 6"	6 x 12	2 x 3 3/4	7	3 1/4 x 8 1/2	3 3/8 x 6 5/8	3/4 **
	7/8	7.6	5.6	15	4' 0"	7 x 14	2 1/4 x 4 1/4	11	4 1/2 x 10	3 3/4 x 7 1/8	7/8
	1	9.8	7.2	20	4' 6"	8 x 16	2 1/2 x 4 1/2	11	4 1/2 x 11 1/2	3 3/4 x 7 1/8	1
	1 1/8	12	9.1	24	5' 0"	9 x 18	2 7/8 x 5 1/8	15	4 7/8 x 13	4 3/8 x 8 3/8	1 1/8
6 x 37 EIP, IWRC	1 1/4	15	11	30	5' 6"	10 x 20	3 1/2 x 6 1/2	15	5 1/2 x 14 1/2	4 3/8 x 8 3/8	1 1/4
	1 3/8	18	13	36	6' 0"	11 x 22	3 1/2 x 6 1/4	22	6 x 16	5 x 9 1/2	1 3/8
	1 1/2	21	16	42	7' 0"	12 x 24	3 1/2 x 6 1/4	22	6 x 17 1/2	5 x 9 1/2	1 1/2**
	1 3/4	28	21	57	8' 0"	14 x 28	4 1/2 x 9	30	7 x 20	6 3/4 x 11 3/4	-
	2	37	28	73	9' 0"	16 x 32	6 x 12	37	7 x 23 1/2	8 x 14 1/2	-
	2 1/4	44	35	89	10' 0"	18 x 36	7 x 14	45	8 1/2 x 26	8 x 15 1/2	-
	2 1/2	54	42	109	11' 0"	20 x 40	-	-	8 1/2 x 29 1/2	-	-

Note: Larger diameter slings available. Basket ratings are based on a minimum D/d of 25.
1. 1 Ton = 2,000 lbs.
2. Minimum sling length when using standard eyes.
Note: **Length Tolerances** - Single Part Wire Rope Slings - Standard length tolerance is plus or minus two rope diameters, or plus or minus 0.5% of the sling length, whichever is greater.

⚠ WARNING Do not exceed rated capacities. Sling capacity decreases as the angle from horizontal decreases. Slings should not be used at angles of less than 30°.

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INSPECTION CRITERIA

Inspection Criteria for Synthetic Web Slings
Refer to illustrations of damaged webbing

Remove from service if any of the following is visible:

- Capacity tag is missing or illegible
- Red core warning yarns are visible
- Sling shows signs of melting, charring or chemical damage
- End fittings are excessively pitted, corroded, distorted, cracked or broken
- Cuts on the face or edge of webbing
- Holes, tears, snags or crushed web
- Signs of excessive abrasive wear
- Broken or worn threads in the stitch patterns
- Any other visible damage which causes doubt as to its strength

Red Core Yarns - are an additional warning of dangerous sling damage. When red yarns are visible, the sling should be removed from service immediately. The red core yarns become exposed when the sling surface is cut or worn through the woven face yarns. For other inspection criteria see OSHA/Manufacturer regulations.

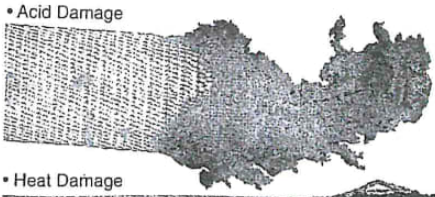
Examples of Web Sling Abuse

Most of the damage shown here would cause immediate catastrophic failure of the sling. Not all of the damage you will see will be this obvious or extreme, but still requires removal from use.

Elasticity - The stretch characteristics of web slings depends on the type of yarn and the web finish. Approximate stretch at RATED SLING CAPACITY is:

NYLON		POLYESTER	
Treated	10%	Treated	7%
Untreated	6%	Untreated	3%

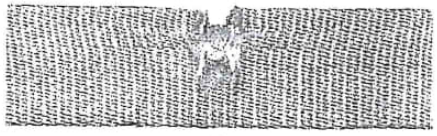
• Acid Damage



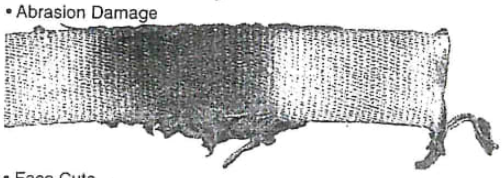
• Heat Damage

• Cuts

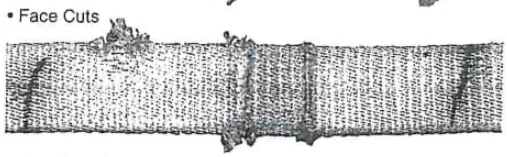
• Cut & Tensile Damage



• Abrasion Damage

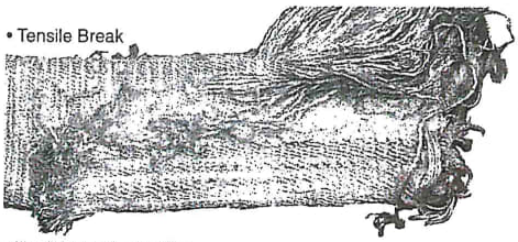


• Face Cuts

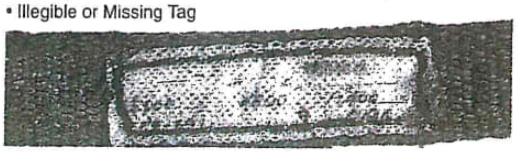


• Punctures & Snags

• Tensile Break



• Illegible or Missing Tag



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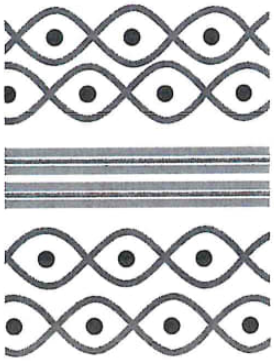
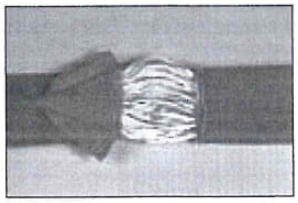
ROUNDSLINGS

- Transverse pick yarns position surface yarns and protect core yarns
- Woven surface yarns also protect core yarns, carry no load
- Longitudinal core yarns carry 100% of load
- Red core warning yarns





Roundsling construction, as shown above, protects all load carrying core yarns from abrasion with an independent, woven jacket. Replacement is not necessary until the red striped white core yarns can be seen through holes in the jacket. When core yarns are visible, sling must be removed from service. Most roundslings provide double wall protection for extended sling life.

INSPECTION CRITERIA

⚠ WARNING Read Definition on Page 1

Inspection Criteria for Roundslings

Remove from service when:

- Cuts to sling cover exposes red striped white core yarns
- Holes, tears, snags or abrasions expose red striped white core yarns
- End fittings are pitted or corroded, cracked, distorted or broken
- The sling shows signs of melting, charring or chemical damage
- Capacity tag is illegible or missing
- Other visible damage which causes doubt as to the strength of the sling

Environmental Considerations

- Nylon and polyester are seriously degraded at temperatures above 200°F
- Many chemicals have an adverse effect on nylon and polyester. The chart is a general guide. For specific temperature, concentration and time factors, please consult WLS prior to purchase or use.

CHEMICAL	OK	NYLON	POLYESTER
Acids			*
Alcohols			
Aldehydes			
Strong Alkalis			**
Bleaching Agents			
Dry Cleaning Solvents			
Ethers			
Halogenated Hydro-Carbons			
Hydro-Carbons			
Ketones			
Oils Crude			
Oils Lubricating			
Soap & Detergents			
Water & Seawater			
Weak Alkalis			

* Disintegrated by concentrated sulfuric acid.
** Degraded by strong alkalis at elevated temperatures.

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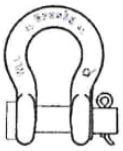
Crosby® Shackles

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

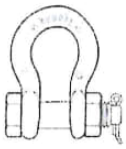


ROUND PIN

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

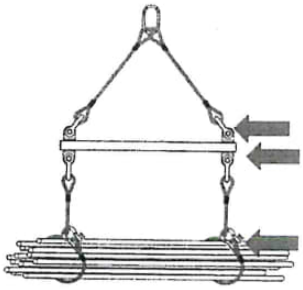
Use in permanent or long-term installations always use nut and cotter.

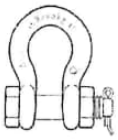
CONNECTION OF SLINGS TO SHACKLES

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.

BOLT-TYPE SHACKLES





Use Bolt-Type Shackle when a permanent or long term connection

Use a screw pin shackle when it will be a temporary connection.

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 page 91.

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Crosby® Shackles

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

Angle loads must be applied in the plane of the bow.

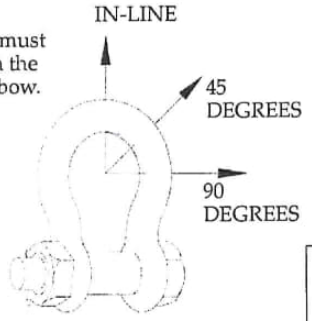
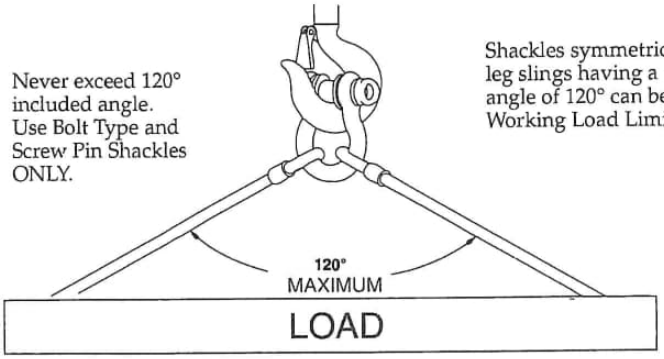


Table 1 Side Loading Reduction Chart for Screw Pin and Bolt Type Shackles Only+	
Angle of Side Load from Vertical In-Line of Shackle	**Adjusted Working Load Limit**
0° - 5° In-Line*	100% of Rated Working Load Limit
45° from In-Line*	70% of Rated Working Load Limit
90° from In-Line*	50% of Rated Working Load Limit

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

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

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.

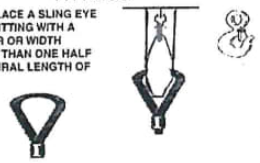
WIRE ROPE SLINGS AND CONNECTIONS TO FITTINGS

USE A THIMBLE TO PROTECT SLING AND TO INCREASE D/d

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

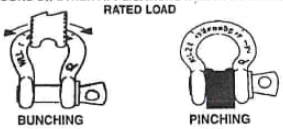
WIRE ROPE SLINGS AND CONNECTIONS TO FITTINGS

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



SYNTHETIC SLINGS RATED LOAD

FOLDING, BUNCHING OR PINCHING OF SYNTHETIC SLINGS, WHICH OCCURS WHEN USED WITH SHACKLES, HOOKS OR OTHER APPLICATIONS WILL REDUCE THE RATED LOAD



BUNCHING PINCHING

ANSI B30.9-1994

CHOKER HITCH FORMED

WITH SHACKLES

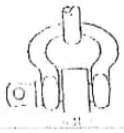
WRONG!

PLACE PIN IN EYE OF SLING

CORRECT!

WITH CHOKER HOOK

CROSBY SHACKLES POINT LOADING



POINT LOADING OF CROSBY SHACKLE PINS IS ACCEPTABLE AS LONG AS LOAD IS REASONABLY CENTERED ON THE PIN

ALTHOUGH POINT LOADING IS ACCEPTABLE, A PAD EYE WIDTH OF 90% OR MORE OF SHACKLE SPREAD IS BEST PRACTICE

SAFETY INSTRUCTIONS

GENERAL SAFETY RULES

Danger always exists when loads are transported by lifting devices, especially when the equipment is not being used properly or is poorly maintained. Because accidents and severe bodily injury or death can result, special safety precautions apply to the operation, inspection, and maintenance of the Walker Lift Magnets.

Following these simple rules can help to avoid lifting accidents:

⚠ DANGER

Always stay clear of the load.
Never lift loads over people or in close proximity to people.
Never attempt to operate this magnet until you read and understand the Operator's Manual.
Never use this magnet to lift, support or transport people.
Never leave any lifted load unattended.
Never lift more than one work piece at a time with this magnet.
Always make sure that the supporting structure and load attaching devices (i.e. crane, chains and hook) are rated to support the weight of the magnet and load.
Always make sure that the load's weight and dimensions are within the Magnet's Lifting Guidelines. These Guidelines are located in the Operator's Manual.
Always let those near you know that a lift is to begin.

Remember, proper lifting knowledge and techniques are the responsibility of the operator. Be sure to read and understand the instructions and safety warnings contained in this manual before using your lifter.

If you do not understand everything in this manual contact Walker Magnetics for assistance before using the magnet.

Call 1-800-W-MAGNET

SAFETY INSTRUCTIONS

RECOGNIZE SAFETY INFORMATION

This is the safety alert symbol. When you see this symbol on your magnet or in this manual, be alert to the potential for personal injury. Follow recommended precautions and safe operating practices at all times.

DANGER Red Background, White Letters	This indicates a situation in which a hazard is imminent and will result in a high probability of serious injury or death.	*These Hazard Signal Words Deserve your Full Attention*
WARNING Orange Background, Black Letters	This indicates a potentially hazardous situation, which could result in some probability of serious injury or death.	
CAUTION Yellow Background, Black Letters	This indicates a potentially hazardous situation, which could result in minor injury or moderate injury.	

UNSAFE LIFTING APPLICATIONS FOR YOUR MAGNET

DANGER

Never lift more than one workpiece at a time with this magnet.

Never lift any castings that do not have a machined fl at lifting surface for the magnet. The location of the lifting surface should be such to permit the load to remain level when lifted.

DANGER

Never lift a load by its narrowest dimension.

WARNING

If you have any diffi culty lifting a load, DON'T LIFT IT!
Call Walker for advice at 1-800-962-4638

WAYS TO AVOID A REDUCTION OF LIFTING CAPACITY

DANGER

To Avoid any Reduction of Lifting Capacity:

The lifting surfaces of the magnet and the area of the load where the magnet will be located must be clean, smooth, fl at and free of nicks and burrs.

The full area of the magnet's lifting surface must be in contact with the load.

The load must be at least 2.5" (64 mm) thick.

The load must be low carbon steel such as AISI 1020.

The magnet's lifting surface must stay level and the contacting surface of the load remain fl at.

The temperature of the magnet and/or the load must not be greater than 110°F (43°C).

The control actuator must be fully in the "on" or "lift" position.

Repair of this magnet should only be done by Walker Magnetics or a Qualifi ed Person.*

If you have any diffi culty lifting a load, DON'T LIFT IT! Call Walker Magnetics for advice at 1-800-962-4638.

ADDITIONAL WARNINGS

WARNING

Never lift loads with any dimension greater than those shown in the LIFTING GUIDELINES.

Never operate damaged or malfunctioning magnets.

Never remove or damage Operating and Warning labels.

Persons using pacemakers or other medical devices should not use this magnet until they have consulted with their physician.

WARNING

Disassembly or repair of this magnet can result in reduced holding power and/or cause an unsafe condition. Therefore, anytime the magnet is disassembled beyond the parts list shown in this manual, the magnet must be re-tested for breakaway force in accordance with the test described in ANSI/ASME B30.20.

Modifi cation of any operating mechanism or structure of this magnet can reduce the magnet's effectiveness and/or cause an unsafe condition. Repair or modifi cation of this magnet should only be done by Walker Magnetics or a Qualifi ed Person.*

SAFETY PERSON

O.S. Walker recommends that a person be assigned to review all magnetic handling applications for these magnets to ensure that safe practices and procedures are being followed.

* **Qualifi ed Person** - A person who by extensive knowledge, training and experience, has successfully demonstrated the ability to solve or resolve problems related to Walker lifting magnets. (Walker replacement parts may be installed by a ****Designated Person**.)

** **Designated Person** - A person selected or assigned by the employer as being competent to replace specifi c replacement parts listed in this manual and is able to verify the proper functioning of the specifi c replacement parts and the entire product after the completion of the installation.

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IMPORTANT FACTS FOR THE OPERATION OF LIFT MAGNETS

LOAD CHARACTERISTICS OTHER THAN JUST WEIGHT
MUST BE CONSIDERED IN ORDER TO DETERMINE
THE LOAD THAT ANY MAGNET CAN LIFT.

This statement is true for all lifting magnets because they all operate using the same fundamental laws of physics. Magnetic power is often pictured as lines of magnetic force fl owing from north pole to south pole. Anything that limits the fl ow of these magnetic lines of force obviously reduces the magnet's lifting capacity. There are many important factors, which limit the fl ow of these lines of force.

1. SURFACE CONDITIONS

Magnetic lines of force do not fl ow easily through air. They need iron in order to fl ow freely; therefore, anything that creates a space or an air gap between a magnet and the load limits the fl ow of magnetic lines of force and, thus, reduces the lifting capacity of a magnet.

MAGNET'S LIFTING SURFACE CONDITION — The lifting surfaces of a magnet must be clean, smooth, fl at and free of nicks and burrs to minimize the air gap between a magnet and the load. This magnet has been designed with soft, low carbon steel lifting surfaces in order to maximize the lifting capacity; therefore, special care must be taken to protect these surfaces. Follow the Inspection Instructions in this manual. Attaching or welding other materials to the lifting surfaces in order to reduce wear should not be done with this magnet because it will reduce the lifting capacity.

LOAD SURFACE CONDITION — Paper, dirt, rags, rust, paint, and scale act the same as air. Also, a rough surface fi nish on the load creates an air gap between the magnet and load. Any of these conditions will reduce the magnet's lifting capacity.

2. LOAD THICKNESS

The greater the number of lines of magnetic force fl owing from a magnet into the load, the greater the effectiveness of the magnet. The thicker the load, the more lines of magnetic force are able to fl ow. After a certain thickness of load, no additional lines of force will fl ow because the magnet has reached its full capacity.

Thin material (load) means less iron available, and thus fewer lines of magnetic force fl ow from the magnet into the load. Therefore, the lifting capacity of the magnet is reduced. In some cases, the magnet will attract more than one thin plate of material when set on a stack of thin plates. DO NOT LIFT more than one plate at a time since the lower plate may not be held suffi ciently.

The lifting guidelines provide the user with what minimum thickness of load is required to reach full lifting capacity. Below such thickness of load, the user must accept the reduced lifting capacity of the magnet as shown in the guidelines.

3. LOAD ALLOY

Low carbon steels, such as AISI 1020 steel, are nearly as good conductors of magnetic lines of force as pure iron. However, many other alloys contain non-magnetic materials, which reduce the ability of magnetic lines of force to fl ow into the load. An alloy such as AISI 300 series of stainless steel is almost as poor a conductor of magnetic lines of force as air.

Type 416 stainless steel is considered magnetic, but it contains enough chromium so that a magnet can develop only one-half as much force on a type 416 stainless steel load as it can on a AISI 1020 steel load. Also, because of the carbon content, the force developed on cast iron is less than one-half of that developed on AISI 1020 steel. (Chilled cast iron further reduces the force to less than one-quarter.)

4. LOAD LENGTH OR WIDTH

As the length or width of a load increases, it ceases to remain fl at when lifted and the edges begin to droop. This drooping or sagging of the load can create an air gap between the load and the magnet. This is called peel. If this occurs, the lifting capacity of the magnet is greatly reduced.

For plate lifting, where drooping often occurs, rectangular shaped magnets must be positioned so that the length of the magnet is parallel to the width of the load.

5. POSITION OF MAGNET'S LIFTING SURFACE

As the position of the magnet's lifting surface changes from horizontal to vertical, the lifting capacity of the magnet decreases. When the magnet's lifting surfaces are vertical, the lifting capacity of the magnet is minimum and dependent upon the coeffi cient of friction between the magnet's lifting surface and the load.

6. PORTION OF MAGNET SURFACE IN CONTACT WITH LOAD

The full surface of the magnet must contact the load if the magnet is to achieve rated lift capacity.

7. LOAD TEMPERATURE

The temperature of the load can cause damage to the magnet and, if high enough, can even change the magnetic characteristics of the load. For Standard Lift Magnets, Walker should be consulted if the load or air temperature exceeds 110° F (43° C).

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SAFETY

FOR FAST, EASY LIFTING WITH YOUR WALKER

NEO-125, NEO-250, NEO-500,

NEVER attempt to turn the magnet on or off in the "Lifting Guidelines" section of this on loads that are too thin will result in the

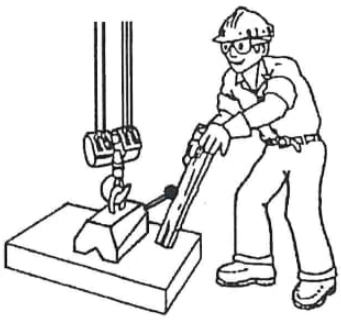
1 NEVER

attempt to operate this lift magnet until you read and understand the OPERATOR'S MANUAL & SAFETY INSTRUCTIONS for the NEO-125, NEO-250, NEO-500, NEO-1000 AND NEO-2000 Lifting Magnets.

2

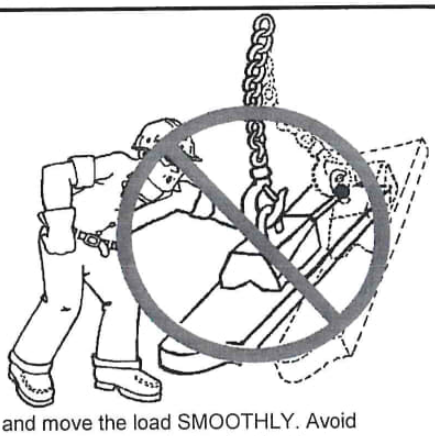
Check the condition of the magnet prior to every lift. WIPE clean the bottom of the magnet and the area on the load where the magnet will be located. File away burrs.

5



Check to be sure no one is near the load to be lifted. Inform others in the area that a lift is to begin. Lift the load 2 to 3 inches (50 to 75 mm) and then jar the load to insure that adequate holding power is available.
ALWAYS STAY CLEAR OF THE LOAD.

6



Lift and move the load SMOOTHLY. Avoid jarring and swinging the load while it is in transit. KEEP THE LOAD LEVEL. NEVER let the load come in contact with any obstruction.

If you have any diffi culty lifting a load, DON'T LIFT IT. Ask your supervisor for help or call Walker Magnetics, Inc., for advice at 1-800-W-MAGNET

When working in an area using lifting magnets, wear safety glasses, work gloves, steel-toed shoes and a safety hat.

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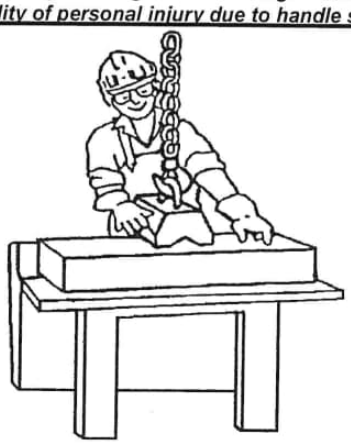
RULES

LIFT MAGNETS MODELS:

NEO-1000 & NEO-2000

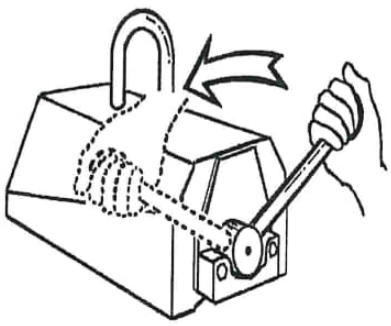
unless the magnet is in contact with a load of a thickness equal to those listed manual. Attempting to energize or de-energize this magnet without a load or high probability of personal injury due to handle spring back.

3



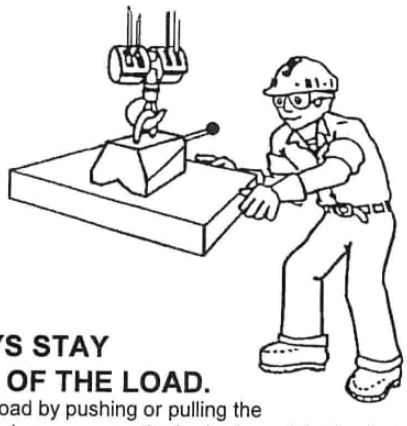
Position the magnet so the load remains level.

4



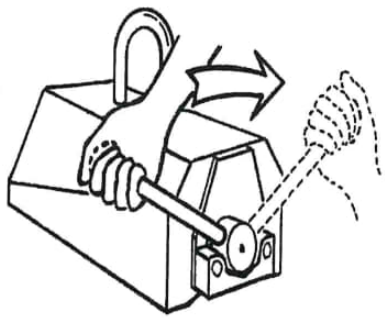
To energize magnet, grip the handle fi rmly and pull the handle from its locked position. Turn the handle to the "ON" position. Then be sure to return the handle to the FULLY LOCKED POSITION. Release the handle.

7



ALWAYS STAY CLEAR OF THE LOAD.
Guide the load by pushing or pulling the edges. This keeps your entire body clear of the load at all times. DO NOT guide the load by pushing or pulling the Magnet. NEVER get in a position where you could get hit with load if it dropped.

8



Carefully set the load down. To release the load, grip the handle fi rmly, unlock the handle shaft, and turn the handle to the "OFF" position. Lift the magnet slightly to be sure the load has been released.

⚠ CAUTION **NEVER** re-energize the magnet until it has been placed in contact with the load to be lifted. Prematurely energizing the magnet could cause unwanted materials to be attracted to the magnet. **PERSONAL INJURY MAY RESULT.**

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RECOMMENDED LIFTING PROCEDURES

SAFETY HOOK LATCH

Always use a safety hook latch on your crane hook to hold your magnets.

STAY CLEAR OF THE LOAD

Guide the load by pushing or pulling the edges of the load. Keep your entire body clear of the load at all times.

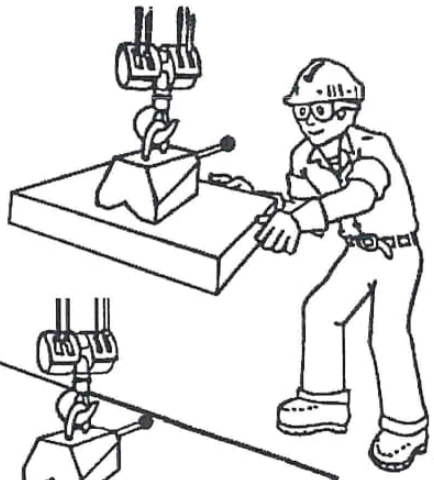
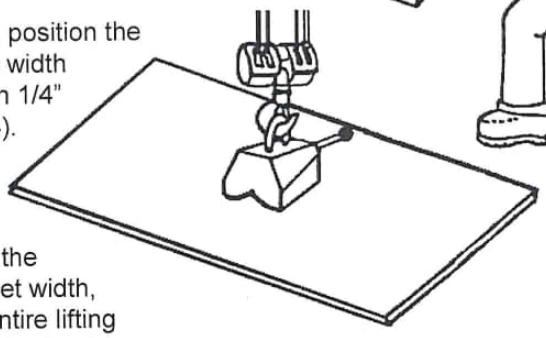


PLATE LIFTING

On plates less than 1 1/2" (38mm) thick, position the magnet length so that it is parallel to the width of the plate. Never lift any plate less than 1/4" (6mm) thick. (See Important Facts 2 & 4).



BAR LIFTING

When the load is thicker than 1 1/2" (38mm), and the load width is less than the magnet length, but wider than the magnet width, position the magnet length so that the entire lifting surface of the magnet is in contact with the load. When the load width is less than the magnet width, position the magnet so you get the maximum, and equal amounts of each of the magnets pole areas in contact with the load.

ALWAYS MAKE SURE THAT THE LOAD'S WEIGHT AND DIMENSIONS ARE WITHIN THE MAGNET'S LIFTING GUIDELINES.

UNSAFE LIFTING APPLICATIONS FOR YOUR NEO-125, 250, 500, 1000, AND 2000 LIFTING MAGNETS

⚠ DANGER

Never lift more than one workpiece at a time with this magnet.

Never lift any castings that do not have a machined fl at lifting surface for the magnet. The location of the lifting surface should be such to permit the load to remain level when lifted.

⚠ DANGER

- **Never** lift a load by its narrowest dimension.

⚠ WARNING If you have any diffi culty lifting a load, DON'T LIFT IT! Call Walker for advice at 1-800-962-4638

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GUIDELINES FOR THE REDUCTION OF THE RATED LIFTING CAPACITY

⚠ CAUTION: Each Walker magnet model is rated for a different weight limit, and the load characteristics will affect the lifting capacity of the magnets. The lifting guidelines for the various models are shown on the following pages.

The Lifting Guidelines charts show the effect of air gap, load thickness, load length, and load width on lifting capacity. As the thickness of the load decreases, so does the rated lifting capacity of the magnet. The tables show the maximum weight or load size, which can be lifted for each thickness under varying air gap conditions. DO NOT EXCEED EITHER THE MAXIMUM WEIGHT OR SIZE FOR EACH THICKNESS.

Each value shown on the Lifting Guidelines charts is for AISI 1020 steel, and any increase in alloy content will result in further reduction of the lifting capacity of the magnet.

THIS TABLE PROVIDES SOME REDUCTION FACTORS FOR MATERIAL OTHER THAN AISI 1020 STEEL	
Reduction Factors for Materials Other than AISI 1020 Steel	
Materials	**REDUCTION FACTOR**
Cast Steel	0.90
3% Silicon Steel	0.80
AISI 1095 Steel	0.70
416 Stainless Steel	0.50
Cast Iron (non-chilled)	0.45
Pure Nickel	0.10
For Other Materials Consult O.S. Walker	

PLATE

Rated lift Capacity (For these materials) = **Reduction Factor** multiplied by **Maximum Load Value** (For 1020 Steel) from Lifting Guidelines (plate). See pages 12, 14 & 16.

Example: Lifting AISI 1095 STEEL, ½" thick, ROUGH machined fl at surfaces (use .020" air gap) with a Model NEO-250 magnet.

Rated Lift Capacity = 0.70 multiplied by 160 = 112 pounds.

ROUND BARS & PIPES

Rated lift Capacity (For these materials) = **Reduction Factor** multiplied by **Maximum Load Value** (For AISI 1020 Steel) from Lifting Guidelines (round bar & pipe). See pages 13, 15 & 17.

Example: Lifting CAST IRON, (non-chilled), 8" diameter solid round bar, CLEAN AND SMOOTH GROUND surfaces (use 0" air gap) with a Model NEO-500 lifting magnet.

Rated Lift Capacity = 0.45 multiplied by 38" = 17.1".

⚠ WARNING If you have any diffi culty lifting a load, DON'T LIFT IT! Call Walker for advice at 1-800-962-4638

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NEO-1000 LIFTING GUIDELINES (PLATE)

Values shown are for maximum rated capacities when operating instructions and warnings are followed.

VALUES ARE BASED UPON AISI 1020 STEEL

Higher alloy steels and other magnetic materials will require further reductions of these rated capacities (See page 11 for the Guidelines for the reduction of the Rated Lifting Capacities.)

NEVER EXCEED EITHER THE MAXIMUM WEIGHT OR SIZE SHOWN FOR EACH LOAD THICKNESS AND TYPE OF SURFACE CONDITION

LOAD THICKNESS Inches	TYPE OF SURFACE CONDITION					
	CLEAN & SMOOTH Similar to a Flat (32 micro-inch RMS) Ground Surface .000" Max. Air Gap †		RUST OR SCALE Similar to a Flat Hot Rolled Steel Surface .010" Max. Air Gap † (.254mm)		IRREGULAR OR ROUGH Similar to a Flat Smooth Cut File .020" Max. Air Gap † (.508mm)	
	Maximum Load Pounds	Maximum Length Inches	Maximum Load Pounds	Maximum Length Inches	Maximum Load Pounds	Maximum Length Inches
3" & above (76mm & above)	2200 (1000kg)	-	1845 (840kg)	-	1415 (645kg)	-
*2" (51mm)	1960 (890kg)	72 x 48 (1.8 x 1.2m)	1670 (760kg)	72x40 (1.8 x 1.0m)	1320 (600kg)	72x32 (1.8 x .8m)
*1" (25.4mm)	1175 (535kg)	84x48 (2.1 x 1.2m)	1045 (475kg)	76x48 (1.9 x 1.2m)	900 (410kg)	60x30 (1.5 x .75m)
*1/2" (12.7mm)	365 (165kg)	72x36 (1.8 x .9m)	330 (150kg)	60x36 (1.5 x .9m)	285 (130kg)	48x36 (1.2 x .9m)
*3/8" (9.5mm)	235 (108kg)	48x44 (1.2 x 1.1m)	195 (90kg)	48x36 (1.2 x .9m)	155 (72kg)	48x30 (1.2 x .75m

NEVER LIFT ANY LOADS WITH ANY DIMENSION GREATER THAN 84 INCHES (2.1 METERS) OR WITH A THICKNESS LESS THAN 3/8" (9.5 mm)

† Air Gap = nonmagnetic separation between magnet's lifting surface and load.

* Lifting capacity affected by peel and thickness. See notes 2 & 4 in the "Important Facts" and "Recommended Lifting Procedures" (See pages 6, 7 and 10).

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NEO-1000 LIFTING GUIDELINES (ROUND BARS & PIPES)

Values shown are for maximum rated capacities when operating instructions and warnings are followed.

VALUES ARE BASED UPON AISI 1020 STEEL

Higher alloy steels and other magnetic materials will require further reductions of these rated capacities (See page 11 for the Guidelines for the reduction of the Rated Lifting Capacities.)

NEVER EXCEED EITHER THE MAXIMUM LENGTH OR WEIGHT SHOWN FOR EACH ROUND BAR/PIPE DIAMETER, WALL THICKNESS & TYPE OF SURFACE CONDITION

Round Bar/Pipe Diameter Inches	Pipe Wall Thickness Inches	TYPE OF SURFACE CONDITION					
		CLEAN & SMOOTH Similar to a Flat (32 micro-inch RMS) Ground Surface .000" Max. Air Gap †		RUST OR SCALE Similar to a Flat Hot Rolled Steel Surface .010" Max. Air Gap † (.254mm)		IRREGULAR OR ROUGH Similar to a Flat Smooth Cut File .020" Max. Air Gap † (.508mm)	
		Maximum Length Inches	Maximum Load Pounds	Maximum Length Inches	Maximum Load Pounds	Maximum Length Inches	Maximum Load Pounds
11" (279mm) MAX. DIAM.	3/8"	31"	117	27"	97	21"	77
	1/2"	39"	182	35"	163	30"	141
	1"	66"	587	58"	522	50"	449
	SOLID BAR	40"	1100	34"	925	26"	720
8" (203mm)	3/8"	46"	117	38"	97	30"	77
	1/2"	54"	182	49"	163	42"	140
	SOLID BAR	77"	1100	65"	925	50"	720
6" (152mm)	3/8"	62"	117	51"	97	41"	77
	1/2"	74"	182	67"	163	58"	140
	SOLID BAR	137"	1100	115"	925	90"	720
4" (101mm)	3/8"	96"	117	80"	97	63"	77
	1/2"	116"	182	105"	163	90"	140
	SOLID BAR	177"	629	177"	629	177"	629
3" (76mm) MIN. DIAM.	3/8"	133"	117	110"	97	87"	77
	1/2"	114"	127	102"	114	89"	99
	SOLID BAR	177"	354	177"	354	177"	354

NEVER LIFT ROUND BARS OR PIPES WITH:
A diameter LESS THAN 3 Inches or
A diameter GREATER THAN 11 Inches or
A wall thickness LESS THAN 3/8" (9.5 mm) or
A length greater than shown in the Lifting Guidelines above
(Absolute maximum length 177" (4500mm)

† Air Gap = nonmagnetic separation between magnet's lifting surface and load.

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INSPECTION AND MAINTENANCE INSTRUCTIONS

EVERY LIFT

Keep the lifting surfaces of the magnet CLEAN, SMOOTH, FLAT, FREE OF RUST and any FOREIGN MATERIALS. Nicks and burrs on the lifting surfaces will reduce the lifting capacity. If burrs occur, they can be removed by fi ling or hand stoning them away. However, care must be taken to protect the neighboring lifting surfaces.

Check the operation of the handle. The handle shaft should move freely when extended and return promptly upon release. If the handle shaft binds and remains extended, **DO NOT CONTINUE TO USE THE MAGNET**. This handle shaft is a safety feature to prevent an inadvertent release of the load.

DAILY

Check the entire magnet's case, lifting surfaces, eyenook, and welds for cracks or other defects. If present, **DO NOT USE THE MAGNET** – Contact a Qualifi ed Person* or O. S. Walker.

Inspect the eyehook for wear or deformation. If the eyehook is deformed and/or the diameter of the eyehook is worn to less than 5/16" (0.313") for the NEO-125, 7/16" (0.438") for the NEO-250 & NEO-500 or 9/16" (0.563") for the NEO-1000 and NEO-2000 it should be replaced.

Check the condition of the Product Safety/Operating Instruction label and the Lifting Guidelines/Specifi - cation label. If they are missing or damaged, they must be replaced. Your magnet was supplied with one (1) Lifting Guidelines label, (1) Operating Instruction label, and one (1) Product Safety Poster.

Inspect all socket head cap screws. Retighten and/or replace if necessary.

WEEKLY

All the lifting surfaces of the magnet should be checked for fl atness and wear. Uneven wear and out of fl atness can greatly reduce the lifting capacity because it will cause a non-magnetic separation (air gap) between the magnet and the surface of the load. Some nicks and burrs will occur on the magnet's lifting surfaces due to normal usage. They should be fi led or ground away with an abrasive stone. However, when the fl at contact area of the entire magnet's lifting surfaces becomes less than 90% of the original total lifting surfaces, **it should be taken out of service and repaired or replaced.**

The NEO-125, NEO-250, NEO-500, NEO-1000 & the NEO-2000 lifting magnets have specially shaped poles to ensure that the full magnetic intensity is directed into the load. Machining of the fl at portion of the magnet's poles that contact fl at plates & bars, will increase the width of the pole contact. This will reduce the magnetic intensity directed into the load. Also, changing the angle of taper of the pole and or the thickness will change the lifting characteristics of the magnet. Attaching or welding other materials to the lifting surfaces in order to reduce wear **should not** be done with this magnet because it will greatly reduce the lifting capacity. Contact O.S. Walker or a Qualifi ed Person* for proper repair instructions. If machining is done to the poles, the magnet must be re-tested for break-away force in accordance with the test described in ASME 30.20.**

Check the entire magnet's case, lifting surfaces, eye hook, and welds for cracks or other defects. If present, **DO NOT CONTINUE TO USE THE MAGNET**. Contact a Qualifi ed Person* or O.S. Walker Co.

Walker Magnetics recommends that your lifting magnet be re-tested for breakaway force each year. This product is manufactrued in accordance with ASME B30.20 safety standard. (For further information refer to Chapter 20-3 Close Proximity Operated Magnets.)**

* **Qualifi ed Person** - A person who by extensive knowledge, training and experience, has successfully demonstrated the ability to solve or resolve problems related to Walker lifting magnets.

** The American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990

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SAFETY OPERATING DO'S AND DONT'S

LIFTING CLAMPS

1 **DO** consult Operators Manual or RENFROE when in doubt. RENFROE factory representatives are available upon request to train and assist in establishing the proper use of RENFROE products.

2 **DO** Lock clamp closed before lifting load. **NEVER** lift with lock in "open" or "lock open" position.

3 **DO** use hooks with a safety latch. **NEVER** use a connection that may release the clamp.

4 **DO** inspect clamp before each lift, follow inspection and maintenance instructions outlined in the manual and use RENFORE replacement parts to assure proper operation of the clamp.

5 **DO** use correct clamp for job. **NEVER** use large capacity clamps to lift light loads.

6 **DO** use an adequate number of clamps to balance load. **NEVER** lift loads that are not balanced.

7 **DO** use clamps within their related capacity. **NEVER** overload clamps.

8 **DON'T** attach clamp directly to crane hook, always use sling between crane hook and clamp.

9 **DON'T** side load with a straight shackle clamp.

10 **DON'T** lift over workmen. **NEVER** lift over Safety Areas or personnel.

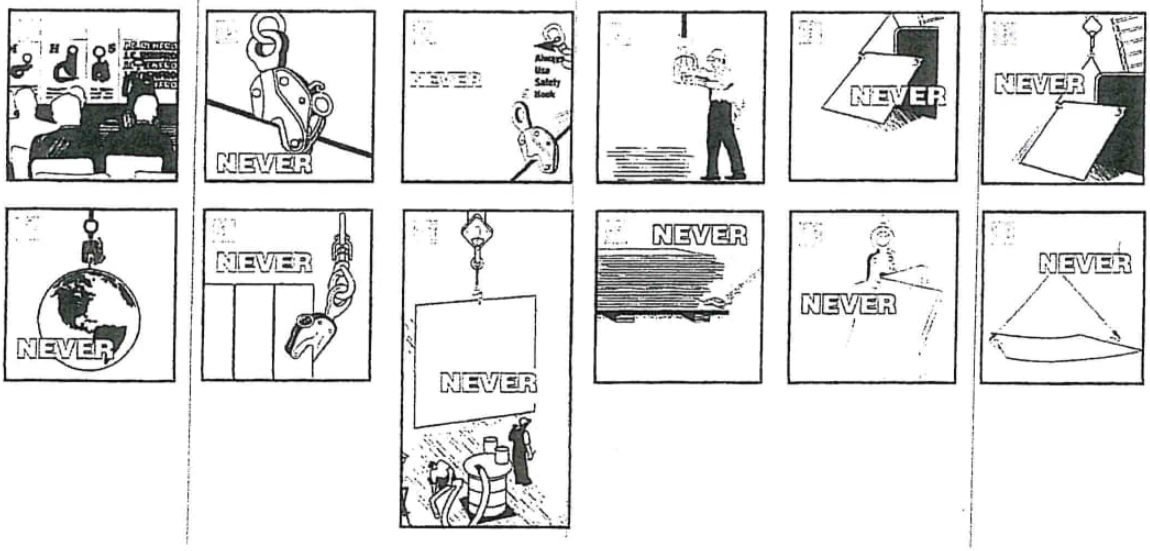
11 **DON'T** misuse. **NEVER** lift plate from bottom of plate stack.

12 **DON'T** rush. **NEVER** lift more than one plate at a time with a vertical clamp.

13 **DON'T** improvise. Always use correct clamp for the job. **NEVER** lift horizontally with a vertical clamp.

14 **DON'T** use a clamp that has been overloaded.

15 **DON'T** alter clamp. **NEVER** grind, weld or modify the clamp in any manner.



OPERATION

Step 1.
Before using any lifting clamp, refer to the Application Section to confirm that the operation to be undertaken is an appropriate application for this product.

Step 2.
Select appropriate capacity and plate thickness. The model designation, capacity and plate thickness are stenciled on each clamp.

WARNING: Never exceed rated capacity or use on plates that are not within the range of plate thickness stenciled on the clamp. Lift only one plate on each lift.

Always use a clamp with maximum plate thickness and rated capacity near equal to the thickness and weight of the plate being lifted.

Step 3.
Inspect clamp before each lift.

WARNING: Do not use if in need of repair.

A. Check the clamp to be certain the Identification and warning tags are present and legible.
B. Do not use the clamp if the tags are missing or illegible
C. Inspect gripping surfaces for wear and defects. Gripping surfaces must be sharp and free of foreign matter.
D. Inspect condition of body for wear, damage and distortion, particularly in the area of the jaw opening.
E. Inspect lifting shackle and all pins for wear and damage.
F. Lock spring must have definite amount of tension when the lock is moved to the "Lock Closed" position without material in the clamp. Lock Pawl must rest on body spacer sleeve.
G. On the model JA and JPA the auxiliary lock button must have a positive spring action that projects it out to engage the lock handle when the handle is moved to the "Lock Closed" position. H. Remove any clamp from service in need of repair.

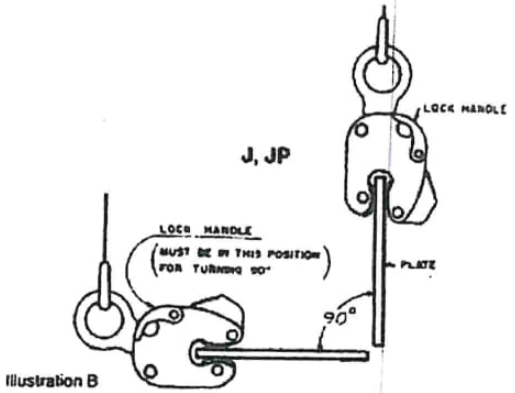


Illustration B

Step 6.
Position clamp on plate being lifted.

WARNING: When using the model J, JP for lifting from horizontal to vertical, the clamp must be positioned with the lock handle always on the topside of the plate when plate is in a horizontal position.

Refer to Illustration B.

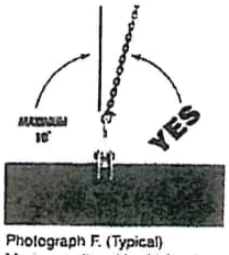
Do not allow inside of jaw opening to rest on edge of plate. Maintain 1/4" clearance. Refer to Illustration C and D, Step 5.

Position clamp so direction of force applied by the crane is in line with the lifting shackle, except JP and JPA refer to De-rated Capacities Chart.

WARNING: Never exceed ten degree side-loading.

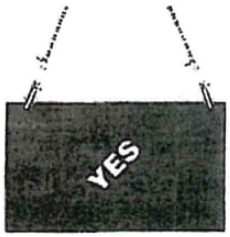
Refer to Photographs E, F, G, H and J.

Photograph E. (Typical)
Sling directly above and in line with the lifting shackle. (J and JA only)



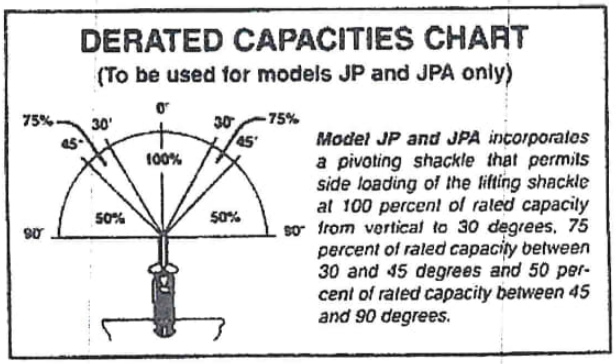
Photograph F. (Typical)
Maximum allowable sideloading. (J and JA only)

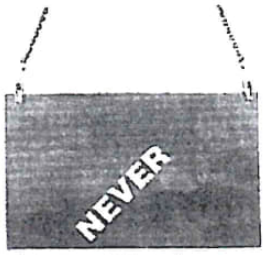
Photograph G. (Typical)
Excessive side loading. (J and JA only)



Photograph H. (Typical)
Clamps in line with sling. (J and JA only)

Step 7.
Make certain the gripping surfaces of the clamp are fully in contact with the plate, and not partially on and off the edge of the plate.





Photograph J (Typical).
(J and JA only)

Step 8.
Place the lock lever in the "Lock Closed" position. Lock Pawl must rest on body spacer sleeve. Spring now exerts force on gripping cam. On model JA, JPA make certain the auxiliary lock button projects from the housing and fully engages the lock handle.

WARNING: Lift only when clamp is in "Lock Closed" position.

Step 9.
Commence lift.

WARNING: The operator should position himself away from the fully clear of the member to be lifted. Plates being turned have a tendency to slide. Do not commence lift until all personnel are clear of the area of the lift. Never stand under or near a member being lifted, lowered or moved.
Refer to Photograph L.

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Maintenance Program for Renfroe Clamps Manufactured from Steel

The severity of service to which the clamp is subjected in the work place determines the frequency and type of inspection procedure required for the clamp. The frequency and type of inspection is determined by the clamp owner. Renfroe acknowledges the ASME B30.20 safety standard which sets forth minimum inspection requirements for "Below-the-Hook" lifting devices and the Renfroe Recommended Inspection Schedule meets and/or exceeds the ASME inspection recommendations.

Before using a clamp operators should be trained by a qualified person to visually inspect a lifting clamp that will include but not be limited to the following:

Every lift Inspection:

A visual inspection by the operator before and after each lift made by the clamp.

A. Check the clamp to be certain the Identification and warning tags are present and legible.
B. Do not use the clamp if the tags are missing or illegible
C. Inspect gripping surfaces for wear and defects. Gripping surfaces must be sharp and free of foreign matter.
D. Inspect condition of body for wear, damage and distortion, particularly in the area of the jaw opening.
E. Inspect lifting shackle and all pins for wear and damage.
F. Lock spring must have definite amount of tension when the lock is moved to the "Lock Closed" position without material in the clamp. Lock Pawl must rest on body spacer sleeve.
G. On the model JA and JPA the auxiliary lock button must have a positive spring action that projects it out to engage the lock handle when the handle is moved to the "Lock Closed" position.
H. Remove any clamp from service in need of repair.

BODY

A. Inspect welds for fractures. RENFROE recommends a dye penetrant or similar method of detecting indications on the clamp. If an indication is found it may be necessary to use a magnetic particle, ultrasonic or similar methods for determining damage to the clamp or components. Inspect all pin holes for wear and elongation.
B. Inspect inside jaw opening for displaced metal and distortion.
C. Inspect clearance of lock handle assembly mounting hole for wear. Clearance with shaft of lock handle assembly should be minor. Mounting holes that are worn, oversized may cause the lock handle to malfunction. Refer to exploded view.

WARNING: Replace clamps containing fractures, elongated pin holes, worn or elongated swivel jaw mounting hole, distorted jaw openings, clamp bodies with worn and rough shackle pin guide slots and jaw opening with displaced metal.

Step 4.

LIFTING SHACKLE J/JA-1

A. Inspect lifting shackle eye for elongation and wear at point where eye engages sling attachment.
B. Inspect shackle pin hole for wear and elongation.
C. Inspect shackle body for bending. NOTE: (JP,JPA) Inspect shackle pivot pin, mounting holes and retaining spiral pins. Elongated shackle eye indicates overloading. Elongated shackle pin holes indicate wear and possible overloading. Bent shackles indicate excessive side-loading.

WARNING: Replace shackles that are bent, show excessive wear at eye, and have elongated eye and shackle pin hole.

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Do's & Don'ts of Installing & Using Hoist Rings

DO:

- **ALWAYS READ SAFETY PRECAUTION PAGE PRIOR TO USE OR INSTALLATION.** (Safety Precaution included with every hoist ring.)
- **ALWAYS INSPECT THE HOIST RING BEFORE EACH USE.**
- Regularly inspect all hoist ring parts.
- Always tighten the screw to the recommended torque value.
- Always make sure that the hoist ring is free to pivot and swivel in all directions.
- Always choose a hoist ring with the proper load rating. See the "Actual Load" equation on the back page to help you choose the appropriate hoist ring.
- Always make sure that the bushing of the hoist ring sits flush against the object being lifted.
- Install hoist rings in materials that have a tensile strength of at least 80,000 psi.
- Always make sure the thread engagement is at least 1.5 times the diameter of the hoist ring screw.
- When installing a hoist ring in a through-hole with a nut and washer, make sure to use a Grade 8 nut that has full thread engagement.
- Consider periodic load-testing as an extra precaution.

DON'T:

- **NEVER EXCEED RATED LOAD.**
- **NEVER APPLY SHOCK LOAD.**
- Never use a hoist ring that you believe is damaged.
- Never use a hoist ring that has damaged threads on the screw.
- Never use a hoist ring in an application where it does not pivot and swivel in every direction freely.
- Never use a hoist ring that is not tightened to the recommended torque.
- Never replace the components of the hoist ring with anything other than parts recommended by Actek.
- Never use a hook larger than the diameter of the hoist ring opening.
- Never shim or use washers between the hoist ring and surface of object being lifted.

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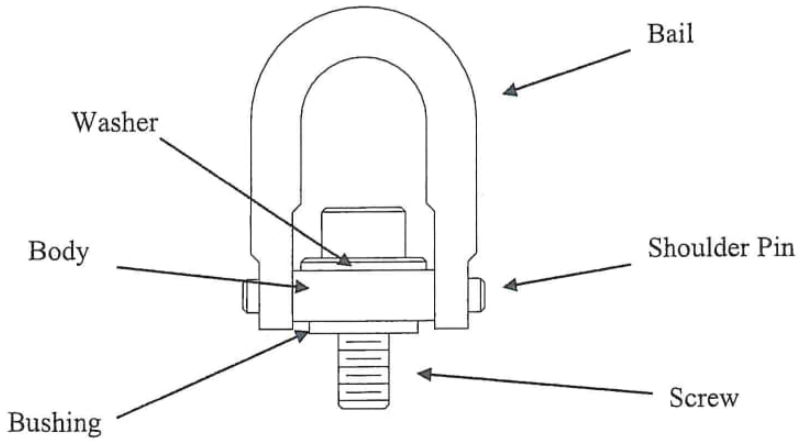
Hoist Ring Inspection & Maintenance

ALWAYS INSPECT THE HOIST RING BEFORE EACH USE. MAKE SURE:

- The screw is tightened to the recommended torque.
  - If the screw is not tightened, the threads may be stripped on a vertical lift.
- The bushing of the hoist ring sits flush against the object being lifted.
  - This ensures that the recommended torque puts the proper preload onto the hoist ring allowing the hoist ring to reach its full 5:1 safety factor.
- The hoist ring is free to swivel and pivot in every direction.
  - If the hoist ring binds up in any direction, it should be removed from service.
- There are no signs of corrosion.
  - This can cause deterioration to the hoist ring material allowing for fatigue or cracking to take place. Corrosion can also prevent the hoist ring from pivoting and swiveling freely.
- There are no signs of wear or cracks, especially on the screw, shoulder pins, and bail.
  - Damage or wear on the screw head, shoulder pins, or bail may be an indication that the hoist ring is coming into contact with something during use. This should be avoided as such contact can cause binding and shock loads which exceed the rating of the hoist ring.
- The shoulder pins are secure and do not rotate or come loose.
  - This can be checked by using pliers to rotate the shoulder pins by hand. If the shoulder pin does rotate, it is no longer securely in place and could come loose causing the hoist ring to break.



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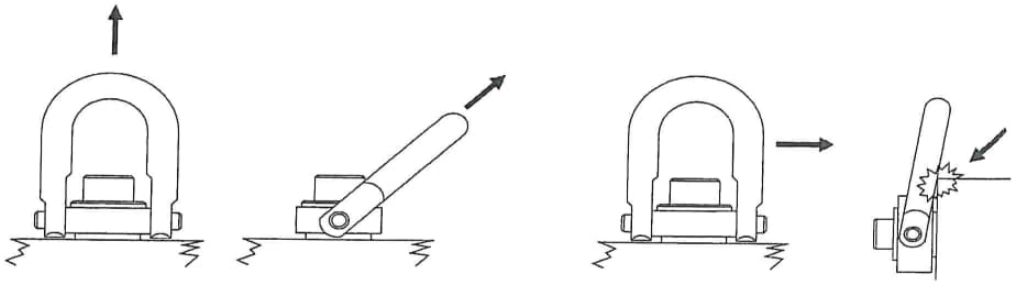


RIGHT RIGHT WRONG WRONG

Important: The load on each hoist ring is not simply total weight divided by the number of hoist rings. The resultant force can be significantly greater at shallow lift angles and with unevenly distributed loads. See the example and chart below.

L = Load experienced by hoist ring
W = Total weight = 2,000 Lbs.
N = Number of hoist rings = 4
A = Lifting angle

$$L = \frac{W}{N \sin A}$$

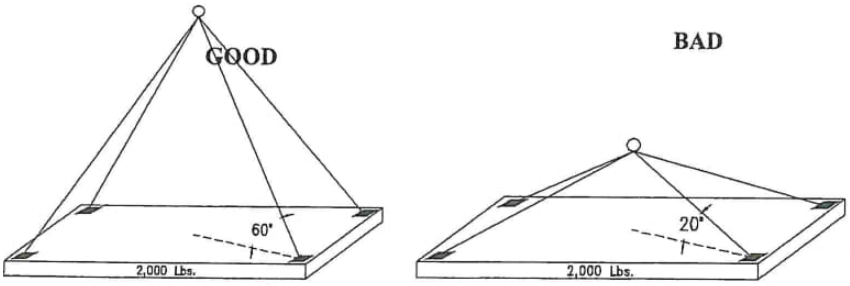
If A = 60:

$$L = \frac{2000}{4 \sin 60} = 577 \text{ Lbs.}$$

If A = 20:

$$L = \frac{2000}{4 \sin 20} = 1{,}462 \text{ Lbs.}$$

Lifting Angle (Degrees)	Number of Hoist Rings	Weight of Load (Pounds)	Actual Applied Load on Hoist Ring (Pounds)
90	4	2,000	500
80	4	2,000	510
70	4	2,000	535
60	4	2,000	580
50	4	2,000	655
40	4	2,000	780
30	4	2,000	1,000
20	4	2,000	1,465



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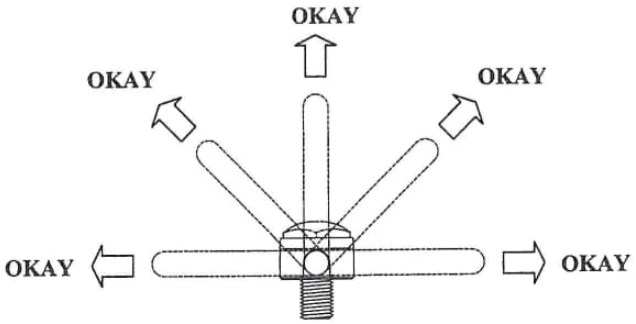
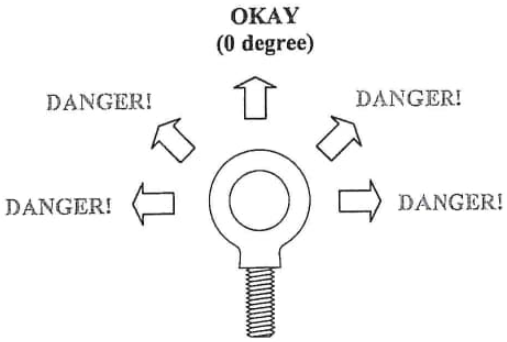
SWIVEL HOIST RINGS
VS.
SHOULDERED EYEBOLT



Swivel Hoist Ring
- same load rating at any angle



Shouldered Eyebolt
- load rating only good for zero degree

Eyebolts have been around for over 100 years and have been doing a good job when used properly. Properly, meaning the direction of the load must be at zero degree. If the load shifts or the direction of loading on the eyebolt is as much as 10 degrees off the zero line of force, the result is a bent eyebolt. **When you bend the eyebolt, it is broken!**

You can't see the break most of the time. If you examine the bent area using x-ray, you will find the damage. This will lead to **failure if the eyebolt** is used any longer.

Swivel Hoist Rings are designed for lifting at any angle because they can swivel 360° and pivot 180°. Therefore, the rated load remains the same, regardless of the angle of force. As a result, you **increase safety and peace of mind.**

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2 step inspection and safe use guidelines for Cortland Plasma® 12-Strand and 12x12

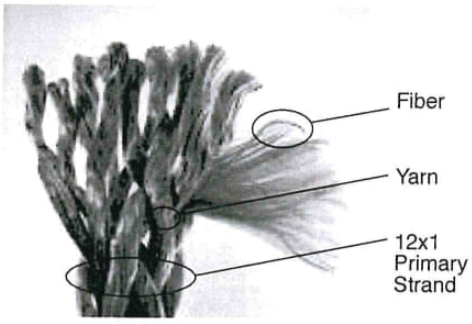
Step # 1 – Inspect the rope

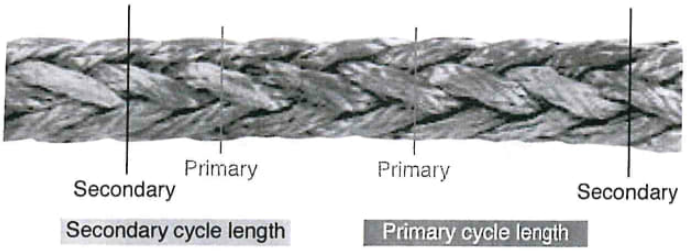
- Cuts; in strand(s)
- Overall abrasion of rope
  - Internal
  - External
- Areas of heat or compression damage
- Braid diameter size inconsistencies
- Glazed or melted fiber

Step # 2 – Inspect bearing surfaces of the rope

- Ensure all contact curvatures are clean, free of debris
- Wear protection
  - Begin at bearing surface "eye" and work your way down the rope
  - Inspect wear protection for integrity; cuts, snags, compression, abrasion, diameter changes
    - If damage is noticed, further inspection of the core Plasma® is required

Inspecting Plasma® Rope





6 or more cut yarns within a **Secondary** cycle length—must repair or retire
3 or more cut yarns within a **Primary** cycle length—must repair or retire rope

External

Internal

Removal from Service Criteria

The following is an inspection guideline for fiber ropes and elements that—if occur—should dictate the fiber rope be removed from service.

	Condition	Remove from service
1	**Rope splice integrity damaged; e.g. tucks pulled out**	√
2	**Distortion of construction/Diameter inconsistency**	√
3	**Internal or external abrasion** Melted or fused yarns and strands, powdery or brittle fibers	√
4	**Cuts (fiber, yarn and strands)** 12x12 construction: Two (2) or more cut adjacent yarns in a strand, or 1/2-cut strand or more 12x1 construction: 1/2-cut strand or more	√
5	**Reduction in overall diameter of rope** Localized diameter area reduction; stiff and flat areas on rope unable to be flexed back into shape	√
6	**Heat damage** Localized areas of fused and melted fibers	√
7	**Discoloration caused by unknown source** Localized areas that cleaning cannot repair	√

Types of Damage

Distortion
Reference retirement criteria #2

Cut Strand
Reference retirement criteria #4

Heat Damage
Reference retirement criteria #6

Discoloration and Burns
Reference retirement criteria #6–7

Abrasion level 1: normal wear—rope is showing normal wear, internal and external yarn shows light fuzziness and compression.

External

Internal

Abrasion level 2: normal wear—rope has more abrasion internally and externally, some slight total yarn volume loss, but rope is still good for use.

External

Internal

Abrasion level 3: normal wear—heavy internal abrasion, compression and diameter change. Carefully inspect for multiple cut yarns and full strands.

External

Internal

Abrasion level 4: caution—heavy internal abrasion and heat compression fusion of yarns. Also loss of fibers due to abrasion and cutting. Rope has probably lost a percentage of full new-rope strength. Carefully inspect for cut strands.

External

Internal

Abrasion level 5: remove rope from service—heavy external and internal heat compression, yarn volume loss and overall diameter size loss. Rope has lost a major percentage of its full new-rope strength.

External

Internal

Lifting Slings Made From Plasma® 12x12 Ropes

Plasma® 12x12 ropes are excellent lightweight lifting tools providing reliable, safe and cost-efficient alternatives to traditional wire rope slings. When properly selected to meet the job requirements, e.g. strength, lengths, chafe protection, etc, and if used within Work Load Limit (WLL) standards, they can provide consistent performance over many safe and reliable lifts.

For information on selection, use and care of Plasma® 12x12 ropes slings please refer to the Plasma® Rope Sling – Selection, Usage and Care Guidelines.

The intention of this publication is to provide a visual and verbal inspection guide to rope sling users. The information is specific to Plasma® rope slings, not all synthetic rope slings. The process of selection, use and inspection/retirement of using Plasma® 12 strand or 12x12 rope slings, is a serious subject. Anytime a rope or sling is handled and used in a lifting operation the potential for damage and injury is possible. Cortland always recommends the following:

1. Adherence to any certification standards on slings and their use as determined by the end-user for the job; e.g. ASME B30.9 and others
2. Training of all personnel who use the products; selection, sling properties, effects of environment, rigging practices and inspection/retirement guidelines

Rope slings such as Plasma® 12x12 will not perform exactly like wire rope slings in use. Synthetic ropes, while offering weight and strength advantages typically will be less rigid in construction and more flexible. They are also not constructed using wire rope design guidelines. Therefore, use of wire rope inspection guidelines on synthetic rope slings is not recommended. Because of this difference a careful review of Plasma® 12x12 inspection and retirement guidelines is very important for safe use.

Plasma® 12x12 Ropes
Plasma® 12x12 HMPE (High Modulus PolyEthylene) fiber rope slings are produced in a torque-free braided construction. Plasma® 12x12 is a 12-strand rope in which each of the strands is, in turn, a 12-strand construction made with Cortland's Plasma® fiber.

Rope Construction

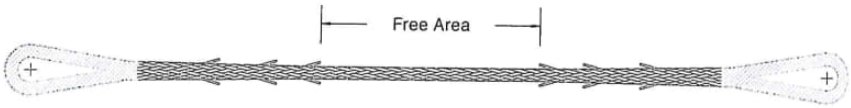
New section of Plasma® 12x12

Plasma® rope yarn

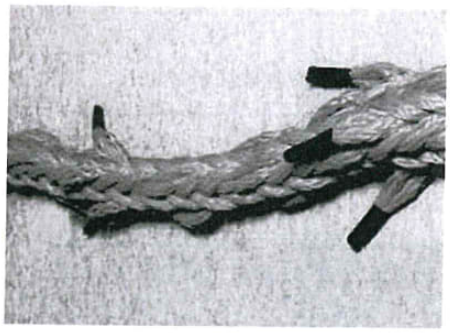
Plasma® rope strand
(12 strand construction)

Rope Construction cont.
Plasma® 12x12 rope slings are offered in two basic sling fabrications; single leg eye-and-eye sling and an endless grommet sling. In both slings, manufacturer specified end or eye termination splices are installed to provide safe and reliable performance. In a vertical lift operation, a new endless grommet sling is rated by Cortland at 1.65 times the new rope sling strength of an eye-to-eye sling. The choice of which sling fabrication is appropriate to a lift is the decision by the end-user designated person of responsibility, typically the lifting engineer.

Figure 2: single leg eye-and-eye sling



- Recommended D:d ratio of eye size is 3:1
- Tapered area from the "base" of the eye splice to the end of last tuck reduces from approximately 1.5 times the original rope O.D. to the nominal size
- Area or clear span between the bases of tapered tuck splices is recommended (see Rope Sling Manual for details)
- Cortland's approved eye splice is the Moran 5/4/3 tuck splice
- MBL rating of eye-and-eye Plasma® rope sling includes splice and does not require further reduction in a vertical pull



Moran 5/4/3 Tuck Splice close up of tails and tuck area below eye splice

Figure 3: endless grommet sling with end-to-end splice

- Typical endless grommet rope sling has one end-to-end splice on one side only
- Eyes are typically formed by lashings. Plasma® endless grommets can be lashed together in selected areas (e.g. every 2M) for ease of rigging/handling
- Size of the middle of the end-to-end splice is typically 1.5 times the single leg O.D.
- Cortland approved end-to-end splice is Moran 5/4/3 tuck splice

Frequent and Periodic Inspection

It is highly recommended that a thorough inspection of all new, modified or repaired Plasma rope slings be conducted by a qualified responsible person before use. The person must h knowledge, training and experience of safe lifting operations & tools.

Because of the large variety of lifting uses Plasma® 12x12 rope slings are subjected to, it is also recommended to use a conservative approach to evaluation. Residual strength in a rope is subject to many considerations and a visual inspectic only provide a subjective estimate on retained strength. Without residual destructive testing backed by lifting history, a ro inspector can only provide estimates of its viability for future use through careful visual inspection and evaluation.

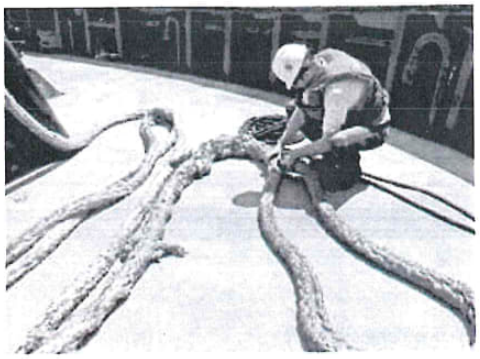
The following inspection information is designed to ensure the safe and reliable use of a Cortland sling. (It is partially or c from the ASME B30.9-2006, Chapter 9-4 – Synthetic Rope Slings: Selection, Use and Maintenance standard and US Cc Institute International Guideline, CI 2001-04 First Edition, Fiber Rope Inspection and Retirement Criteria).

Frequency of inspection
Visual inspection of sling by user or designated person each day or shift the sling is used. If the sling shows damage or i questionable in appearance, it should be removed from service until approved by a qualified person.

Periodic inspection
A designated person should perform a complete inspection on the sling at least once a year. This inspection should cove length of the sling including splices, end termination hardware, chafe gear and fittings.

A. More frequent inspections by a designated person may be warranted if the following conditions are prevalent
   1. Severity of service conditions
   2. Complexity and nature of lifts being made
   3. Frequency of use
   4. Previous experience gained in the service life of the sling used in similar circumstances
B. A program of inspection procedures and record-keeping is recommended

Methods of inspection:



Lay out line or sling for thorough visual inspection

Used Plasma® 12x12 with protruding splice tails intact

Methods of inspection cont.

Visual inspection for construction changes, excess twist in rope

Inspect for excess surface wear on rope

Inspect to make sure certification tagging is intact and readable

Inspection of hollow core area of Plasma® 12x12 rope. In picture above, no internal wear is observed. Exterior yarn abrasion is noted as "light" and not a problem

Visual inspection of interior yarns shows wear from abrasion or cutting

Visual inspection of yarns on rope in this sample shows heavy cutting on two adjacent strands, but only moderate surface abrasion (darker areas on the surface of the strands)

Inspection Procedures

The following list is recommended for the user or inspector on Plasma® rope slings.

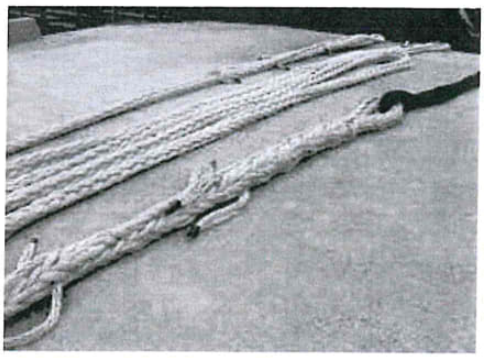
1. Entire length of sling should be laid flat, under hand tension, on smooth surface for visual inspection
2. Inspection of tagging integrity and legibility of information on the tag must be conducted
3. Visual inspection must be conducted with the following key items evaluated; potential areas of concern should be marked or tagged for further inspection
   A. Quality and condition of rope splice terminations
   B. Condition of external chafe gear protective coverings
   C. Condition of related hardware; e.g. thimbles
   D. Kinks, excessive twist or distortion of rope construction; e.g. variations in "pick" or braid helix angle within the rope length, or stiffness
   E. Abrasion wear on surface yarns, strands and entire body of rope. Also inspect for integrity of internal fibers and yarns
   F. Cuts to yarns and strands
   G. Reduction in overall diameter of rope possibly caused by
      - Overloading
      - Excessive abrasion
      - Compression and compaction
      - Excessive sustained heat causing creep (cold flow)
   H. Damage caused by external or friction heat; fiber melting
      - Discoloration
   I. Chemical contamination

Inspection Points Pertinent to Plasma® 12x12 Rope Slings

Quality of Splice: Cortland uses a Moran 5/4/3 tuck splice procedure to make Plasma® 12x12 splice terminations. The splice consists of a short buried section at the base of the eye, followed by a series of tucks that pass over and under strands in the body of the rope.

Splice tails are secured with tape or material to retain a "new look" when originally spliced. However, during handling and use, the tape or covering can wear away allowing the ends of the tucking strands to become loose or frayed. This should not be a worry and will not affect splice integrity. These tucks and buried areas provide the strength rating for the rope sling and therefore their integrity is of primary importance. Splice terminations can be repaired with re-splicing performed by an authorized trained splicer. A proper "re-splice" will offer 100% of the remaining strength of the rope sling.

Quality of Splice cont.

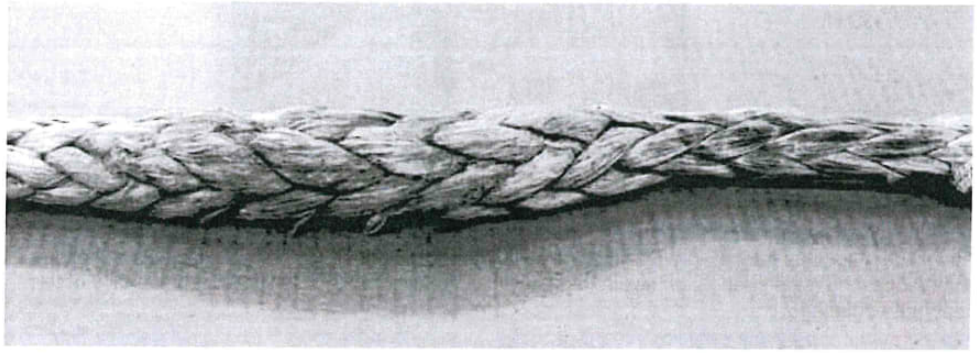


Moran 5/4/3 tuck splice Plasma® 12x12 – which is spectacle-spliced into a pendant. Note exposed "tails" on Moran 5/4/3 splice

Used piece of Plasma® 12x12 line with abrasion wear on splice area. Note the exposed "tails" which no longer have tape securing the ends. This is an example of a used "floppy" tail

Standard eye chafe protection gear on Plasma® 12x12 slings is Cortland's SX coated braid, which offers the high abrasion and cut resistance of HMPE fiber combined with light weight and no water absorption. Some customers may opt for other chafe protective coverings such as JHRG woven HMPE fabric gear, or Cordura® sleeves. These protective sleeves are designed to extend the service life of a sling by mitigating abrasion, cutting, and heat damage. All Cortland chafe sleeve options do not contribute to the rated rope sling strength. Therefore, they can be replaced when cut, torn or worn. During sling inspection, cover chafe protection should be pulled back or removed to allow visual inspection of the rope strength member.

Distortion of Rope Construction



Plasma® 12x12 rope slings are manufactured with balanced yarn and strand construction. Distorted and/or damaged yarns and strands usually occur in most applications. Ropes exhibiting areas of severely distorted construction or yarn damage should be repaired or retired from service.

It is also very important that the operators attempt to determine what caused or continues to cause rope construction distortion or yarn damage in the application. It is likely that modifications in hardware, handling or use of the Plasma® rope may mitigate or eliminate future problems.

Distortion of Rope Construction cont.

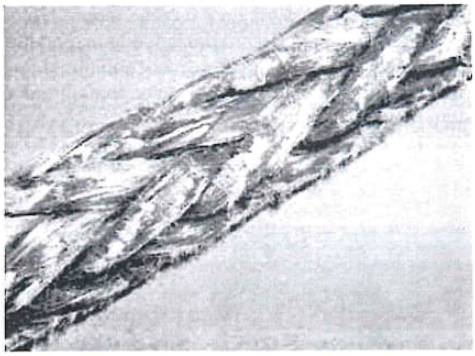
Unequal loading, overloading, shock loading, "pinching" or contact with angled surfaces may cause distortion to the original construction of the rope. Inspection of the rope sling to investigate possible areas of construction distortion should look for two main areas:

1. Twisted strands within the braid length
   A. These strands exhibiting twist should be repaired or the sling should be removed from service
2. Visual changes in "pick" or helix braid angle of the braid
   A. Measuring the areas of suspected deviation in pick angle should take place. These areas should exhibit no more than +/- 5% overall rope length.

Rope distortion may also be an example of creep or cold flow. This is permanent elongation of the fiber and rope. Creep rates depend on the type of material, time, temperature and load relative to breaking strength.

1. Creep is typically not a factor with HMPE rope slings unless long sustained high loads are in effect.
2. Ropes that fail due to creep often retain relatively high strength until they are very close to failure; thus the need to check for operating conditions that may cause excessive creep. **When used at appropriate WLL, high modulus synthetic fibers will not exhibit creep over the normal course of operations.**

Abrasion Wear



Normal low exterior wear; "fuzziness"

Normal low exterior wear; fuzziness but no cut strands

While HMPE is one of the most cut-resistant synthetic fibers available, metal can prove to be stronger than Plasma® in a long duration abrasion event. Signs of excess abrasion include strand pull-outs, heavy fuzzing, cut strands in a single area, and localized bunching. It should be noted that normal light fuzzing of the Plasma® rope surface is to be expected in normal use. This light fuzzing does not reduce the rated strength of the line, and actually creates a protective layer on the surface of the rope that helps to prevent further damage.

Inspection methods for abrasion should include the following:

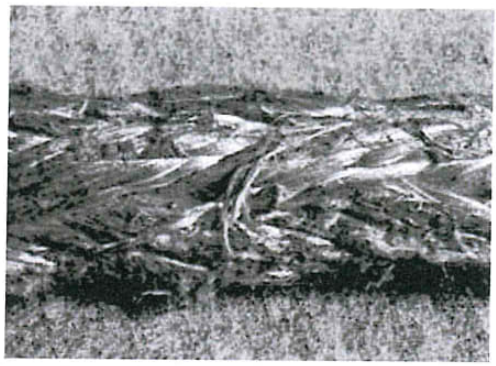
Exterior inspections

1. Measure the outside diameter of strands that exhibit abrasion that appears excessive. These strands should not have other damage, such as cutting, that would further affect the strength.
2. Look for broken exterior yarns
   A. Broken exterior yarns can be caused by normal abrasion, wear against rough or angled surfaces, and environmental exposure to chemicals or sunlight (UV).
   B. Note the type, location and level of damage such as number of broken or noticeably damaged yarns, depth and length of abrasion or wear spots, frequency and spacing of damage, if damage is one strand or multiple strands.
3. Estimate the loss of strength by comparing abraded or cut fibers as a percentage of the rope or undamaged strand diameter.

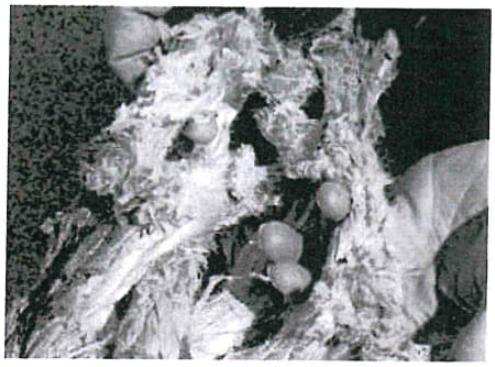
Inspection Points

Interior abrasion inspection

1. Open the rope construction to view internal yarns and strands
   A. Note – Plasma® ropes include a water-based urethane coating to provide abrasion resistance. This coating may lose pigmentation over time and appear lighter in color.
2. Check for the ingress of dirt and particulate matter as well as fluids; e.g. oil or grease.
   A. These items may cause internal abrasion and a determination of future use must be made. Note – the rope can be washed (cleaned) with fresh water if necessary.
   B. Powdery areas or fused yarns internally are probably caused by excessive cycle loading, overloading and/or internal yarn against yarn abrasion. A rope exhibiting these conditions should be retired.



Excessive **exterior** abrasion wear



Excessive **interior** abrasion wear

If the original size or volume of a Plasma® 12x12 rope sling appears to have been reduced by 25% or more either locally or over it's entire length, the rope sling must be retired from service.

Cut or Snagged Yarns and Strands

Repeated lateral abrasion wear against sharp edges can cause the primary type of damage to Plasma® 12x12 rope slings; cut yarn and strands. Partial cutting of yarns and/or strands can create an imbalance in load-sharing, leading to significantly lower strength.

Cut adjacent strands; from its look it may have been cut by a "crossing" wire rope

Cut adjacent strands probably caused by rubbing against a sharp corner or edge of metal

Cut or Snagged Yarns and Strands cont.
As a general rule of thumb during inspection:

1. Cut yarns do not have as much impact as cut strands; however, all cuts should be thoroughly inspected to determine the severity of the cut.
2. While cut rope yarns may be a problem, a cut strand is a larger issue for rope integrity
3. One strand cut 50% or more is cause for retirement
   A. Plasma® 12x12 constructions may be repaired through a strand splice. Proper re-splicing by an authorized individual is required. A 12x12 rope with a strand re-splice should be down-graded in strength by at least 15%

Non chafe protected areas of Plasma® 12x12 may exhibit a yarn or strand snag. A snagged yarn or strand is not cause to remove the sling from service unless the affected strand cannot be "worked" back into the rope construction by hand flexing and compressing the rope.

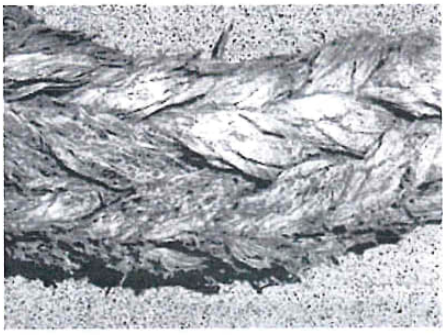
Overall Diameter; Changes to Original Size and Construction of Rope

Unlike relatively rigid wire rope constructions, Plasma® 12x12 rope slings may change shape when under load or bent, against contact surfaces. Synthetic fiber ropes can change shape; however this typically should not be a reason to discard the sling unless the change of shape is permanent and detrimental to strength rating and performance.

New, non-proof loaded or relaxed (in storage), Plasma® 12x12 slings may exhibit outside diameters larger than published nominal sizes. Under load, these ropes will reduce size to proper O.D.

Under normal loading while not compressed against rigid surfaces, a Plasma® 12x12 rope sling will form a round or slightly oval outside diameter. When not under load, a pinched or compressed area of the rope can usually be "worked" or hand-flexed back into it's original shape. Areas of the rope sling that cannot be worked or hand-flexed back into original shape and size, may be an indication of several factors including overloading, excessive cycle-loading, and yarn or strand fusion. These slings must be retired from service.

Overall Diameter Size; Changes to Original Size and Construction of Rope



Excessive abrasion wear – volume of total rope in selected area is substantially reduced

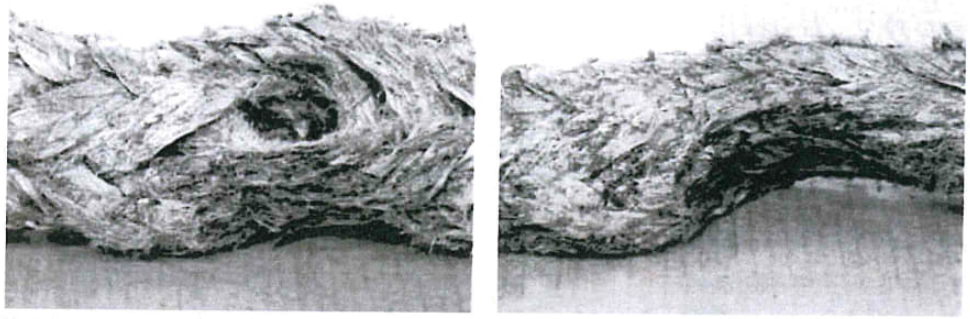
Severe case of compression and construction distortion. Typically this occurs on the bottom layer of a Plasma® winch line compressed against its barrel or flange. If this occurs it is recommended that the severely compressed/ distorted area be cut out before further use.

Excessive abrasion wear – volume of total rope in selected area is substantially reduced

Inspection Points

Heat Damage

Each synthetic fiber has a critical temperature at which it softens permanently, affecting the initial fiber properties, particularly strength and elongation. Plasma® is a high modulus polyethylene fiber. It will gradually begin to lose strength at temperatures above approximately 65°C/150° F. HMPE has a zero-strength temperature around 150°C/297°F. **Long term exposure above 60°C/140°F is not recommended.**



Heat damage on Plasma® rope likely caused by friction heat or slippage. Cover yarns are glazed and fused together. Inspection of the core of the rope on left also shows internal heat. Rope area must cut out or rope retired from service.

Users of Plasma® rope slings need to be aware of high ambient, reflected heat or friction heat in applications, as well as proximity to localized heat sources such as flame or welding that could damage the sling. If it is anticipated that heat will be an issue in the use of a Plasma® lifting sling, care should be taken to protect the rope from high temperatures if at all possible. If this is not possible, the may be necessary to use an alternative high modulus synthetic fiber, such as an aramid, that is more heat resistant.

1. The size and mass of ropes in larger diameters, e.g. 30mm +, may mitigate the effect of heat as it is difficult to transfer exterior heat into the interior of the rope. Typically, the center of a Plasma® rope does not experience heat damage in normal applications.
2. Signs of temperature damage include melting, fused strands and significantly reduced diameter. The fused strands should not be confused with fiber that has been tightly compacted or compressed while under load.

Discoloration

Localized or extended areas of discoloration on Plasma® 12x12 rope slings may be a cause for retirement if they are caused by chemical contamination or excessive build-up of dirt, grease or oil-type fluids. (Please see Cortland Plasma® 12x12 Rope Sling Selection and Use guidelines for a full chart of damaging chemicals).

Heavily discolored Plasma® rope from mud, dirt and fluids. Interior is checked to insure no internal yarn damage.

Rope slings should be inspected for localized areas of:

1. Inflexibility
2. Yarn brittleness, abrasion wear or deterioration
3. Discoloration

In sling lifting applications where there is high potential for the ingress of sharp particulate matter or grit inside the rope, proper chafe protective wear material must be used. Internal yarn and strand cutting caused by grit and dirt in the rope can seriously lower the performance of the sling. If necessary, Plasma® rope slings can be washed; however it is recommended that only fresh water be used and not high pressurized mechanical cleaning. Washed ropes can be dried easily or used immediately.

Grease and oil deposits, of themselves, do not damage Plasma® rope slings. However, they can trap dirt and grit that may damage the rope during use or storage.

Repair of Plasma® 12x12 Ropes

A unique feature of Cortland's 12x12 construction is its ability to be repaired by replacing and re-splicing in a new replacement strand. While the original strength and balance of the rope construction will not be as perfect as in it's original production form, strand replacement is effective for repairing the rope sling when the process is deemed acceptable by a designated responsible person.

1. Re-splicing of Plasma® 12x12 rope for lifting sling operation must be conducted by an authorized person. Detailed strand re-splicing guidelines are available from Cortland.
2. Re-spliced Plasma® 12x12 rope slings must be newly tagged with required identification information per certification agency. Re-tagging is done by the repairing agency.
3. Knotting of Plasma® 12x12 rope slings is not allowed under any circumstances.

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Recertification

Recertification and Use of Modified or Repaired Plasma® Rope Slings

The choice of re-using a Plasma® rope sling must be made after careful inspection and maintenance of the sling and a decision by a qualified person as to the suitability of the sling for use on another lift.

Plasma® rope slings have been successfully used on multiple project lifts, stored for several months or more, inspected, repaired, possibly modified in length, re-spliced and recertified after proof-loading. The Plasma® HMPE fiber has excellent long-term fiber fatigue resistance properties and the majority of rope slings used at or below customer selected or classification society certified WLL, have several years of usual service life and performance. The following scheduled list is highly recommended to end-users seeking future use of Plasma® rope slings.

Retirement

Retirement Criteria

A summary guide for retirement of Plasma® 12x12 rope slings is offered below. Plasma® 12x12 rope slings meeting any one of the listed criteria, and not being able to be repaired or used after repair should be immediately retired from future use.

Performance properties, such as strength and length tolerances, that are altered or modified after sling repair may disallow the particular repaired sling from service in lifting. Safe rigging practices using used or repaired slings are the responsibility of the responsible qualified person for the lift.

	Condition	Retire
1	**Tagging illegible or missing**	✓
2	**Rope splice integrity damaged; e.g. tucks pulled out**	✓
3	**Distortion of construction / Diameter inconsistency**	✓
5	**Internal abrasion** Melted or fused yarns and strands Powdery or brittle fibres	✓
6	**Cuts (fiber, yarn and strands)** Two (2) or more cut adjacent yarns in a strand One cut strand	✓
7	**Reduction in overall diameter of rope** Localized diameter area reduction Stiff and flat areas on rope unable to be flexed back into shape	✓
8	**Heat damage** Localized areas of fused and melted fibres	✓
9	**Discoloration caused by unknown source** Localized areas that "cleaning" cannot repair	✓

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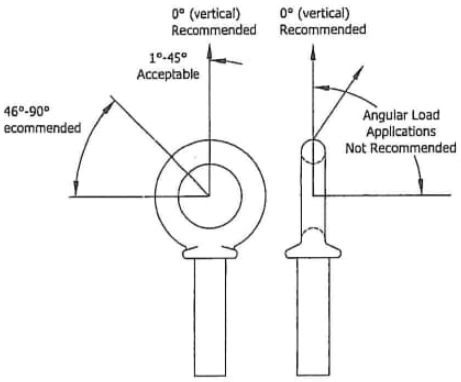
ACTEK® MFG . & ENG. INC.

SHOULDER EYEBOLT SAFETY PRECAUTIONS

WARNING: PRIOR TO USING ANY HOIST RING, PLEASE READ THE FOLLOWING FOR PROPER INSTALLATION AND USAGE.

- **DO NOT** work, stand or crawl around the load of the Eyebolt. Ensure a safe distance from the load.
- **DO NOT** use wrenches, crowbars, etc. to tighten Eyebolts. Hand tightening is recommended.
- **DO NOT** use a single Eyebolt to lift a load that can rotate. Safety Swivel Hoist Rings are recommended for such loads.
- **DO NOT** force hooks or any other fittings into the eye; they must fit freely.
- **DO NOT** exceed the Rated Capacity.
- **DO NOT SHOCK LOAD EYEBOLTS.** Gradually increase lifting of the load to minimize load-shock.
- **DO NOT** weld Eyebolts, or perform any weld-repair on Eyebolts.
- **DO NOT** machine Eyebolts on the shank or shoulder to achieve proper seating.
- **DO NOT** expose Eyebolts to extreme environmental conditions, as they may adversely affect the Rated Capacity.
-

Rated Capacities



Shoulder Eyebolt Rated Capacities

Size	0° Lbs.	45° Lbs.	46° +
1/4	500	125	SAFETY SWIVEL HOIST RINGS RECOMMENDED
5/16	900	225	
3/8	1,300	325	
7/16	1,800	450	
1/2	2,400	600	
7/16	3,000	800	
5/8	4,000	1,000	
3/4	5,000	1,250	
7/8	7,000	1,750	
1	9,000	2,250	
1 1/8	12,000	3,000	
1 1/4	15,000	3,750	
1 1/2	21,000	5,250	
1 3/4	28,000	7,000	
2	38,000	9,500	
2 1/2	56,000	14,000	

Rated Capacity Guidelines

- The minimum threaded shank length of Eyebolts must be one thread diameter to attain the rated capacity.
- No greater load should be applied to an Eyebolt than the Rated Capacity listed.
- Angular lifts significantly reduce Shoulder Eyebolt Rated Capacities. Shoulder Eyebolts should not be used for angular lifts greater than 45°; **Safety Swivel Hoist Rings are recommended for such applications.**
- Plain Eyebolts are not recommended for angular load applications. **Safety Swivel Hoist Rings are recommended for such applications.**

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ACTEK® MFG . & ENG. INC.

LIFTING DEVICE SAFETY INFORMATION

Actek® Mfg. & Eng., Inc. products are intended for use only by trained, qualified and experienced workmen. Misuse of any Actek® product or lack of supervision and inspection can lead to serious accidents including death. Actek® Mfg. & Eng., Inc. has always stressed that safety is of utmost importance.

Prior to any use of Actek® product, evaluation of the product application, safety precautions, safe working load, and control of all field conditions is mandatory. Prevent applications that exceed the safe working load or any other product misuse. Actek® cautions you that all safety factors shown are approximate. Safe working loads should never be exceeded under any circumstances.

If you have any questions about the proper use or installation of any Actek® product, please contact our office directly.

1110 Fullerton Road, City of Industry, CA 91748 • (800) 752-7229

Safety Notes

Actek® Mfg. & Eng. Inc. ensures that all materials used on all our products meets or exceeds the safety requirements for lifting. The safe working loads listed are based upon a new or in "as new" condition product. A safe working load is considered to be the greatest load that should be applied to an item at any time.

Inspection & Maintenance

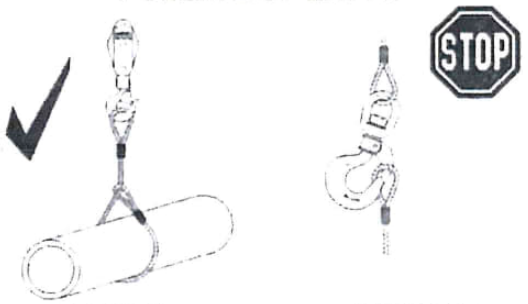
In order to insure the safest lifting, all for safety purposes, Actek® products must be properly used and maintained in the proper manner. Hoist rings may be are subject to wear, corrosion, deformation, overloading, and other limiting factors which may will affect the safe working load. Prior to use the user of any Actek® product, the product should be regularly inspected to determine if it may be used or whether it should removed from service. It is the responsibility of the user to inspect all lifting units for signs of wear and to discard the any parts when showing visible signs of wear. Every user should establish a safety inspection program for routine visual inspection of all products to determine whether signs of wear (e.g. cracks, corrosion, deformation) are present. The product inspection schedule should be established based upon factors such as frequency of use, period of use and environment. In addition to the regular safety inspection, the following safety directives must be followed:

- Prior to use, always inspect hoist rings for possible wear or damage. Never use hoist rings that show any sign of wear or damage.
- Never use hoist rings if bail is bent or elongated.
- Prior to use, threads must be clean, undamaged, and must fit properly.
- Always install hoist rings using the listed torque value. Periodically check torque because screws could loosen during extended service.
- Bent bolts should be discarded or replaced never straightened; failing to do so may lead to serious injuries or death.
- Never use washers or any spacers between bushing and mounting surface.
- Always make sure the hoist ring pivots and rotates in all directions freely.
- Never use hoist ring near or around corrosive material.
- If hoist ring is exposed to extreme temperatures (hot or cold), please contact our engineering department for suggestions/consultation.
- Safe working loads should never be exceeded under any circumstances.

If there are questions regarding the replacement or repair of worn Actek® products, please contact our engineering division.

HOIST HOOK LATCHES

FOULING OF LATCH

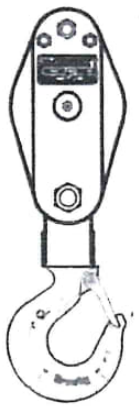


CORRECT!
SLING IN BASE OF HOOK

INCORRECT!
SLING FOULED ON LATCH

(POH530A)

LATCH PURPOSE



"WHERE REQUIRED, A LATCH SHALL BE PROVIDED"

THE REQUIREMENT IS INDICATED BY THE TYPE OF HOIST EQUIPMENT BEING USED

THE PURPOSE OF A LATCH IS TO BRIDGE THE THROAT OPENING OF THE HOOK, FOR THE PURPOSE OF RETAINING SLINGS OR OTHER DEVICES UNDER SLACK RIGGING CONDITIONS ONLY

THE LATCH IS NOT INTENDED TO SUPPORT THE LOAD

(POH529B)

ASME B30.10

LATCH REQUIREMENTS

CORRECT
SLING IN
BASE OF HOOK

INCORRECT
SLING FOULED
ON LATCH

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

THE USE OF A HOOK WITH A LATCH DOES NOT PRECLUDE THE INADVERTANT DETACHMENT OF A SLACK SLING OR A LOAD FROM THE HOOK

VISUAL VERIFICATION OF PROPER HOOK ENGAGEMENT IS REQUIRED IN ALL CASES

(POH198B)

ASME B30.10

NOTES:

ALL HOIST HOOKS MUST BE LOADED IN THE BASE OF THE HOOK. NEVER FOUL A LATCH BY ALLOWING THE SLING TO BEAR AGAINST THE LATCH. ALWAYS VERIFY THAT THE SLINGS ARE IN THE BASE OF THE HOOK AND CLEAR OF LATCH.

CROSBY OFFERS A VARIETY OF DIFFERENT STYLE HOOKS AND LATCHES FOR MANY LIFTING APPLICATIONS.

ALL CROSBY LATCHES HAVE UTILITY AND PERFORM FUNCTIONS FOR THE LIFTING INDUSTRY.

ALL OF CROSBY STYLE HOOK LATCHES ARE REPRESENTED IN DIAGRAMS SHOWN IN ASME B30.10.

THE RESPONSIBILITY FOR THE USE AND APPLICATION REST WITH THE USER. ONLY THE USER HAS THE INFORMATION NEEDED TO SELECT THE PROPER HOOK AND LATCH.

BEFORE THE STYLE OF HOOK LATCH IS CONSIDERED, THE SYSTEM DESIGNER/USER SHOULD DECIDE IF A HOOK IS APPROPRIATE, OR IF A SHACKLE SHOULD BE CONSIDERED.

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.

THE USE OF A HOOK WITH A LATCH DOES NOT PRECLUDE THE INADVERTANT DETACHMENT OF A SLACK SLING OR A LOAD FROM THE HOOK.

VISUAL VERIFICATION OF PROPER HOOK ENGAGEMENT IS REQUIRED IN ALL CASES.

HOIST HOOK LATCHES

LATCH REQUIREMENTS

ASME B30.2 – OVERHEAD AND GANTRY CRANES
"LATCH EQUIPPED HOOKS SHALL BE USED UNLESS THE APPLICATION MAKES THE USE OF THE LATCH IMPRACTICAL OR UNNECESSARY"

ASME B30.5 – MOBILE AND LOCOMOTIVE CRANES:
"HOOKS SHALL BE EQUIPPED WITH LATCHES UNLESS THE APPLICATION MAKES THE USE OF A LATCH IMPRACTICAL"

ASME B30.22 - ARTICULATING BOOM CRANES:
"HOOKS SHALL BE EQUIPPED WITH LATCHES UNLESS THE APPLICATION MAKES THE USE OF A LATCH IMPRACTICAL"

(POH196L)

ASME STANDARDS

LATCH REQUIREMENTS

ASME B30.16 AND B30.21 – OVERHEAD HOIST AND MANUAL LEVER HOISTS:
"HOOKS SHALL BE EQUIPPED WITH LATCHES UNLESS THE USE OF THE LATCH CREATES A HAZARDOUS CONDITION..."

ASME B30.9 – SLINGS:
"HOOK CHARACTERISTICS SHALL MEET THE REQUIREMENTS OF ASME B30.10 ... FOR HOOKS, REMOVAL CRITERIA AS STATED IN ASME B30.10"

ASME B30.9 DOES NOT SPECIFICALLY REQUIRE LATCHES ON SLINGS. IT DOES REQUIRE THAT LATCHES, IF PRESENT, SHOULD SEAT PROPERLY AND ROTATE PROPERLY. THE LATCH IS NOT INTENDED TO SUPPORT THE LOAD.

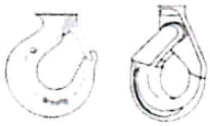
(POH196M)

ASME STANDARDS

PERSONNEL LIFTING SYSTEMS LATCH REQUIREMENTS

ASME B30.23: "HOOKS USED FOR ATTACHMENTS OF A PERSONNEL LIFTING PLATFORM SHALL BE OF THE TYPE THAT CAN BE POSITIVELY LOCKED CLOSED AND THAT WILL PREVENT THE PLATFORM LIFTING BRIDLE FROM BEING DISLODGED"

OSHA 1926.1431: "HOOKS... SHALL BE OF A TYPE THAT CAN BE CLOSED AND LOCKED."



(POH196K)

ASME B30.23 AND OSHA 1926.1431

NOTES:

THE REQUIREMENT FOR LATCHES IS SPECIFIED IN OSHA 1910.181(j)(2)(ii) WHICH STATES THAT "SAFETY LATCH TYPE HOOKS SHALL BE USED WHEREVER POSSIBLE."

OSHA 1926.1431 - LIFTING PERSONNEL PLATFORMS REQUIRES THAT LATCHES MUST BE USED AND THE "HOOK LATCHES MUST BE LOCKED."

OSHA 1926.1425(c)(1-3) STATES – WHEN EMPLOYEES ARE ENGAGED IN HOOKING, UNHOOKING, OR GUIDING THE LOAD, OR IN THE INITIAL CONNECTION OF A LOAD TO A COMPONENT OR STRUCTURE AND ARE WITHIN THE FALL ZONE, ALL OF THE FOLLOWING CRITERIA MUST BE MET:

1. THE MATERIALS BEING HOISTED MUST BE RIGGED TO PREVENT UNINTENTIONAL DISPLACEMENT.
2. HOOKS WITH SELF-CLOSING LATCHES OR THEIR EQUIVALENT MUST BE USED. *EXCEPTION:* "J" HOOKS ARE PERMITTED TO BE USED FOR SETTING WOODEN TRUSSES.
3. THE MATERIALS MUST BE RIGGED BY A QUALIFIED RIGGER.

OSHA 1926.1433 (d)(4)(i-iii) STATES THAT THE FOLLOWING REQUIREMENTS APPLY TO EQUIPMENT THAT HAS A MANUFACTURER-RATED HOISTING/LIFTING CAPACITY OF MORE THAN 2,000 POUNDS.
(d)(4) LATCHING HOOKS

i. HOOKS MUST BE EQUIPPED WITH LATCHES, EXCEPT WHERE THE REQUIREMENTS OF PARAGRAPH (d)(4)(ii) OF THIS SECTION ARE MET.
ii. HOOKS WITHOUT LATCHES, OR WITH LATCHES REMOVED OR DISABLED, MUST NOT BE USED UNLESS:
   A. A QUALIFIED PERSON HAS DETERMINED THAT IT IS SAFER TO HOIST AND PLACE THE LOAD WITHOUT LATCHES (OR WITH THE LATCHES REMOVED/TIEDBACK).
   B. ROUTES FOR THE LOADS ARE PRE-PLANNED TO ENSURE THAT NO EMPLOYEE IS REQUIRED TO WORK IN THE FALL ZONE EXCEPT FOR EMPLOYEES NECESSARY FOR THE HOOKING OR UNHOOKING OF THE LOAD.
iii. THE LATCH MUST CLOSE THE THROAT OPENING AND BE DESIGNED TO RETAIN SLINGS OR OTHER LIFTING DEVICES/ ACCESSORIES IN THE HOOK WHEN THE RIGGING APPARATUS IS SLACK.

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SAFETY GUIDELINES

Manufacturers of chain, can only control the specifications of our chain products in accordance with industry and governmental standards for chain manufacturing. It would be impossible for any warning to contain all of the possible misapplication associated with the use of industrial group products. Warnings are intended to identify only those risks which are most common. The responsibility and understanding of the proper safe use and application of the products, ultimately rest with the end user. We are not responsible for the end user's assembly in which our products may be used. Failure of the product can occur due to misapplication, abuse, intentional alteration or improper maintenance. Product failure can result in property damage, personal injury or death.

Working Load Limit (WLL)

The "Working Load Limit" (rated capacity) is the maximum load that shall be applied in direct tension to an undamaged straight length of chain, strap or fittings.

Proof Test

The "Proof Test" (manufacturing test force) is a term designating the minimum tensile force which has been applied to a product under constantly increasing force in direct tension during the manufacturing process. These loads are manufacturing integrity tests and shall not be used as criteria for service or design purposes.

Minimum Breaking Force

The "Minimum Breaking Force" is the minimum force at which the product during manufacture has been found by testing to break when a constantly increasing force is applied in direct tension. Breaking force values are not guarantees that all chain or strap segments will endure these loads. This test is a manufacturer's attribute acceptance test and shall not be used as a criteria for service or design purposes.

The Working Load Limits and the associated safety factor of each 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 assigned Working Load Limit, a reduced Working Load Limit or whether the product must be withdrawn from service. The terms "Working Load Limit", "Proof Test" and "Minimum Breaking Force" contain no implication of what load the product will withstand if the product is used in such conditions of abuse and misuse.

The Working Load Limit of a sling or assembly must not exceed the lowest Working Load Limit of the components in the sling or assembly. Use only approved parts as replacements when servicing or repairing slings or assemblies.

All Working Load Limits (WLL) shown in this catalog apply only to new or "in as new" condition products. USE ONLY GRADE 80 OR GRADE 100 ALLOY OR GRADE 50 STAINLESS STEEL CHAIN AND ATTACHMENTS FOR OVERHEAD LIFTING.

When using hooks in a shortening (grab) or choker application, the Working Load Limit (WLL) of the sling must be reduced by 20%.

LIFTING PRODUCTS ARE INTENDED TO BE USED AT OR BELOW THE WORKING LOAD LIMITS (WLL) SPECIFIED IN CONSTANTLY INCREASING FORCE APPLICATIONS UNDER DIRECT TENSION OR IN A STRAIGHT LINE PULL.

SHOCK LOADING IS PROHIBITED AND SIDE LOADING MUST BE AVOIDED, AS IT EXERTS ADDITIONAL DYNAMIC FORCES OR LOADING WHICH THE PRODUCT IS NOT DESIGNED TO ACCOMMODATE. THE CONDITIONS INVOLVING USE IN CERTAIN ENVIRONMENTAL SITUATIONS SUCH AS UNUSUAL (HIGH OR LOW) TEMPERATURE, CHEMICAL, ETC..., CAN CAUSE CHANGES IN CHAIN PERFORMANCE.

All chains and attachments are capable of creating sparks unless otherwise noted. Welding load support parts or products can be hazardous. Knowledge of materials, heat treatment and welding procedures are necessary for proper welding.

CAUTIONS & WARNINGS

Temperature and Chain

Use of Grade 80 Chain Under Heat Conditions

Effect of Elevated Temperature on the Working Load Limit of Grade 80 Alloy Chain.

Chains should not be used outside of the -40° F to 400° F (-40° C to 204° C) temperature range without consulting the chain manufacturer. The specific working load limit reductions for Grade 80 chains used at and after exposure to elevated temperatures have been established and are shown below.

Maximum Temperature of Chain	Reduction of Working Load Limit While At Temperature	Reduction of Working Load Limit After Exposure to Temperature
Below 400°	None	None
400°	10%	None
500°	15%	None
600°	20%	5%
700°	30%	10%
800°	40%	15%
900°	50%	20%
1000°	60%	25%
Over 1000°	* (see below)	* (see below)

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

Use of Grade 100 Chain Under Heat Conditions

Effect of Elevated Temperature on the Working Load Limit of Grade 100 Alloy Chain.

Chains should not be used outside of the -40° F to 400° F (-40° C to 204° C) temperature range without consulting the chain manufacturer. The specific working load limit reductions for Grade 100 chains used at and after exposure to elevated temperatures have been established and are shown below.

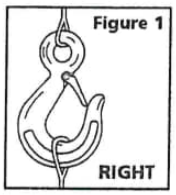
Maximum Temperature of Chain	Reduction of Working Load Limit While At Temperature	Reduction of Working Load Limit After Exposure to Temperature
Below 400°	None	None
400°	15%	None
500°	25%	5%
600°	30%	15%
700°	40%	20%
800°	50%	25%
900°	60%	30%
1000°	70%	35%
Over 1000°	* (see below)	* (see below)

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

General Hook & Latch Guidelines

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. Do not point load hooks–load should bear on the bowl of hook. The latch must never support the load. (See Figure 1 & 2).
- Latches are intended to retain loose sling or devices under slack conditions.
- Latches are not intended to be an anti-fouling device.



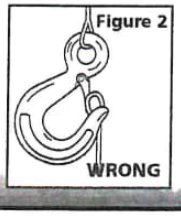
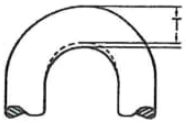


Table of Wear

If chain is worn to less than the minimum allowable thickness (T), remove the chain from service.



Specifications

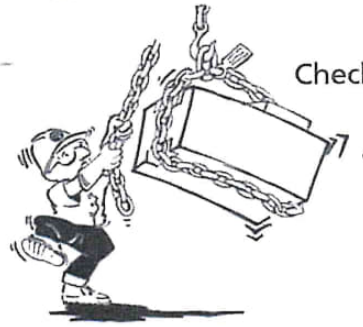
Size of Chain		Material Diameter		Min Allowable Thickness (T)	
Inches	mm	Grade 80	Grade 100	Grade 80	Grade 100
9/32"	7mm	0.274	0.279	0.247	0.239
3/8"	10mm	0.392	0.404	0.353	0.353
1/2"	13mm	0.510	0.529	0.459	0.459
5/8"	16mm	0.630	0.625	0.536	0.546
3/4"	20mm	0.781	--	0.664	--
7/8"	22mm	0.906	--	0.770	--
1"	26mm	1.032	--	0.877	--
1-1/4"	32mm	1.250	--	1.063	--

CHAIN & SLING GUIDELINES

Check #1 - **Inspections**

Visually examine the sling before each use. Look for stretched, gouged, bent or worn links and components, including hooks, with open throats, cracks or distortion, if damaged, remove from service.

Worn Links | Bent Links | Gouged Links | Stretched Links



Check #2 - **Balance**

Know the load — determine the weight, center of gravity, angle and lift and select the proper size of sling.

Check #3 - **Overload**

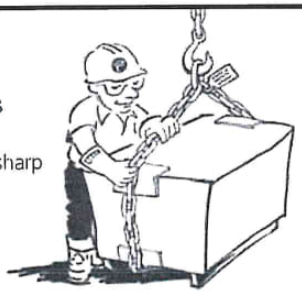
Never overload the sling — check the working load limit on the identification tag. Always consider the effect of Angle of Lift — the tension on each leg of the sling is increased as the angle of lift, from horizontal, decreases.

Check #4 - **Knots, Twists & Kinks**

Make sure chain is not twisted, knotted or kinked before lifting load. Slings should not be shortened with knots, bolts or other make-shift devices.

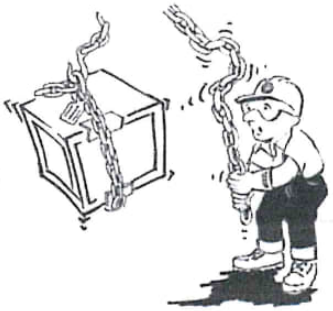
Check #5 - **Sharp Edges**

Protect chain with padding when lifting sharp edged loads.



Check #6 - **Abrupt Movement**

Lift and lower loads smoothly. Do not jerk.

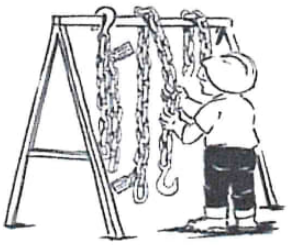


Check #7 - **High Temperatures**

Do not expose alloy chain or sling to temperatures of 400°F or higher.

Check #8 - **Chain Care**

Store slings properly on an A-Frame and protect chain slings from corrosion during storage.



WEB SLINGS

DANGER:

Overhead lifting presents a very real danger of serious personal injury or loss of life if lifting equipment is not used properly. OSHA and ASME have adopted the following requirements for safe operation of all lifting slings. Please read and understand all of these instructions prior to using any lifting sling or sling assembly. Slings should only be used by qualified persons who are responsible for the sling & rigging selection, inspection and use. Use of these products demonstrates an understanding of these warnings and the risks involved.

SAFE USE:

Inspect all sling components prior to each use. Never use slings that are damaged or defective. Damaged or defective slings must be removed from service immediately. The following conditions constitute a damaged sling: acid or caustic burns, melting of any part of the web surface, broken or worn stitching, distortion of eyes or fittings, or web snags, cuts, tears, and punctures. Only slings with legible identification tags shall be used. Keep all tags and labels away from the load, hook and point of choke, to avoid rendering the tag non-readable and the sling therefore unusable. If in doubt about the safety of a sling, DO NOT use it without having it proof tested.

Slings must never be shortened with knots, sewing or other makeshift devices nor should they ever be extended from their original length with non-original hardware, fittings or other devices. Never twist or kink the legs of a sling. The web sling legs (branches) shall contain or support the load from the sides above the center of gravity when using a sling in a basket configuration. Web slings shall not be bunched between the ears of a clevis, shackle or in a hook.

Never load in excess of the rated capacity for the application. Consideration must be given to the load angle which affects the rated capacity of the sling. Shock loading shall be avoided. The load applied to a hook shall be centered in the base or bowl of the hook to avoid hook tip overloading.

Select only web slings with suitable characteristics for the load type, hitch and the environment of their use. Web slings should always be hitched in a manner that provides for control of the load. Web slings used in a basket hitch must have the load balanced to prevent slippage. Web slings used in a choker hitch must be of sufficient length to assure that the choking action is on the webbing and never on the fittings, eyes or sling identification tag.

Never drag web slings on the floor. Protect webbing at all times from corners, edges, protrusions, or abrasive surfaces. Never pull slings out from under a load when the load is resting on the sling. Place blocks under the load prior to setting down the load to allow removal of the web sling. Do not drop web slings with metal end fittings.

Personnel must keep all body parts from between the sling and the load, and from between the sling and the crane/hoist hook. Persons shall never ride the web sling or the load during lifting or while suspended. Persons shall stand clear of all loads while lifting or while suspended. During lifting, with or without the load, personnel must be alert for possible snagging of the load or the web sling.

When not in use, web slings should be stored in a cool, dry and dark place to avoid loss of strength through exposure to ultra-violet (UV) light or weather. Never store web slings in areas that are chemically active. Chemicals can destroy the integrity of web slings in varying degrees that are not always readily apparent upon visual inspection. Never store or use web slings in temperatures above 194° F (90° C) or below minus 40° F (-40 °C). Never attempt to repair a damaged web sling. Replace it immediately. Only Type I and Type II web sling hardware may be reused and then only by a qualified sling manufacturer after inspection.

ALL CARGO CONTROL PRODUCTS

WARNING:

Observe all tie down requirements of the Commercial Vehicle Safety Alliance (CVSA.), Federal Department of Transportation (DOT), CCMTA (Canadian Council of Motor Transport Administrators) or other local regulations governing cargo restraint and tie down. Use only products that are rated and tagged with working load limits (WLL) for cargo tie down applications.

SAFE USE:

Inspect all tie down components prior to each use. Never use items that are damaged, worn or defective. Remove them from service immediately and replace with new. Do not attempt to repair. The following conditions constitute a damaged tie down strap: acid or caustic burns, melting of any part of the web surface, broken or worn stitching, distortion of eyes or fittings, or web snags, cuts, tears, and punctures. Only tie down straps with legible identification tags should be used. Keep all tags and labels away from the load, vehicle body and winch to avoid tag damage rendering the tag non-readable and the strap assembly therefore unusable. The following conditions constitute a damaged tie down chain assembly: damaged or distorted links, distortion of eyes or hooks, nicks or gouges in the chain or hooks. If in doubt about the safety of a tie down component or assembly do not use it. Loadbinders should not be used if any of the previous conditions exist or if the handles are bent or distorted.

WINCHES

INSTALLATION:

Mount & position the winch so that the latch/pawl drops into the gear sprocket teeth by its own weight. Portable and slider winches must be positioned not to interfere with any other trailer components.

MAINTENANCE:

The winch assembly should be protected from corrosion by application of a rust inhibiting paint. Avoid paint build up in the latch/pawl area that may inhibit the free movement of its parts. A light oil should be used to keep these parts moving freely to insure safe operation.

PROPER USE:

The loose end of the web assembly should be inserted through the web slot in the winch mandrel and the excess web pulled through. After tensioning, there must be 2-3 full wraps of webbing around the mandrel. Less wraps may result in web slippage. More wraps will cause additional strain to be exerted on the winch assembly and reduce the load capacity of the winch. Cable/wire rope must be used only on winches designed for their use. To use, twist an eye on the end of the cable with at least 2 feet of loose tail. Place the eye over the cable pin on the winch mandrel and tighten the winch, wrapping the cable over the loose tail a minimum of 4 times to secure the cable from slippage.

CAUTION:

Inspect all strap and winch assembly components prior to each use for damage or deterioration. Remove damaged product from service immediately and replace. Do not attempt to repair. Use extreme caution when tensioning the winch assembly to assure the latch/pawl is fully engaged in the gear sprocket teeth before releasing the pressure on the winch bar. Always keep hands and fingers away from the winch pawl. Always make sure that the load is adequately secured prior to movement of the vehicle using a sufficient quantity of appropriate strength tie downs. Never exceed the Working Load Limit of either the tie down or the hardware/winch. Remember, all assemblies are only as strong as their weakest point, including the point of attachment. All component parts must meet or exceed CVSA guidelines, Federal DOT Regulation, CCMTA regulations as well as local regulations. Tie downs must be checked periodically during transit and re-tensioned as needed to maintain a secure load. Never modify a winch to perform any use other than that for which it was specifically designed. Misuse or modification of any type will result in voiding any or all of the warranty and liability by the manufacturer/seller.

WINCH BARS

PROPER USE:

Use extreme caution when tensioning the winch/assembly to assure the latch/pawl is fully engaged in the gear sprocket teeth before releasing the pressure on the winch bar. Always keep hands and fingers away from the winch pawl & keep face, head and body out of path of winch bar. Inspect all binding components, (winch, strap assembly, chain assembly, loadbinder) prior to each use. Never use damaged or worn equipment. Remove from service and replace with new. Do not attempt to repair. Winch bars are used entirely at the users own risk and the use of a winch bar demonstrates an understanding of the risks and a willingness to accept the consequences of possible property damage, serious personal injury and/or loss of life. When using winch bars with winches: the tapered point of the bar must be

inserted completely through both holes in the winch cap. Failure to insert bar correctly could cause the bar to slip and result in serious personal injury and/or loss of life. During tightening and before releasing the tie down assembly, check the winch pawl to insure it has properly engaged the gear sprocket. Always grip the winch bar at the knurled section of the bar for increased safety. When using winch bar with binders: only use combination winch bars designed with a binder cradle to assist in tightening a loadbinder. Insure that the loadbinder handle is fully inserted into the winch bar cradle and locked in place. Keep head and body out of the path of the loadbinder handle in case of slippage or kickback. Failure to do so may result in serious personal injury and/or loss of life.

TOW STRAPS & CHAINS

DANGER:

PLEASE READ AND UNDERSTAND ALL OF THESE INSTRUCTIONS PRIOR TO USING ANY Tow Chain or Tow Strap. Towing or recovery of a vehicle presents a very real danger of property damage, serious personal injury and/or loss of life. Never attach fittings that have a strength rating (WLL) less than the assembly to which they are being attached. Insure that the chain or strap is attached to a secure part on both vehicles capable of withstanding the forces involved in towing or recovery. Woven fabric straps store energy that when released could cause a whipping action and endanger operators and bystanders. Keep all persons away from the vehicles and strap or chain during towing or recovery. USE OF THESE PRODUCTS DEMONSTRATES AN UNDERSTANDING OF THESE WARNINGS AND THE RISKS INVOLVED.

PROPER USE:

Tow chains and tow straps are designed for general purpose towing and recovery only. They are not intended to be used for highway towing or for extended periods of time. In these cases, a tow bar is required for safe operation. Tow chains/straps should never be used in a manner where failure of either the chain/strap, attachments or vehicle anchor points could result in personal injury. Keep all persons a safe distance away from all vehicles during a tow or recovery operation. The Working Load Limit shown in this catalog or on the package or assembly should never be exceeded. This is the maximum safe load that the assembly should ever be exposed to when in a like new condition. Apply tension in a gradual and uniform manner to avoid shock loading the assembly which could cause failure. Be sure that the assembly is not twisted, kinked, or knotted. Never subject the chain or strap to sharp edges as these can damage the chain or even cut the strap. If unavoidable, use caution and pad the area with rubber or similar material (a cut section of tire can be used for this purpose). Inspect all assemblies and attachments prior to use for any visible signs of damage.

The following will reduce the Working Load Limit of the assembly:

a.) Tip loading of hooks, twisting, kinks, knots or improper attachments

b.) Deterioration of the assembly or attachments caused by wear, usage, UV degradation, chemicals, acids, corrosion, cuts, abrasions, high heat exposure, misuse or abuse

c.) Impact caused by jerking or snatching. After use, inspect assembly and attachments for any visible signs of damage prior to storage. Clean and store in a cool and dry place, out of direct sunlight, where damage to the assembly or attachments is not likely to occur.

CARGO BARS & LOADLOCKS

WARNING:

Failure to understand these instructions and warnings could cause serious personal injury or property damage. Use of these products demonstrates an understanding of these warnings/ instructions and the risks involved. Do not use bars to support ANY vertical loads. SmartBars™ and loadlocks are NOT designed to be used as a shoring beam. Using these bars as a step is not advised and could result in serious personal injury. Cargo bars and loadlocks are not designed to secure cargo inside a trailer, only to assist in the stability of a load. SmartBars™ and loadlocks are designed to push out approximately one inch against flexible van trailer walls and can be damaged if used against immovable objects such as door frames. To avoid damaging the bars and trailer, never use more than one hand to close the lever. On the SmartBar™ push handle release button when fully retracted to extend. A stop keeps the bar from sliding open when fully retracted and must be released before operating the lever or the bar can be damaged. To disengage lock, push on handle release tabs.

WISCONSIN LIFTING SPECIALISTS INC.
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OSHA Frequent (Monthly) Overhead Crane & Hoist Inspection

The Frequent (Monthly) Overhead Crane & Hoist Inspection is a detailed visual and operational inspection performed as often as daily to monthly, based on severity of service, environment and continual usage.

Hooks, wire ropes and load chains shall be inspected at minimum, monthly intervals and documented with a certification record which includes:

- Date of inspection
- Signature of person who performed the inspection
- Serial number or identifier of the hook, chain or wire rope inspected

29 CFR 1910.179, ASME B30.2 & CMAA Spec-78
Provide requirements for Crane and Hoist Frequent (Monthly) Inspections.

The Frequent Inspection shall be performed by a qualified inspector. WLS Inc. technicians are trained and qualified to inspect, analyze and repair deficiencies found during inspections.

Below is a brief list of Frequent Inspection items per regulations:

- Control device motions agree with control device markings
- Brakes do not allow excessive drift and stopping distances are normal
- Check hook for cracks, nicks, gouges, and hook throat opening
- Hook latch is present and operates properly
- Wire rope is free of kinks, diameter reduction, broken wires or strands
- Load chain is not stretched, twisted, worn or has distorted links
- Wire rope and load chain is properly reeved
- Upper limit device stops lifting motion preventing two-blocking
- Check for signs of oil and lubrication leaking
- Check for unusual sounds while operating Crane & Hoist
- Warning devices work properly and labels displayed and visible

Each system will be given operational tests to verify all functions operate properly. A Frequent Inspection report will be provided upon completion of inspection detailing recommended repairs.

WLS Inc. will help you stay OSHA compliant by providing you a thorough Crane and Hoist Frequent Inspection.

OSHA 1910.179 Overhead & Gantry Cranes Regulations

(The following excerpt taken directly from OSHA 1910.179)

Frequent Inspection

The following items shall be inspected for defects at intervals as defined in paragraph (j)(1)(ii) of this section, or as specifically indicated, including observation during operation for any defects which might appear between regular inspections. All deficiencies such as listed shall be carefully examined and determination made as to whether they constitute a safety hazard:

1. All functional operating mechanisms for maladjustment interfering with proper operation. Daily.
2. Deterioration or leakage in lines, tanks, valves, drain pumps, and or other parts of air or hydraulic systems. Daily.
3. Hooks with deformation or cracks. Visual inspection daily; monthly inspection with a certification record which includes the date of inspection, the signature of the person who performed the inspection and the serial number, or other identifier, of the hook inspected. For hooks with cracks or having more than 15 percent in excess of normal throat opening or more than 10 twist from the plane of the unbent hook refer to paragraph (L)(3)(iii)(a) of this section.
4. Hoist chains, including end connections, for excessive wear, twist, distorted links interfering with proper function, or stretch beyond manufacturer's recommendations. Visual inspection daily; monthly inspection with a certification record which includes the date of inspection, the signature of the person who performed the inspection and an identifier of the chain which was inspected.
5. [Reserved]
6. All functional operating mechanisms for excessive wear of components.
7. Rope reeving for noncompliance with manufacturer's recommendation.

Inspection Classification.

1. Initial inspection. Prior to initial use all new and altered cranes shall be inspected to insure compliance with the provisions of this section.
2. Inspection procedure for cranes in regular service is divided into two general classifications based upon the intervals at which inspections should be performed. The intervals in turn are dependent upon the nature of the critical components of the crane and the degree of their exposure to wear, deterioration, or malfunction. The two general classifications are herein designated as "frequent" and "periodic" with respective intervals between inspections as defined below:
   - Frequent inspection - Daily to monthly intervals.
   - Periodic inspection - 1 to 2 month intervals.

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OSHA Periodic (Annual) Overhead Crane & Hoist Inspection

The Periodic (Annual) Overhead Crane & Hoist Inspection is a detailed visual and operational inspection. Individual components are examined to determine their condition. The Periodic Inspection is performed Annually, Semi-Annually and perhaps Quarterly based on severity of service, environment and continual usage.

29 CFR 1910.179, ASME B30.2 & CMAA Spec-78
Provide requirements for Crane and Hoist Periodic (Annual) Inspections.

The Periodic Inspection shall be performed by a qualified inspector.

WLS Inc. technicians are trained and qualified to inspect, analyze and repair deficiencies found during inspections.

Below is a brief list of Periodic Inspection items per regulations:

- Crane structure - girders, end trucks, walkways, ladders and cab
- Runway and building structure
- Gear case and transmissions
- Signs, labels and markings
- Sheaves and drums
- Shafts, axles, wheels, couplings
- Brakes (holding and control)
- Indicators, gages
- Control panels, conductor system and electrical components
- Covers and guards
- Bumpers and end stops
- Wire rope, chain, hook and bottom blocks

Each system will be given operational tests to verify all functions operate properly. An inspection report analysis will be provided upon completion of inspection detailing recommended repairs.

WLS Inc. will help you stay OSHA compliant by providing you a thorough Crane and Hoist Periodic Inspection.

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OSHA 1910.179 Overhead & Gantry Cranes Regulations

(The following excerpt taken directly from OSHA 1910.179)

Periodic Inspection

Complete inspections of the crane shall be performed at intervals as generally defined in paragraph (j)(1)(ii)(b) of this section, depending upon its activity, severity of service and environment, or as specifically indicated below. These inspections shall include the requirements of paragraph (j)(2) of this section and in addition, the following items. Any deficiencies such as listed shall be carefully examined and determination made as to whether they constitute a safety hazard:

1. Deformed, cracked or corroded members.
2. Loose bolts or rivets.
3. Cracked or worn sheaves and drums.
4. Worn, cracked or distorted parts such as pins, bearings, shafts, gears, rollers, locking and clamping devices.
5. Excessive wear on brake system parts, linings, pawls, and ratchets.
6. Load, wind, and other indicators over their full range, for any significant inaccuracies.
7. Gasoline, diesel, electric, or other power plants for improper performance or noncompliance with applicable safety requirements.
8. Excessive wear of chain drive sprockets and excessive chain stretch.
9. [Reserved]
10. Electrical apparatus, for signs of pitting or any deterioration of controller contractors, limit switches and pushbutton stations.

Cranes not in regular use.

1. A crane which has been idle for a period of 1 month or more, but less than 6 months, shall be given an inspection conforming with requirements or paragraph (j)(2) of this section and paragraph (m)(2) of this section before placing in service.
2. A crane which has been idle for a period of over 6 months shall be given a complete inspection conforming with requirements of paragraph (j)(2) and (3) of this section and paragraph (m)(2) of this section before placing in service.
3. Standby cranes shall be inspected at least semi-annually in accordance with requirements of paragraph (j)(2) of this section and paragraph (m)(2) of this section.

1910.179(a)

1910.179(a)(1)
A "crane" is a machine for lifting and lowering a load and moving it horizontally, with the hoisting mechanism an integral part of the machine. Cranes whether fixed or mobile are driven manually or by power.

1910.179(a)(2)
An "automatic crane" is a crane which when activated operates through a preset cycle or cycles.

1910.179(a)(3)
A "cab-operated crane" is a crane controlled by an operator in a cab located on the bridge or trolley.

1910.179(a)(4)
"Cantilever gantry crane" means a gantry or semigantry crane in which the bridge girders or trusses extend transversely beyond the crane runway on one or both sides.

1910.179(a)(5)
"Floor-operated crane" means a crane which is pendant or nonconductive rope controlled by an operator on the floor or an independent platform.

1910.179(a)(6)
"Gantry crane" means a crane similar to an overhead crane except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more legs running on fixed rails or other runway.

1910.179(a)(7)
"Hot metal handling crane" means an overhead crane used for transporting or pouring molten material.

1910.179(a)(8)
"Overhead crane" means a crane with a movable bridge carrying a movable or fixed hoisting mechanism and traveling on an overhead fixed runway structure.

1910.179(a)(9)
"Power-operated crane" means a crane whose mechanism is driven by electric, air, hydraulic, or internal combustion means.

1910.179(a)(10)
A "pulpit-operated crane" is a crane operated from a fixed operator station not attached to the crane.

1910.179(a)(11)
A "remote-operated crane" is a crane controlled by an operator not in a pulpit or in the cab attached to the crane, by any method other than pendant or rope control.

1910.179(a)(12)
A "semigantry crane" is a gantry crane with one end of the bridge rigidly supported on one or more legs that run on a fixed rail or runway, the other end of the bridge being supported by a truck running on an elevated rail or runway.

1910.179(a)(13)
"Storage bridge crane" means a gantry type crane of long span usually used for bulk storage of material; the bridge girders or trusses are rigidly or nonrigidly supported on one or more legs. It may have one or more fixed or hinged cantilever ends.

1910.179(a)(14)
"Wall crane" means a crane having a jib with or without trolley and supported from a side wall or line of columns of a building. It is a traveling type and operates on a runway attached to the side wall or columns.

1910.179(a)(15)
"Appointed" means assigned specific responsibilities by the employer or the employer's representative.

1910.179(a)(16)
"ANSI" means the American National Standards Institute.

1910.179(a)(17)
An "auxiliary hoist" is a supplemental hoisting unit of lighter capacity and usually higher speed than provided for the main hoist.

1910.179(a)(18)
A "brake" is a device used for retarding or stopping motion by friction or power means.

1910.179(a)(19)
A "drag brake" is a brake which provides retarding force without external control.

1910.179(a)(20)
A "holding brake" is a brake that automatically prevents motion when power is off.

1910.179(a)(21)
"Bridge" means that part of a crane consisting of girders, trucks, end ties, footwalks, and drive mechanism which carries the trolley or trolleys.

1910.179(a)(22)
"Bridge travel" means the crane movement in a direction parallel to the crane runway.

1910.179(a)(23)
A "bumper" [buffer] is an energy absorbing device for reducing impact when a moving crane or trolley reaches the end of its permitted travel; or when two moving cranes or trolleys come in contact.

1910.179(a)(24)
The "cab" is the operator's compartment on a crane.

1910.179(a)(25)
"Clearance" means the distance from any part of the crane to a point of the nearest obstruction.

1910.179(a)(26)
"Collectors current" are contacting devices for collecting current from runway or bridge conductors.

1910.179(a)(27)
"Conductors, bridge" are the electrical conductors located along the bridge structure of a crane to provide power to the trolley.

1910.179(a)(28)
"Conductors, runway" [main] are the electrical conductors located along a crane runway to provide power to the crane.

1910.179(a)(29)
The "control braking means" is a method of controlling crane motor speed when in an overhauling condition.

1910.179(a)(30)
"Countertorque" means a method of control by which the power to the motor is reversed to develop torque in the opposite direction.

1910.179(a)(31)
"Dynamic" means a method of controlling crane motor speeds when in the overhauling condition to provide a retarding force.

1910.179(a)(32)
"Regenerative" means a form of dynamic braking in which the electrical energy generated is fed back into the power system.

1910.179(a)(33)
"Mechanical" means a method of control by friction.

1910.179(a)(34)
"Controller, spring return" means a controller which when released will return automatically to a neutral position.

1910.179(a)(35)
"Designated" means selected or assigned by the employer or the employer's representative as being qualified to perform specific duties.

1910.179(a)(36)
A "drift point" means a point on a travel motion controller which releases the brake while the motor is not energized. This allows for coasting before the brake is set.

1910.179(a)(37)
The "drum" is the cylindrical member around which the ropes are wound for raising or lowering the load.

1910.179(a)(38)
An "equalizer" is a device which compensates for unequal length or stretch of a rope.

1910.179(a)(39)
"Exposed" means capable of being contacted inadvertently. Applied to hazardous objects not adequately guarded or isolated.

1910.179(a)(40)
"Fail-safe" means a provision designed to automatically stop or safely control any motion in which a malfunction occurs.

1910.179(a)(41)
"Footwalk" means the walkway with handrail, attached to the bridge or trolley for access purposes.

1910.179(a)(42)
A "hoist" is an apparatus which may be a part of a crane, exerting a force for lifting or lowering.

1910.179(a)(43)
"Hoist chain" means the load bearing chain in a hoist.

NOTE: Chain properties do not conform to those shown in ANSI B30.9-1971, Safety Code for Slings.

1910.179(a)(44)
"Hoist motion" means that motion of a crane which raises and lowers a load.

1910.179(a)(45)
"Load" means the total superimposed weight on the load block or hook.

1910.179(a)(46)
The "load block" is the assembly of hook or shackle, swivel, bearing, sheaves, pins, and frame suspended by the hoisting rope.

1910.179(a)(47)
"Magnet" means an electromagnetic device carried on a crane hook to pick up loads magnetically.

1910.179(a)(48)
"Main hoist" means the hoist mechanism provided for lifting the maximum rated load.

1910.179(a)(49)
A "man trolley" is a trolley having an operator's cab attached thereto.

1910.179(a)(50)
"Rated load" means the maximum load for which a crane or individual hoist is designed and built by the manufacturer and shown on the equipment nameplate(s).

1910.179(a)(51)
"Rope" refers to wire rope, unless otherwise specified.

1910.179(a)(52)
"Running sheave" means a sheave which rotates as the load block is raised or lowered.

1910.179(a)(53)
"Runway" means an assembly of rails, beams, girders, brackets, and framework on which the crane or trolley travels.

1910.179(a)(54)
"Side pull" means that portion of the hoist pull acting horizontally when the hoist lines are not operated vertically.

1910.179(a)(55)
"Span" means the horizontal distance center to center of runway rails.

1910.179(a)(56)
"Standby crane" means a crane which is not in regular service but which is used occasionally or intermittently as required.

1910.179(a)(57)
A "stop" is a device to limit travel of a trolley or crane bridge. This device normally is attached to a fixed structure and normally does not have energy absorbing ability.

1910.179(a)(58)
A "switch" is a device for making, breaking, or for changing the connections in an electric circuit.

1910.179(a)(59)
An "emergency stop switch" is a manually or automatically operated electric switch to cut off electric power independently of the regular operating controls.

1910.179(a)(60)
A "limit switch" is a switch which is operated by some part or motion of a power-driven machine or equipment to alter the electric circuit associated with the machine or equipment.

1910.179(a)(61)
A "main switch" is a switch controlling the entire power supply to the crane.

1910.179(a)(62)
A "master switch" is a switch which dominates the operation of contactors, relays, or other remotely operated devices.

1910.179(a)(63)
The "trolley" is the unit which travels on the bridge rails and carries the hoisting mechanism.

1910.179(a)(64)
"Trolley travel" means the trolley movement at right angles to the crane runway.

1910.179(a)(65)
"Truck" means the unit consisting of a frame, wheels, bearings, and axles which supports the bridge girders or trolleys.

1910.179(b)

1910.179(b)(1)
Application. This section applies to overhead and gantry cranes, including semigantry, cantilever gantry, wall cranes, storage bridge cranes, and others having the same fundamental characteristics. These cranes are grouped because they all have trolleys and similar travel characteristics.

1910.179(b)(2)
New and existing equipment. All new overhead and gantry cranes constructed and installed on or after August 31, 1971, shall meet the design specifications of the American National Standard Safety Code for Overhead and Gantry Cranes, ANSI B30.2.0-1967, which is incorporated by reference as specified in Sec. 1910.6.

1910.179(b)(3)
Modifications. Cranes may be modified and rerated provided such modifications and the supporting structure are checked thoroughly for the new rated load by a qualified engineer or the equipment manufacturer. The crane shall be tested in accordance with paragraph (k) (2) of this section. New rated load shall be displayed in accordance with subparagraph (5) of this paragraph.

1910.179(b)(4)
Wind indicators and rail clamps. Outdoor storage bridges shall be provided with automatic rail clamps. A wind-indicating device shall be provided which will give a visible or audible alarm to the bridge operator at a predetermined wind velocity. If the clamps act on the rail heads, any beads or weld flash on the rail heads shall be ground off.

1910.179(b)(5)
Rated load marking. The rated load of the crane shall be plainly marked on each side of the crane, and if the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its load block and this marking shall be clearly legible from the ground or floor.

1910.179(b)(6)
Clearance from obstruction.

1910.179(b)(6)(i)
Minimum clearance of 3 inches overhead and 2 inches laterally shall be provided and maintained between crane and obstructions in conformity with Crane Manufacturers Association of America, Inc, Specification No. 61, which is incorporated by reference as specified in Sec. 1910.6, (formerly the Electric Overhead Crane Institute, Inc).

1910.179(b)(6)(ii)
Where passageways or walkways are provided obstructions shall not be placed so that safety of personnel will be jeopardized by movements of the crane.

1910.179(b)(7)
Clearance between parallel cranes. If the runways of two cranes are parallel, and there are no intervening walls or structure, there shall be adequate clearance provided and maintained between the two bridges.

1910.179(b)(8)
Designated personnel - Only designated personnel shall be permitted to operate a crane covered by this section.

1910.179(c)
Cabs -

1910.179(c)(1)
Cab location.

1910.179(c)(1)(i)
The general arrangement of the cab and the location of control and protective equipment shall be such that all operating handles are within convenient reach of the operator when facing the area to be served by the load hook, or while facing the direction of travel of the cab. The arrangement shall allow the operator a full view of the load hook in all positions.

1910.179(c)(1)(ii)
The cab shall be located to afford a minimum of 3 inches clearance from all fixed structures within its area of possible movement.

1910.179(c)(2)
Access to crane. Access to the cab and/or bridge walkway shall be by a conveniently placed fixed ladder, stairs, or platform requiring no step over any gap exceeding 12 inches. Fixed ladders shall be in conformance with the American National Standard Safety Code for Fixed Ladders, ANSI A14.3-1956, which is incorporated by reference as specified in Sec. 1910.6.

1910.179(c)(3)
Fire extinguisher. Carbon tetrachloride extinguishers shall not be used.

1910.179(c)(4)
Lighting. Light in the cab shall be sufficient to enable the operator to see clearly enough to perform his work.

1910.179(d)
Footwalks and ladders -

1910.179(d)(1)
Location of footwalks.

1910.179(d)(1)(i)
If sufficient headroom is available on cab-operated cranes, a footwalk shall be provided on the drive side along the entire length of the bridge of all cranes having the trolley running on the top of the girders.

1910.179(d)(1)(ii)
Where footwalks are located in no case shall less than 48 inches of headroom be provided.

1910.179(d)(2)
Construction of footwalks.

1910.179(d)(2)(i)
Footwalks shall be of rigid construction and designed to sustain a distributed load of at least 50 pounds per square foot.

1910.179(d)(2)(ii)
Footwalks shall have a walking surface of antislip type. NOTE: Wood will meet this requirement.

1910.179(d)(2)(iii)

1910.179(d)(2)(iv)
The inner edge shall extend at least to the line of the outside edge of the lower cover plate or flange of the girder.

1910.179(d)(3)
Toeboards and handrails for footwalks. Toeboards and handrails shall be in compliance with section 1910.23 of this part.

1910.179(d)(4)
Ladders and stairways.

1910.179(d)(4)(i)
Gantry cranes shall be provided with ladders or stairways extending from the ground to the footwalk or cab platform.

1910.179(d)(4)(ii)
Stairways shall be equipped with rigid and substantial metal handrails. Walking surfaces shall be of an antislip type.

1910.179(d)(4)(iii)
Ladders shall be permanently and securely fastened in place and shall be constructed in compliance with 1910.27.

1910.179(e)
Stops, bumpers, rail sweeps, and guards -

1910.179(e)(1)
Trolley stops.

1910.179(e)(1)(i)
Stops shall be provided at the limits of travel of the trolley.

1910.179(e)(1)(ii)
Stops shall be fastened to resist forces applied when contacted.

1910.179(e)(1)(iii)
A stop engaging the tread of the wheel shall be of a height at least equal to the radius of the wheel.

1910.179(e)(2)
Bridge bumpers -

1910.179(e)(2)(i)
A crane shall be provided with bumpers or other automatic means providing equivalent effect, unless the crane travels at a slow rate of speed and has a faster deceleration rate due to the use of sleeve bearings, or is not operated near the ends of bridge and trolley travel, or is restricted to a limited distance by the nature of the crane operation and there is no hazard of striking any object in this limited distance, or is used in similar operating conditions. The bumpers shall be capable of stopping the crane (not including the lifted load) at an average rate of deceleration not to exceed 3 ft/s/s when traveling in either direction at 20 percent of the rated load speed.

1910.179(e)(2)(i)(a)
The bumpers shall have sufficient energy absorbing capacity to stop the crane when traveling at a speed of at least 40 percent of rated load speed.

1910.179(e)(2)(i)(b)
The bumper shall be so mounted that there is no direct shear on bolts.

1910.179(e)(2)(ii)
Bumpers shall be so designed and installed as to minimize parts falling from the crane in case of breakage.

1910.179(e)(3)
Trolley bumpers -

1910.179(e)(3)(i)
A trolley shall be provided with bumpers or other automatic means of equivalent effect, unless the trolley travels at a slow rate of speed, or is not operated near the ends of bridge and trolley travel, or is restricted to a limited distance of the runway and there is no hazard of striking any object in this limited distance, or is used in similar operating conditions. The bumpers shall be capable of stopping the trolley (not including the lifted load) at an average rate of deceleration not to exceed 4.7 ft/s/s when traveling in either direction at one-third of the rated load speed.

1910.179(e)(3)(ii)
When more than one trolley is operated on the same bridge, each shall be equipped with bumpers or equivalent on their adjacent ends.

1910.179(e)(3)(iii)
Bumpers or equivalent shall be designed and installed to minimize parts falling from the trolley in case of age.

1910.179(e)(4)
Rail sweeps. Bridge trucks shall be equipped with sweeps which extend below the top of the rail and project in front of the truck wheels.

1910.179(e)(5)
Guards for hoisting ropes.

1910.179(e)(5)(i)
If hoisting ropes run near enough to other parts to make fouling or chafing possible, guards shall be installed to prevent this condition.

1910.179(e)(5)(ii)
A guard shall be provided to prevent contact between bridge conductors and hoisting ropes if they could come into contact.

1910.179(e)(6)
Guards for moving parts.

1910.179(e)(6)(i)
Exposed moving parts such as gears, set screws, projecting keys, chains, chain sprockets, and reciprocating components which might constitute a hazard under normal operating conditions shall be guarded.

1910.179(e)(6)(ii)
Guards shall be securely fastened.

1910.179(e)(6)(iii)
Each guard shall be capable of supporting without permanent distortion the weight of a 200-pound person unless the guard is located where it is impossible for a person to step on it.

1910.179(f)
Brakes -

1910.179(f)(1)
Brakes for hoists.

1910.179(f)(1)(i)
Each independent hoisting unit of a crane shall be equipped with at least one self-setting brake, hereafter referred to as a holding brake, applied directly to the motor shaft or some part of the gear train.

1910.179(f)(1)(ii)
Each independent hoisting unit of a crane, except worm-geared hoists, the angle of whose worm is such as to prevent the load from accelerating in the lowering direction shall, in addition to a holding brake, be equipped with control braking means to prevent overspeeding.

1910.179(f)(2)
Holding brakes.

1910.179(f)(2)(i)
Holding brakes for hoist motors shall have not less than the following percentage of the full load hoisting torque at the point where the brake is applied.

1910.179(f)(2)(i)(a)
125 percent when used with a control braking means other than mechanical.

1910.179(f)(2)(i)(b)
100 percent when used in conjunction with a mechanical control braking means.

1910.179(f)(2)(i)(c)
100 percent each if two holding brakes are provided.

1910.179(f)(2)(ii)
Holding brakes on hoists shall have ample thermal capacity for the frequency of operation required by the service.

1910.179(f)(2)(iii)
Holding brakes on hoists shall be applied automatically when power is removed.

1910.179(f)(2)(iv)
Where necessary holding brakes shall be provided with adjustment means to compensate for wear.

1910.179(f)(2)(v)
The wearing surface of all holding-brake drums or discs shall be smooth.

1910.179(f)(2)(vi)
Each independent hoisting unit of a crane handling hot metal and having power control braking means shall be equipped with at least two holding brakes.

1910.179(f)(3)
Control braking means.

1910.179(f)(3)(i)
A power control braking means such as regenerative, dynamic or countertorque braking, or a mechanically controlled braking means shall be capable of maintaining safe lowering speeds of rated loads.

1910.179(f)(3)(ii)
The control braking means shall have ample thermal capacity for the frequency of operation required by service.

1910.179(f)(4)
Brakes for trolleys and bridges.

1910.179(f)(4)(i)
Foot-operated brakes shall not require an applied force of more than 70 pounds to develop manufacturer's rated brake torque.

1910.179(f)(4)(ii)
Brakes may be applied by mechanical, electrical, pneumatic, hydraulic, or gravity means.

1910.179(f)(4)(iii)
Where necessary brakes shall be provided with adjustment means to compensate for wear.

1910.179(f)(4)(iv)
The wearing surface of all brakedrums or discs shall be smooth.

1910.179(f)(4)(v)
All foot-brake pedals shall be constructed so that the operator's foot will not easily slip off the pedal.

1910.179(f)(4)(vi)
Foot-operated brakes shall be equipped with automatic means for positive release when pressure is released from the pedal.

1910.179(f)(4)(vii)
Brakes for stopping the motion of the trolley or bridge shall be of sufficient size to stop the trolley or bridge within a distance in feet equal to 10 percent of full load speed in feet per minute when traveling at full speed with full load.

1910.179(f)(4)(viii)
If holding brakes are provided on the bridge or trolleys, they shall not prohibit the use of a drift point in the control circuit.

1910.179(f)(4)(ix)
Brakes on trolleys and bridges shall have ample thermal capacity for the frequency of operation required by the service to prevent impairment of functions from overheating.

1910.179(f)(5)
Application of trolley brakes.

1910.179(f)(5)(i)
On cab-operated cranes with cab on trolley, a trolley brake shall be required as specified under paragraph (f)(4) of this section.

1910.179(f)(5)(ii)
A drag brake may be applied to hold the trolley in a desired position on the bridge and to eliminate creep with the power off.

1910.179(f)(6)
Application of bridge brakes.

1910.179(f)(6)(i)
On cab-operated cranes with cab on bridge, a bridge brake is required as specified under paragraph (f)(4) of this section.

1910.179(f)(6)(ii)
On cab-operated cranes with cab on trolley, a bridge brake of the holding type shall be required.

1910.179(f)(6)(iii)
On all floor, remote and pulpit-operated crane bridge drives, a brake of noncoasting mechanical drive shall be provided.

1910.179(g)
Electric equipment -

1910.179(g)(1)
General.

1910.179(g)(1)(i)
Wiring and equipment shall comply with subpart S of this part.

1910.179(g)(1)(ii)
The control circuit voltage shall not exceed 600 volts for a.c. or d.c. current.

1910.179(g)(1)(iii)
The voltage at pendant push-buttons shall not exceed 150 volts for a.c. and 300 volts for d.c.

1910.179(g)(1)(iv)
Where multiple conductor cable is used with a suspended pushbutton station, the station must be supported in some satisfactory manner that will protect the electrical conductors against strain.

1910.179(g)(1)(v)
Pendant control boxes shall be constructed to prevent electrical shock and shall be clearly marked for identification of functions.

1910.179(g)(2)
Equipment.

1910.179(g)(2)(i)
Electrical equipment shall be so located or enclosed that live parts will not be exposed to accidental contact under normal operating conditions.

1910.179(g)(2)(ii)
Electric equipment shall be protected from dirt, grease, oil, and moisture.

1910.179(g)(2)(iii)
Guards for live parts shall be substantial and so located that they cannot be accidently deformed so as to make contact with the live parts.

1910.179(g)(3)
Controllers.

1910.179(g)(3)(i)
Cranes not equipped with spring-return controllers or momentary contact pushbuttons shall be provided with a device which will disconnect all motors from the line on failure of power and will not permit any motor to be restarted until the controller handle is brought to the "off" position, or a reset switch or button is operated.

1910.179(g)(3)(ii)
Lever operated controllers shall be provided with a notch or latch which in the "off" position prevents the handle from being inadvertently moved to the "on" position. An "off" detent or spring return arrangement is acceptable.

1910.179(g)(3)(iii)
The controller operating handle shall be located within convenient reach of the operator.

1910.179(g)(3)(iv)
As far as practicable, the movement of each controller handle shall be in the same general directions as the resultant movements of the load.

1910.179(g)(3)(v)
The control for the bridge and trolley travel shall be so located that the operator can readily face the direction of travel.

1910.179(g)(3)(vi)
For floor-operated cranes, the controller or controllers if rope operated, shall automatically return to the "off" position when released by the operator.

1910.179(g)(3)(vii)
Pushbuttons in pendant stations shall return to the "off" position when pressure is released by the crane operator.

1910.179(g)(3)(viii)
Automatic cranes shall be so designed that all motions shall fail-safe if any malfunction of operation occurs.

1910.179(g)(3)(ix)
Remote-operated cranes shall function so that if the control signal for any crane motion becomes ineffective the crane motion shall stop.

1910.179(g)(4)
Resistors.

1910.179(g)(4)(i)
Enclosures for resistors shall have openings to provide adequate ventilation, and shall be installed to prevent the accumulation of combustible matter too near to hot parts.

1910.179(g)(4)(ii)
Resistor units shall be supported so as to be as free as possible from vibration.

1910.179(g)(4)(iii)
Provision shall be made to prevent broken parts or molten metal falling upon the operator or from the crane.

1910.179(g)(5)
Switches.

1910.179(g)(5)(i)
The power supply to the runway conductors shall be controlled by a switch or circuit breaker located on a fixed structure, accessible from the floor, and arranged to be locked in the open position.

1910.179(g)(5)(ii)
On cab-operated cranes a switch or circuit breaker of the enclosed type, with provision for locking in the open position, shall be provided in the leads from the runway conductors. A means of opening this switch or circuit breaker shall be located within easy reach of the operator.

1910.179(g)(5)(iii)
On floor-operated cranes, a switch or circuit breaker of the enclosed type, with provision for locking in the open position, shall be provided in the leads from the runway conductors. This disconnect shall be mounted on the bridge or footwalk near the runway collectors. One of the following types of floor-operated disconnects shall be provided:

1910.179(g)(5)(iii)(a)
Nonconductive rope attached to the main disconnect switch.

1910.179(g)(5)(iii)(b)
An undervoltage trip for the main circuit breaker operated by an emergency stop button in the pendant pushbutton in the pendant pushbutton station.

1910.179(g)(5)(iii)(c)
A main line contactor operated by a switch or pushbutton in the pendant pushbutton station.

1910.179(g)(5)(iv)
The hoisting motion of all electric traveling cranes shall be provided with an overtravel limit switch in the hoisting direction.

1910.179(g)(5)(v)
All cranes using a lifting magnet shall have a magnet circuit switch of the enclosed type with provision for locking in the open position. Means for discharging the inductive load of the magnet shall be provided.

1910.179(g)(6)
Runway conductors. Conductors of the open type mounted on the crane runway beams or overhead shall be so located or so guarded that persons entering or leaving the cab or crane footwalk normally could not come into contact with them.

1910.179(g)(7)
Extension lamps. If a service receptacle is provided in the cab or on the bridge of cab-operated cranes, it shall be a grounded three-prong type permanent receptacle, not exceeding 300 volts.

1910.179(h)
Hoisting equipment -

1910.179(h)(1)
Sheaves.

1910.179(h)(1)(i)
Sheave grooves shall be smooth and free from surface defects which could cause rope damage.

1910.179(h)(1)(ii)
Sheaves carrying ropes which can be momentarily unloaded shall be provided with close-fitting guards or other suitable devices to guide the rope back into the groove when the load is applied again.

1910.179(h)(1)(iii)
The sheaves in the bottom block shall be equipped with close-fitting guards that will prevent ropes from becoming fouled when the block is lying on the ground with ropes loose.

1910.179(h)(1)(iv)
Pockets and flanges of sheaves used with hoist chains shall be of such dimensions that the chain does not catch or bind during operation.

1910.179(h)(1)(v)
All running sheaves shall be equipped with means for lubrication. Permanently lubricated, sealed and/or shielded bearings meet this requirement.

1910.179(h)(2)
Ropes.

1910.179(h)(2)(i)
In using hoisting ropes, the crane manufacturer's recommendation shall be followed. The rated load divided by the number of parts of rope shall not exceed 20 percent of the nominal breaking strength of the rope.

1910.179(h)(2)(ii)
Socketing shall be done in the manner specified by the manufacturer of the assembly.

1910.179(h)(2)(iii)
Rope shall be secured to the drum as follows:

1910.179(h)(2)(iii)(a)
No less than two wraps of rope shall remain on the drum when the hook is in its extreme low position.

1910.179(h)(2)(iii)(b)
Rope end shall be anchored by a clamp securely attached to the drum, or by a socket arrangement approved by the crane or rope manufacturer.

1910.179(h)(2)(iv)
Eye splices. [Reserved]

1910.179(h)(2)(v)
Rope clips attached with U-bolts shall have the U-bolts on the dead or short end of the rope. Spacing and number of all types of clips shall be in accordance with the clip manufacturer's recommendation. Clips shall be drop-forged steel in all sizes manufactured commercially. When a newly installed rope has been in operation for an hour, all nuts on the clip bolts shall be retightened.

1910.179(h)(2)(vi)
Swaged or compressed fittings shall be applied as recommended by the rope or crane manufacturer.

1910.179(h)(2)(vii)
Wherever exposed to temperatures, at which fiber cores would be damaged, rope having an independent wirerope or wire-strand core, or other temperature-damage resistant core shall be used.

1910.179(h)(2)(viii)
Replacement rope shall be the same size, grade, and construction as the original rope furnished by the crane manufacturer, unless otherwise recommended by a wire rope manufacturer due to actual working condition requirements.

1910.179(h)(3)
Equalizers. If a load is supported by more than one part of rope, the tension in the parts shall be equalized.

1910.179(h)(4)
Hooks. Hooks shall meet the manufacturer's recommendations and shall not be overloaded.

1910.179(i)
Warning device. Except for floor-operated cranes a gong or other effective warning signal shall be provided for each crane equipped with a power traveling mechanism.

1910.179(j)
Inspection -

1910.179(j)(1)
Inspection classification.

1910.179(j)(1)(i)
Initial inspection. Prior to initial use all new and altered cranes shall be inspected to insure compliance with the provisions of this section.

1910.179(j)(1)(ii)
Inspection procedure for cranes in regular service is divided into two general classifications based upon the intervals at which inspection should be performed. The intervals in turn are dependent upon the nature of the critical components of the crane and the degree of their exposure to wear, deterioration, or malfunction. The two general classifications are herein designated as "frequent" and "periodic" with respective intervals between inspections as defined below:

1910.179(j)(1)(ii)(a)
Frequent inspection - Daily to monthly intervals.

1910.179(j)(1)(ii)(b)
Periodic inspection - 1 to 12-month intervals.

1910.179(j)(2)
Frequent inspection. The following items shall be inspected for defects at intervals as defined in paragraph (j)(1)(ii) of this section or as specifically indicated, including observation during operation for any defects which might appear between regular inspections.
All deficiencies such as listed shall be carefully examined and determination made as to whether they constitute a safety hazard:

1910.179(j)(2)(i)
All functional operating mechanisms for maladjustment interfering with proper operation. Daily.

1910.179(j)(2)(ii)
Deterioration or leakage in lines, tanks, valves, drain pumps, and other parts of air or hydraulic systems. Daily.

1910.179(j)(2)(iii)
Hooks with deformation or cracks. Visual inspection daily; monthly inspection with a certification record which includes the date of inspection, the signature of the person who performed the inspection and the serial number, or other identifier, of the hook inspected. For hooks with cracks or having more than 15 percent in excess of normal throat opening or more than 10° twist from the plane of the unbent hook refer to paragraph (l)(3)(iii)(a) of this section.

1910.179(j)(2)(iv)
Hoist chains, including end connections, for excessive wear, twist, distorted links interfering with proper function, or stretch beyond manufacturer's recommendations. Visual inspection daily; monthly inspection with a certification record which includes the date of inspection, the signature of the person who performed the inspection and an identifier of the chain which was inspected.

1910.179(j)(2)(vi)
All functional operating mechanisms for excessive wear of components.

1910.179(j)(2)(vii)
Rope reeving for noncompliance with manufacturer's recommendations.

1910.179(j)(3)
Periodic inspection. Complete inspections of the crane shall be performed at intervals as generally defined in paragraph (j)(1)(ii)(b) of this section, depending upon its activity, severity of service, and environment, or as specifically indicated below. These inspections shall include the requirements of paragraph (j)(2) of this section and in addition, the following items. Any deficiencies such as listed shall be carefully examined and determination made as to whether they constitute a safety hazard:

1910.179(j)(3)(i)
Deformed, cracked, or corroded members.

1910.179(j)(3)(ii)
Loose bolts or rivets.

1910.179(j)(3)(iii)
Cracked or worn sheaves and drums.

1910.179(j)(3)(iv)
Worn, cracked or distorted parts such as pins, bearings, shafts, gears, rollers, locking and clamping devices.

1910.179(j)(3)(v)
Excessive wear on brake system parts, linings, pawls, and ratchets.

1910.179(j)(3)(vi)
Load, wind, and other indicators over their full range, for any significant inaccuracies.

1910.179(j)(3)(vii)
Gasoline, diesel, electric, or other powerplants for improper performance or noncompliance with applicable safety requirements.

1910.179(j)(3)(viii)
Excessive wear of chain drive sprockets and excessive chain stretch.

1910.179(j)(3)(ix)
Electrical apparatus, for signs of pitting or any deterioration of controller contactors, limit switches and pushbutton stations.

1910.179(j)(4)
Cranes not in regular use.

1910.179(j)(4)(i)
A crane which has been idle for a period of 1 month or more, but less than 6 months, shall be given an inspection conforming with requirements of paragraph (j)(2) of this section and paragraph (m)(2) of this section before placing in service.

1910.179(j)(4)(ii)
A crane which has been idle for a period of over 6 months shall be given a complete inspection conforming with requirements of paragraphs (j)(2) and (3) of this section and paragraph (m)(2) of this section before placing in service.

1910.179(j)(4)(iii)
Standby cranes shall be inspected at least semi-annually in accordance with requirements of paragraph (j)(2) of this section and paragraph (m)(2) of this section.

1910.179(k)
Testing -

1910.179(k)(1)
Operational tests.

1910.179(k)(1)(i)
Prior to initial use all new and altered cranes shall be tested to insure compliance with this section including the following functions:

1910.179(k)(1)(i)(a)
Hoisting and lowering.

1910.179(k)(1)(i)(b)
Trolley travel.

1910.179(k)(1)(i)(c)
Bridge travel.

1910.179(k)(1)(i)(d)
Limit switches, locking and safety devices.

1910.179(k)(1)(ii)
The trip setting of hoist limit switches shall be determined by tests with an empty hook traveling in increasing speeds up to the maximum speed. The actuating mechanism of the limit switch shall be located so that it will trip the switch, under all conditions, in sufficient time to prevent contact of the hook or hook block with any part of the trolley.

1910.179(k)(2)
Rated load test. Test loads shall not be more than 125 percent of the rated load unless otherwise recommended by the manufacturer. The test reports shall be placed on file where readily available to appointed personnel.

1910.179(l)
Maintenance -

1910.179(l)(1)
Preventive maintenance. A preventive maintenance program based on the crane manufacturer's recommendations shall be established.

1910.179(l)(2)
Maintenance procedure.

1910.179(l)(2)(i)
Before adjustments and repairs are started on a crane the following precautions shall be taken:

1910.179(l)(2)(i)(a)
The crane to be repaired shall be run to a location where it will cause the least interference with other cranes and operations in the area.

1910.179(l)(2)(i)(b)
All controllers shall be at the off position.

1910.179(l)(2)(i)(c)
The main or emergency switch shall be open and locked in the open position.

1910.179(l)(2)(i)(d)
Warning or "out of order" signs shall be placed on the crane, also on the floor beneath or on the hook where visible from the floor.

1910.179(l)(2)(i)(e)
Where other cranes are in operation on the same runway, rail stops or other suitable means shall be provided to prevent interference with the idle crane.

1910.179(l)(2)(ii)
After adjustments and repairs have been made the crane shall not be operated until all guards have been reinstalled, safety devices reactivated and maintenance equipment removed.

1910.179(l)(3)
Adjustments and repairs.

1910.179(l)(3)(i)
Any unsafe conditions disclosed by the inspection requirements of paragraph (j) of this section shall be corrected before operation of the crane is resumed. Adjustments and repairs shall be done only by designated personnel.

1910.179(l)(3)(ii)
Adjustments shall be maintained to assure correct functioning of components. The following are examples:

1910.179(l)(3)(ii)(a)
All functional operating mechanisms.

1910.179(l)(3)(ii)(b)
Limit switches.

1910.179(l)(3)(ii)(c)
Control systems.

1910.179(l)(3)(ii)(d)
Brakes.

1910.179(l)(3)(ii)(e)
Power plants.

1910.179(l)(3)(iii)
Repairs or replacements shall be provided promptly as needed for safe operation. The following are examples:

1910.179(l)(3)(iii)(a)
Crane hooks showing defects described in paragraph (j)(2)(iii) of this section shall be discarded. Repairs by welding or reshaping are not generally recommended. If such repairs are attempted they shall only be done under competent supervision and the hook shall be tested to the load requirements of paragraph (k)(2) of this section before further use.

1910.179(l)(3)(iii)(b)
Load attachment chains and rope slings showing defects described in paragraph (j)(2) (iv) and (v) of this section respectively.

1910.179(n)(3)(ii)
Before starting to hoist the following conditions shall be noted:

1910.179(n)(3)(ii)(a)
Hoist rope shall not be kinked.

1910.179(n)(3)(ii)(b)
Multiple part lines shall not be twisted around each other.

1910.179(n)(3)(ii)(c)
The hook shall be brought over the load in such a manner as to prevent swinging.

1910.179(n)(3)(iii)
During hoisting care shall be taken that:

1910.179(n)(3)(iii)(a)
There is no sudden acceleration or deceleration of the moving load.

1910.179(n)(3)(iii)(b)
The load does not contact any obstructions.

1910.179(n)(3)(iv)
Cranes shall not be used for side pulls except when specifically authorized by a responsible person who has determined that the stability of the crane is not thereby endangered and that various parts of the crane will not be overstressed.

1910.179(n)(3)(v)
While any employee is on the load or hook, there shall be no hoisting, lowering, or traveling.

1910.179(n)(3)(vi)
The employer shall require that the operator avoid carrying loads over people.

1910.179(n)(3)(vii)
The operator shall test the brakes each time a load approaching the rated load is handled. The brakes shall be tested by raising the load a few inches and applying the brakes.

1910.179(n)(3)(viii)
The load shall not be lowered below the point where less than two full wraps of rope remain on the hoisting drum.

1910.179(n)(3)(ix)
When two or more cranes are used to lift a load one qualified responsible person shall be in charge of the operation. He shall analyze the operation and instruct all personnel involved in the proper positioning, rigging of the load, and the movements to be made.

1910.179(n)(3)(x)
The employer shall insure that the operator does not leave his position at the controls while the load is suspended.

1910.179(n)(3)(xi)
When starting the bridge and when the load or hook approaches near or over personnel, the warning signal shall be sounded.

1910.179(n)(4)
Hoist limit switch.

1910.179(n)(4)(i)
At the beginning of each operator's shift, the upper limit switch of each hoist shall be tried out under no load. Extreme care shall be exercised; the block shall be "inched" into the limit or run in at slow speed. If the switch does not operate properly, the appointed person shall be immediately notified.

1910.179(n)(4)(ii)
The hoist limit switch which controls the upper limit of travel of the load block shall never be used as an operating control.

1910.179(o)
Other requirements, general -

1910.179(o)(1)
Ladders.

1910.179(o)(1)(i)
The employer shall insure that hands are free from encumbrances while personnel are using ladders.

1910.179(o)(1)(ii)
Articles which are too large to be carried in pockets or belts shall be lifted and lowered by hand line.

1910.179(o)(2)
Cabs.

1910.179(o)(2)(i)
Necessary clothing and personal belongings shall be stored in such a manner as not to interfere with access or operation.

1910.179(o)(2)(ii)
Tools, oil cans, waste, extra fuses, and other necessary articles shall be stored in the tool box, and shall not be permitted to lie loose in or about the cab.

1910.179(o)(3)
Fire extinguishers. The employer shall insure that operators are familiar with the operation and care of fire extinguishers provided.

[39 FR 23502, June 27, 1974, as amended at 40 FR 27400, June 27, 1975; 49 FR 5322, Feb. 10, 1984; 51 FR 34560, Sept. 29, 1986; 55 FR 32015, Aug. 6, 1990; 61 FR 9227, March 7, 1996]

1910.184(a)

Scope. This section applies to slings used in conjunction with other material handling equipment for the movement of material by hoisting, in employments covered by this part. The types of slings covered are those made from alloy steel chain, wire rope, metal mesh, natural or synthetic fiber rope (conventional three strand construction), and synthetic web (nylon, polyester, and polypropylene).

1910.184(b) Definitions.

Angle of loading is the inclination of a leg or branch of a sling measured from the horizontal or vertical plane as shown in Fig. N-184-5; provided that an angle of loading of five degrees or less from the vertical may be considered a vertical angle of loading.

Basket hitch is a sling configuration whereby the sling is passed under the load and has both ends, end attachments, eyes or handles on the hook or a single master link.

Braided wire rope is a wire rope formed by plaiting component wire ropes.

Bridle wire rope sling is a sling composed of multiple wire rope legs with the top ends gathered in a fitting that goes over the lifting hook.

Cable laid endless sling-mechanical joint is a wire rope sling made endless by joining the ends of a single length of cable laid rope with one or more metallic fittings.

Cable laid grommet-hand tucked is an endless wire rope sling made from one length of rope wrapped six times around a core formed by hand tucking the ends of the rope inside the six wraps.

Cable laid rope is a wire rope composed of six wire ropes wrapped around a fiber or wire rope core.

Cable laid rope sling-mechanical joint is a wire rope sling made from a cable laid rope with eyes fabricated by pressing or swaging one or more metal sleeves over the rope junction.

Choker hitch is a sling configuration with one end of the sling passing under the load and through an end attachment, handle or eye on the other end of the sling.

Coating is an elastomer or other suitable material applied to a sling or to a sling component to impart desirable properties.

Cross rod is a wire used to join spirals of metal mesh to form a complete fabric. (See Fig. N-184-2.)

Designated means selected or assigned by the employer or the employer's representative as being qualified to perform specific duties.

Equivalent entity is a person or organization (including an employer) which, by possession of equipment, technical knowledge and skills, can perform with equal competence the same repairs and tests as the person or organization with which it is equated.

Fabric (metal mesh) is the flexible portion of a metal mesh sling consisting of a series of transverse coils and cross rods.

Female handle (choker) is a handle with a handle eye and a slot of such dimension as to permit passage of a male handle thereby allowing the use of a metal mesh sling in a choker hitch. (See Fig. N-184-1.)

Handle is a terminal fitting to which metal mesh fabric is attached. (See Fig. N-184-1.)

Handle eye is an opening in a handle of a metal mesh sling shaped to accept a hook, shackle or other lifting device. (See Fig. N-184-1.)

Hitch is a sling configuration whereby the sling is fastened to an object or load, either directly to it or around it.

Link is a single ring of a chain.

Male handle (triangle) is a handle with a handle eye.

Master coupling link is an alloy steel welded coupling link used as an intermediate link to join alloy steel chain to master links. (See Fig. N-184-3.)

Master link or gathering ring is a forged or welded steel link used to support all members (legs) of an alloy steel chain sling or wire rope sling.

Mechanical coupling link is a nonwelded, mechanically closed steel link used to attach master links, hooks, etc., to alloy steel chain.

Proof load is the load applied in performance of a proof test.

Proof test is a nondestructive tension test performed by the sling manufacturer or an equivalent entity to verify construction and workmanship of a sling.

Rated capacity or working load limit is the maximum working load permitted by the provisions of this section.

Reach is the effective length of an alloy steel chain sling measured from the top bearing surface of the upper terminal component to the bottom bearing surface of the lower terminal component.

Selvage edge is the finished edge of synthetic webbing designed to prevent unraveling.

Sling is an assembly which connects the load to the material handling equipment.

Sling manufacturer is a person or organization that assembles sling components into their final form for sale to users.

Spiral is a single transverse coil that is the basic element from which metal mesh is fabricated. (See Fig. N-184-2.)

Strand laid endless sling-mechanical joint is a wire rope sling made endless from one length of rope with the ends joined by one or more metallic fittings.

Strand laid grommet-hand tucked is an endless wire rope sling made from one length of strand wrapped six times around a core formed by hand tucking the ends of the strand inside the six wraps.

Strand laid rope is a wire rope made with strands (usually six or eight) wrapped around a fiber core, wire strand core, or independent wire rope core (IWRC).

Vertical hitch is a method of supporting a load by a single, vertical part or leg of the sling. (See Fig. N-184-4.)

1910.184(c)
Safe operating practices. Whenever any sling is used, the following practices shall be observed:

1910.184(c)(1)
Slings that are damaged or defective shall not be used.

1910.184(c)(2)
Slings shall not be shortened with knots or bolts or other makeshift devices.

1910.184(c)(3)
Sling legs shall not be kinked.

1910.184(c)(4)
Slings shall not be loaded in excess of their rated capacities.

1910.184(c)(5)
Slings used in a basket hitch shall have the loads balanced to prevent slippage.

1910.184(c)(6)
Slings shall be securely attached to their loads.

1910.184(c)(7)
Slings shall be padded or protected from the sharp edges of their loads.

1910.184(c)(8)
Suspended loads shall be kept clear of all obstructions.

1910.184(c)(9)
All employees shall be kept clear of loads about to be lifted and of suspended loads.

1910.184(c)(10)
Hands or fingers shall not be placed between the sling and its load while the sling is being tightened around the load.

1910.184(c)(11)
Shock loading is prohibited.

1910.184(c)(12)
A sling shall not be pulled from under a load when the load is resting on the sling.

1910.184(c)(13)
Employers must not load a sling in excess of its recommended safe working load as prescribed by the sling manufacturer on the identification markings permanently affixed to the sling.

1910.184(c)(14)
Employers must not use slings without affixed and legible identification markings.

1910.184(d)
Inspections. Each day before being used, the sling and all fastenings and attachments shall be inspected for damage or defects by a competent person designated by the employer. Additional inspections shall be performed during sling use, where service conditions warrant. Damaged or defective slings shall be immediately removed from service.

1910.184(e)
Alloy steel chain slings.

1910.184(e)(1)
Sling identification. Alloy steel chain slings shall have permanently affixed durable identification stating size, grade, rated capacity, and reach.

1910.184(e)(2)
Attachments.

1910.184(e)(2)(i)
Hooks, rings, oblong links, pear shaped links, welded or mechanical coupling links or other attachments shall have a rated capacity at least equal to that of the alloy steel chain with which they are used or the sling shall not be used in excess of the rated capacity of the weakest component.

1910.184(e)(2)(ii)
Makeshift links or fasteners formed from bolts or rods, or other such attachments, shall not be used.

1910.184(e)(3)
Inspections.

1910.184(e)(3)(i)
In addition to the inspection required by paragraph (d) of this section, a thorough periodic inspection of alloy steel chain slings in use shall be made on a regular basis, to be determined on the basis of (A) frequency of sling use; (B) severity of service conditions; (C) nature of lifts being made; and (D) experience gained on the service life of slings used in similar circumstances. Such inspections shall in no event be at intervals greater than once every 12 months.

1910.184(e)(3)(ii)
The employer shall make and maintain a record of the most recent month in which each alloy steel chain sling was thoroughly inspected, and shall make such record available for examination.

1910.184(e)(3)(iii)
The thorough inspection of alloy steel chain slings shall be performed by a competent person designated by the employer, and shall include a thorough inspection for wear, defective welds, deformation and increase in length. Where such defects or deterioration are present, the sling shall be immediately removed from service.

1910.184(e)(4)
Proof testing. The employer shall ensure that before use, each new, repaired, or reconditioned alloy steel chain sling, including all welded components in the sling assembly, shall be proof tested by the sling manufacturer or equivalent entity, in accordance with paragraph 5.2 of the American Society of Testing and Materials Specification A391-65, which is incorporated by reference as specified in Sec. 1910.6 (ANSI G61.1-1968). The employer shall retain a certificate of the proof test and shall make it available for examination.

1910.184(e)(5)

1910.184(e)(6)
Safe operating temperatures. Employers must permanently remove an alloy steel-chain slings from service if it is heated above 1000 degrees F. When exposed to service temperatures in excess of 600 degrees F, employers must reduce the maximum working-load limits permitted by the chain manufacturer in accordance with the chain or sling manufacturer's recommendations.

1910.184(e)(7)
Repairing and reconditioning alloy steel chain slings.

1910.184(e)(7)(i)
Worn or damaged alloy steel chain slings or attachments shall not be used until repaired. When welding or heat testing is performed, slings shall not be used unless repaired, reconditioned and proof tested by the sling manufacturer or an equivalent entity.

1910.184(e)(7)(ii)
Mechanical coupling links or low carbon steel repair links shall not be used to repair broken lengths of chain.

1910.184(e)(8)
Effect of wear. If the chain size at any point of the link is less than that stated in Table N-184-1, the employer must remove the chain from service.

1910.184(e)(9)
Deformed attachments.

1910.184(e)(9)(i)
Alloy steel chain slings with cracked or deformed master links, coupling links or other components shall be removed from service.

TABLE N-184-1. - MINIMUM ALLOWABLE CHAIN SIZE AT ANY POINT OF LINK

Chain Size	Inches
1/4	13/64
3/8	19/64
1/2	25/64
5/8	31/64
3/4	19/32
7/8	45/64
1	13/16
1 1/8	29/32
1 1/4	1
1 3/8	1 3/32
1 1/2	1 3/16
1 3/4	1 13/32

1910.184(e)(9)(ii)
Slings shall be removed from service if hooks are cracked, have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.

1910.184(f)
Wire-rope sling --

1910.184(f)(1)
Sling use. Employers must use only wire-rope slings that have permanently affixed and legible identification markings as prescribed by the manufacturer, and that indicate the recommended safe working load for the type(s) of hitch(es) used, the angle upon which it is based, and the number of legs if more than one.

1910.184(f)(2)
Minimum sling lengths.

1910.184(f)(2)(i)
Cable laid and 6x19 and 6x37 slings shall have a minimum clear length of wire rope 10 times the component rope diameter between splices, sleeves or end fittings.

1910.184(f)(2)(ii)
Braided slings shall have a minimum clear length of wire rope 40 times the component rope diameter between the loops or end fittings.

1910.184(f)(2)(iii)
Cable laid grommets, strand laid grommets and endless slings shall have a minimum circumferential length of 96 times their body diameter.

1910.184(f)(3)
Safe operating temperatures. Fiber core wire rope slings of all grades shall be permanently removed from service if they are exposed to temperatures in excess of 200 deg. F. When nonfiber core wire rope slings of any grade are used at temperatures above 400 deg. F or below minus 60 deg. F, recommendations of the sling manufacturer regarding use at that temperature shall be followed.

1910.184(f)(4)
End attachments.

1910.184(f)(4)(i)
Welding of end attachments, except covers to thimbles, shall be performed prior to the assembly of the sling.

1910.184(f)(4)(ii)
All welded end attachments shall not be used unless proof tested by the manufacturer or equivalent entity at twice their rated capacity prior to initial use. The employer shall retain a certificate of the proof test, and make it available for examination.

1910.184(f)(5)
Removal from service. Wire rope slings shall be immediately removed from service if any of the following conditions are present:

1910.184(f)(5)(i)
Ten randomly distributed broken wires in one rope lay, or five broken wires in one strand in one rope lay.

1910.184(f)(5)(ii)
Wear or scraping of one-third the original diameter of outside individual wires.

1910.184(f)(5)(iii)
Kinking, crushing, bird caging or any other damage resulting in distortion of the wire rope structure.

1910.184(f)(5)(iv)
Evidence of heat damage.

1910.184(f)(5)(v)
End attachments that are cracked, deformed or worn.

1910.184(f)(5)(vi)
Hooks that have been opened more than 15 percent of the normal throat opening measured at the narrowest point or twisted more than 10 degrees from the plane of the unbent hook.

1910.184(f)(5)(vii)
Corrosion of the rope or end attachments.

1910.184(g)
Metal mesh slings --

1910.184(g)(1)
Sling marking. Each metal mesh sling shall have permanently affixed to it a durable marking that states the rated capacity for vertical basket hitch and choker hitch loadings.

1910.184(g)(2)
Handles. Handles shall have a rated capacity at least equal to the metal fabric and exhibit no deformation after proof testing.

1910.184(g)(3)
Attachments of handles to fabric. The fabric and handles shall be joined so that:

1910.184(g)(3)(i)
The rated capacity of the sling is not reduced.

1910.184(g)(3)(ii)
The load is evenly distributed across the width of the fabric.

1910.184(g)(3)(iii)
Sharp edges will not damage the fabric.

1910.184(g)(4)
Sling coatings. Coatings which diminish the rated capacity of a sling shall not be applied.

1910.184(g)(5)
Sling testing. All new and repaired metal mesh slings, including handles, shall not be used unless proof tested by the manufacturer or equivalent entity at a minimum of 1 1/2 times their rated capacity. Elastomer impregnated slings shall be proof tested before coating.

1910.184(g)(6)
[Reserved]

1910.184(g)(7)
Safe operating temperatures. Metal mesh slings which are not impregnated with elastomers may be used in a temperature range from minus 20 deg. F to plus 550 deg. F without decreasing the working load limit. Metal mesh slings impregnated with polyvinyl chloride or neoprene may be used only in a temperature range from zero degrees to plus 200 deg. F. For operations outside these temperature ranges or for metal mesh slings impregnated with other materials, the sling manufacturer's recommendations shall be followed.

1910.184(g)(8)
Repairs.

1910.184(g)(8)(i)
Metal mesh slings which are repaired shall not be used unless repaired by a metal mesh sling manufacturer or an equivalent entity.

1910.184(g)(8)(ii)
Once repaired, each sling shall be permanently marked or tagged, or a written record maintained, to indicate the date and nature of the repairs and the person or organization that performed the repairs. Records of repairs shall be made available for examination.

1910.184(g)(9)
Removal from service. Metal mesh slings shall be immediately removed from service if any of the following conditions are present:

1910.184(g)(9)(i)
A broken weld or broken brazed joint along the sling edge.

1910.184(g)(9)(ii)
Reduction in wire diameter of 25 per cent due to abrasion or 15 per cent due to corrosion.

1910.184(g)(9)(iii)
Lack of flexibility due to distortion of the fabric.

1910.184(g)(9)(iv)
Distortion of the female handle so that the depth of the slot is increased more than 10 per cent.

1910.184(g)(9)(v)
Distortion of either handle so that the width of the eye is decreased more than 10 per cent.

1910.184(g)(9)(vi)
A 15 percent reduction of the original cross sectional area of metal at any point around the handle eye.

1910.184(g)(9)(vii)
Distortion of either handle out of its plane.

1910.184(h)
Natural and synthetic fiber-rope slings --

1910.184(h)(1)
Sling use. Employers must use natural and synthetic fiber-rope slings that have permanently affixed and legible identification markings stating the rated capacity for the type(s) of hitch(es) used and the angle upon which it is based, type of fiber material, and the number of legs if more than one.

1910.184(h)(2)
Safe operating temperatures. Natural and synthetic fiber rope slings, except for wet frozen slings, may be used in a temperature range from minus 20 deg. F to plus 180 deg. F without decreasing the working load limit. For operations outside this temperature range and for wet frozen slings, the sling manufacturer's recommendations shall be followed.

1910.184(h)(3)
Splicing. Spliced fiber rope slings shall not be used unless they have been spliced in accordance with the following minimum requirements and in accordance with any additional recommendations of the manufacturer:

1910.184(h)(3)(i)
In manila rope, eye splices shall consist of at least three full tucks, and short splices shall consist of at least six full tucks, three on each side of the splice center line.

1910.184(h)(3)(ii)
In synthetic fiber rope, eye splices shall consist of at least four full tucks, and short splices shall consist of at least eight full tucks, four on each side of the center line.

1910.184(h)(3)(iii)
Strand end tails shall not be trimmed flush with the surface of the rope immediately adjacent to the full tucks. This applies to all types of fiber rope and both eye and short splices. For fiber rope under one inch in diameter, the tail shall project at least six rope diameters beyond the last full tuck. For fiber rope one inch in diameter and larger, the tail shall project at least six inches beyond the last full tuck. Where a projecting tail interferes with the use of the sling, the tail shall be tapered and spliced into the body of the rope using at least two additional tucks (which will require a tail length of approximately six rope diameters beyond the last full tuck).

1910.184(h)(3)(iv)
Fiber rope slings shall have a minimum clear length of rope between eye splices equal to 10 times the rope diameter.

1910.184(h)(3)(v)
Knots shall not be used in lieu of splices.

1910.184(h)(3)(vi)
Clamps not designed specifically for fiber ropes shall not be used for splicing.

1910.184(h)(3)(vii)
For all eye splices, the eye shall be of such size to provide an included angle of not greater than 60 degrees at the splice when the eye is placed over the load or support.

1910.184(h)(4)
End attachments. Fiber rope slings shall not be used if end attachments in contact with the rope have sharp edges or projections.

1910.184(h)(5)
Removal from service. Natural and synthetic fiber rope slings shall be immediately removed from service if any of the following conditions are present:

1910.184(h)(5)(i)
Abnormal wear.

1910.184(h)(5)(ii)
Powdered fiber between strands.

1910.184(h)(5)(iii)
Broken or cut fibers.

1910.184(h)(5)(iv)
Variations in the size or roundness of strands.

1910.184(h)(5)(v)
Discoloration or rotting.

1910.184(h)(5)(vi)
Distortion of hardware in the sling.

1910.184(h)(6)
Repairs. Only fiber rope slings made from new rope shall be used. Use of repaired or reconditioned fiber rope slings is prohibited.

1910.184(i)
Synthetic web slings --

1910.184(i)(1)
Sling identification. Each sling shall be marked or coded to show the rated capacities for each type of hitch and type of synthetic web material.

1910.184(i)(2)
Webbing. Synthetic webbing shall be of uniform thickness and width and selvage edges shall not be split from the webbing's width.

1910.184(i)(3)
Fittings. Fittings shall be:

1910.184(i)(3)(i)
Of a minimum breaking strength equal to that of the sling; and

1910.184(i)(3)(ii)
Free of all sharp edges that could in any way damage the webbing.

1910.184(i)(4)
Attachment of end fittings to webbing and formation of eyes. Stitching shall be the only method used to attach end fittings to webbing and to form eyes. The thread shall be in an even pattern and contain a sufficient number of stitches to develop the full breaking strength of the sling.

1910.184(i)(5)
[Reserved]

1910.184(i)(6)
Environmental conditions. When synthetic web slings are used, the following precautions shall be taken:

1910.184(i)(6)(i)
Nylon web slings shall not be used where fumes, vapors, sprays, mists or liquids of acids or phenolics are present.

1910.184(i)(6)(ii)
Polyester and polypropylene web slings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

1910.184(i)(6)(iii)
Web slings with aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

1910.184(i)(7)
Safe operating temperatures. Synthetic web slings of polyester and nylon shall not be used at temperatures in excess of 180 deg. F. Polypropylene web slings shall not be used at temperatures in excess of 200 deg. F.

1910.184(i)(8)
Repairs.

1910.184(i)(8)(i)
Synthetic web slings which are repaired shall not be used unless repaired by a sling manufacturer or an equivalent entity.

1910.184(i)(8)(ii)
Each repaired sling shall be proof tested by the manufacturer or equivalent entity to twice the rated capacity prior to its return to service. The employer shall retain a certificate of the proof test and make it available for examination.

1910.184(i)(8)(iii)
Slings, including webbing and fittings, which have been repaired in a temporary manner shall not be used.

1910.184(i)(9)
Removal from service. Synthetic web slings shall be immediately removed from service if any of the following conditions are present:

1910.184(i)(9)(i)
Acid or caustic burns;

1910.184(i)(9)(ii)
Melting or charring of any part of the sling surface;

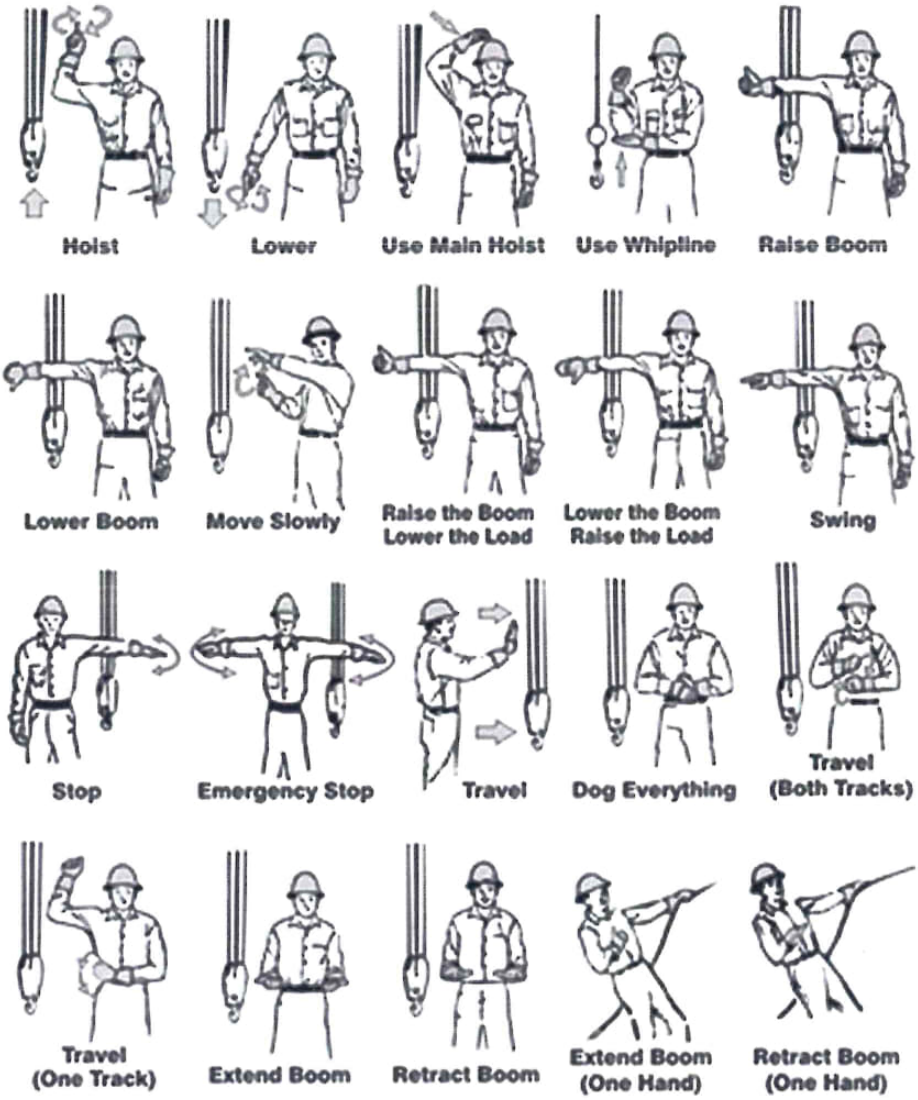
1910.184(i)(9)(iii)
Snags, punctures, tears or cuts;

1926.251(e)(8)(iv)
Broken or worn stitches; or

1926.251(e)(8)(v)
Distortion of fittings.

[40 FR 27369, June 27, 1975, as amended at 40 FR 31598, july 28, 1975; 41 FR 13353, Mar. 30, 1976; 58 FR 35309, june 30, 1993; 61 FR 9227, March 7, 1996; 76 FR 36607, June 8, 2011]

CRANE HAND SIGNALS



Just remembering these Mobile Crane hand signals only does not fulfill your job as signalman, you need to follow these guidelines also for work safety:

- Always pay attention to how the crane and load moves when the operator follows your signals.
- Prior to making the lifts you should discuss the signals and the lift path with the operator.
- Always keep your hand away from your body so that the operator have a better view and can see it clearly.
- Maintain a clear view of the operator, load and entire load path.
- Prior to lifting or setting a load make sure that everyone is ready.
- You can also use a middle man to transfer signals to the operator if it is not possible for one person to see everything (radios can also be used).

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CRANE HAND SIGNAL DESCRIPTIONS

- **Hoist Load:** With forearm vertical forefinger pointing up, move hand in a small horizontal circle
- **Lower Load:** With forearm vertical forefinger pointing down, move hand in a horizontal circle
- **Main Hoist:** Tap fist on Head and then use regular signals
- **Use Whipline(Auxiliary Hoist):** Tap elbow with one hand and then use normal signals
- **Raise Boom:** Arm extended, fingers closed and thumb pointing upwards
- **Lower Boom:** Arm extended, fingers closed and thumb pointing downwards
- **Move Slowly:** Use one hand to give any motion signal and place the other hand motionless infront of the hand giving the signal
- **Raise Boom & Lower Load:** Arm extended, thumb pointing up, flex fingers in and out as long as the load movement is desired
- **Lower Boom & Raise Load:** Arm extended, thumb pointing down, flex fingers in and out as long as the load movement is desired
- **Swing:** With extended arm, point the finger in the direction of the swing of boom
- **Stop:** Arm extended with palm down, move arm back and forth horizontally
- **Emergency Stop:** Both Arms extended with palms down, move arms back and forth horizontally
- **Travel:** With arm extended, forward hand open and slightly raised, make pushing motion in direction of travel
- **Dog Everything:** Clasp hands infront of the body
- **Travel(Both Tracks):** Use both fists infront of body making a circular motion about each other indicating direction of travel forward or backward
- **Travel(One Track):** Lock the track on side indicated by raised fist. travel opposite track in direction indicated by circualar motion of the other fist rotating infront of the body
- **Extend Boom(Telescoping Booms):** Both fists infront of the body with thumbs pointing outward
- **Retract Boom(Telescoping Booms):** Both fists infront of the body with thumbs pointing toward each other
- **Extend Boom(One Hand):** One fist infront of chest with thumb pointing up and tapping the chest
- **Retract Boom(One Hand):** One fist infront of chest with thumb pointing outward and heet of fist tapping the chest

LIFTING SAFETY REVIEW

WISCONSIN LIFTING SPECIALISTS INC.

Name: _____

Company: _____

Date: _____

1. Which of the following defects are cause for removing a web sling or polyester round sling from service?
   A. Cut or snag
   B. Excessive abrasion or wear
   C. Missing or illegible sling identification
   D. Ultraviolet light damage
   E. All of the above

2. When using multiple leg rigging, the most desirable sling angles to have are?
   A. 5-25 degrees
   B. 30-40 degrees
   C. 45-60 degrees
   D. 75-90 degrees

3. The minimum recommended sling angle is ?
   A. 30 degrees
   B. 45 degrees
   C. 60 degrees
   D. Sling angles are not recommended

4. When a shackle is side loaded at a 90 degree angle, the loss of capacity is?
   A. 10%
   B. 50%
   C. 75%
   D. Shackles can not be side loaded

5. All chain slings, approved for overhead lifting, must be removed from service if exposed to temperatures over 1000 degrees.
   A. True
   B. False

6. A tear in the outer sheath of a polyester endless sling requires removal from service?
   A. True
   B. False

7. The maximum included angle of a screw pin or bolt type shackle is?
   A. 15 degrees
   B. 30 degrees
   C. 120 degrees
   D. 180 degrees

8. OSHA 1910.184 inspection frequency requires?
   A. Initial inspection upon purchase before use
   B. Daily inspection before use
   C. Periodic inspection not to exceed one year
   D. Does not require inspection

9. Maximum wear limitation of hooks and shackles is?
   A. 5%
   B. 10%
   C. 15 %
   D. 20%

10. The foundation for safe rigging practices starts with?
   A. Know the working load limit of rigging components
   B. Load all components within the W.L.L
   C. Inspecting all cranes and rigging gear prior to use
   D. A legible W.L.L tag or label

11: When moving a suspended load it is always better to lead the load than follow it.
   A) True
   B) False

12. Which grade of chain is the only acceptable type for use in chain slings for lifting?
   A. Transport G-7
   B. High test G-4
   C. Alloy G-8 and Above
   D. Proof coil G-3

13. The load chain of any hoist ____ be wrapped around a load for lifting purposes.
   A. should not
   B. can
   C. shall not

14. Which angle from horizontal will produce the greatest tension in a sling leg ?
   A. 100 Degrees
   B. 60 degrees
   C. 45 degrees
   D. 30 degrees

15. Which of the following is not a removal criteria for a synthetic web sling?
   A. Color Fading from exposure to sunlight/UV
   B. Worn or broken stitching
   C. Illegible or missing tag
   D. Severe pliability

16: Both Synthetic AND Steel Slings can be damaged by weld spatter and heat from a welding torch.
   A) True
   B) False

17. An eyebolt used at any angle other than zero degrees can reduce capacity of that eye bolt by:
   A. 50%
   B. 30%
   C. 30 Degrees
   D. 75%

18. It is not necessary to read the operating, maintenance manual or warning information prior to using designated lifting equipment.
   A. True
   B. False

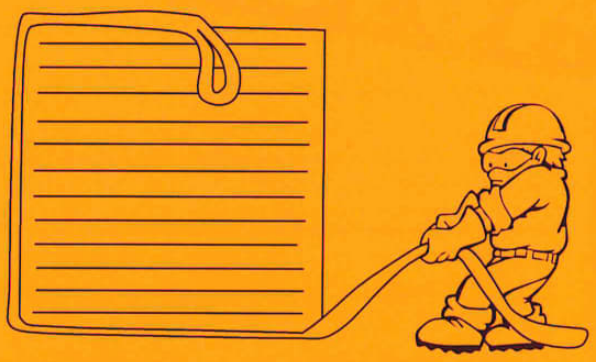
19. Any crane operator must be trained in the operation and care of fire extinguishers.
   A. False
   B. True

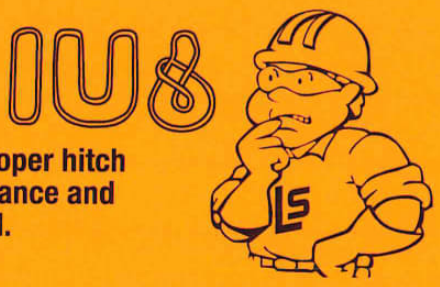
20. Cranes, Hoists and Rigging Equipment need to be inspected and approved for use:
   A. By 1st Shift Safety Director
   B. By Maintenance Department
   C. By Every User

POLYESTER, SYNTHETIC AND NYLON WEB SAFETY TIPS

1 Continually inspect for damage, wear and misuse.

2 Take precautions to avoid damage to slings.





3 Use proper hitch for balance and control.

4 Consider sling angle and compensate accordingly.

PAY ATTENTION TO SLING ANGLES

Lifting angles reduce the capacity of all slings.

SLING ANGLE TABLE (Angle of Lift)

ANGLE/DEGREES HORIZONTAL	LOSS FACTOR	ANGLE/DEGREES HORIZONTAL	LOSS FACTOR
90	1.000	55	0.819
85	0.996	50	0.766
80	0.985	45	0.707
75	0.966	40	0.643
70	0.940	35	0.574
65	0.906	30	0.500
60	0.866		

When selecting a sling to carry a given load, it is important to consider the angle at which the sling will be used. As the angle increases, the load to which the sling is subjected increases substantially. Please use the below example and the chart to determine your capacity when lifting with angles:

EXAMPLE: You have two 1", 2 ply endless slings with 3200 lb vertical ratings. Your lift requires use of the slings at 60 degree angles, calculate your reduced capacity like this:

Capacity of one 1" 2 ply sling ..... 3200 lb
You are using two slings ..... x 2
Total Capacity before angles ..... 6400 lb
Refer to chart, select 60 degree angle loss factor ..... .866
Multiply the total capacity and the loss factor ..... .866 x 6400
Your reduced capacity ..... 5542 lb

NOTES

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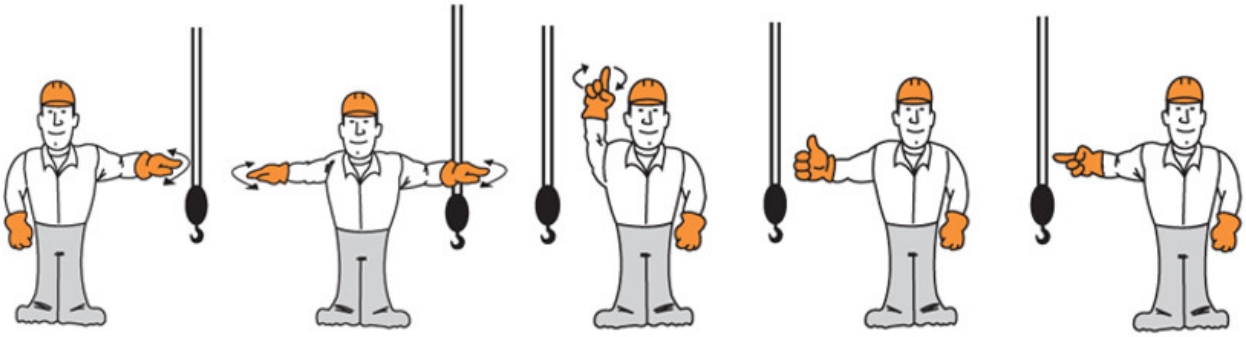
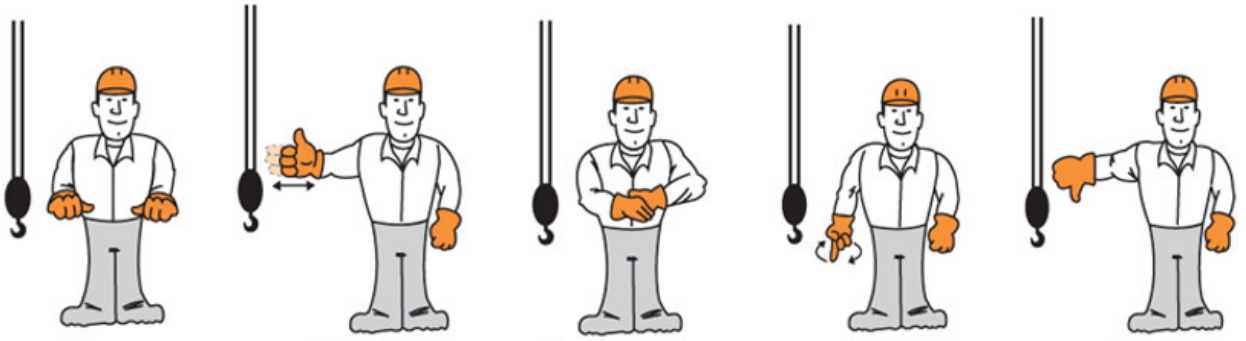
Common Crane Signals

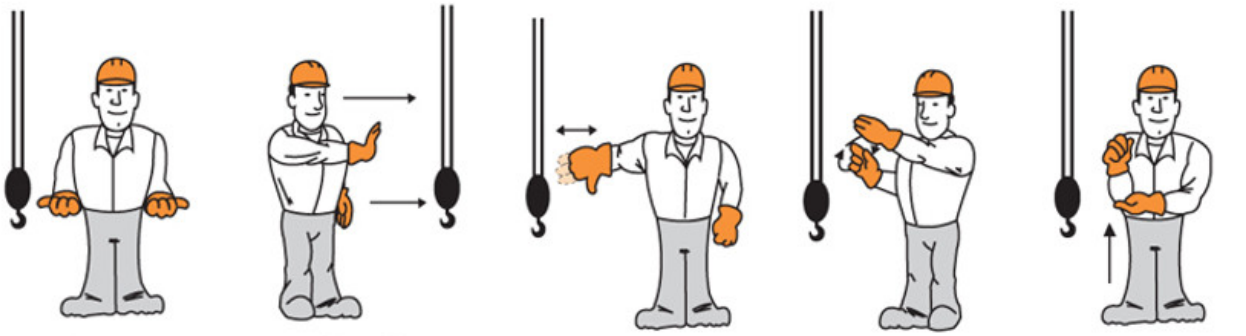
Standard Crane Hand Signals



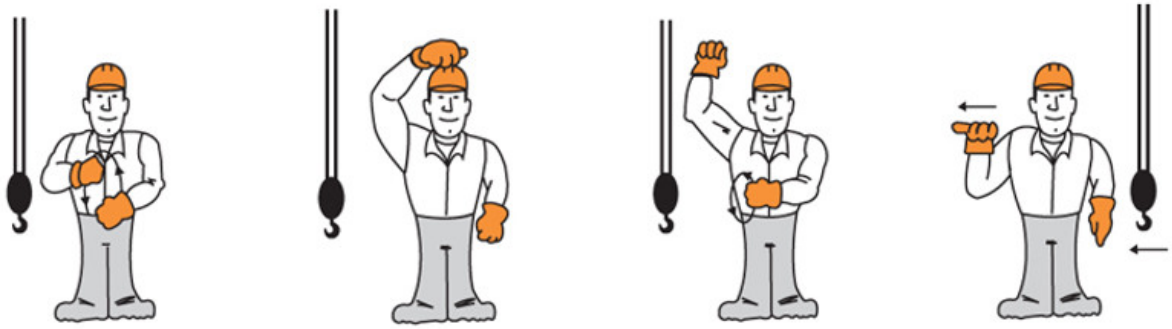
Stop | Emergency Stop | Hoist | Raise Boom | Swing



Retract Telescoping Boom | Raise the Boom Lower the Load | Dog Everything | Lower | Lower Boom



Extend Telescoping Boom | Travel/ Tower Travel | Lower the Boom Raise the Load | Move Slowly | Use Auxiliary Hoist



Crawler Crane Travel Both Tracks | Use Main Hoist | Crawler Crane Travel One Track | Trolley Travel

Source: Construction OSHA 29 CFR 1926.1400, Subpart CC, Appendix A - Standard Hand Signals