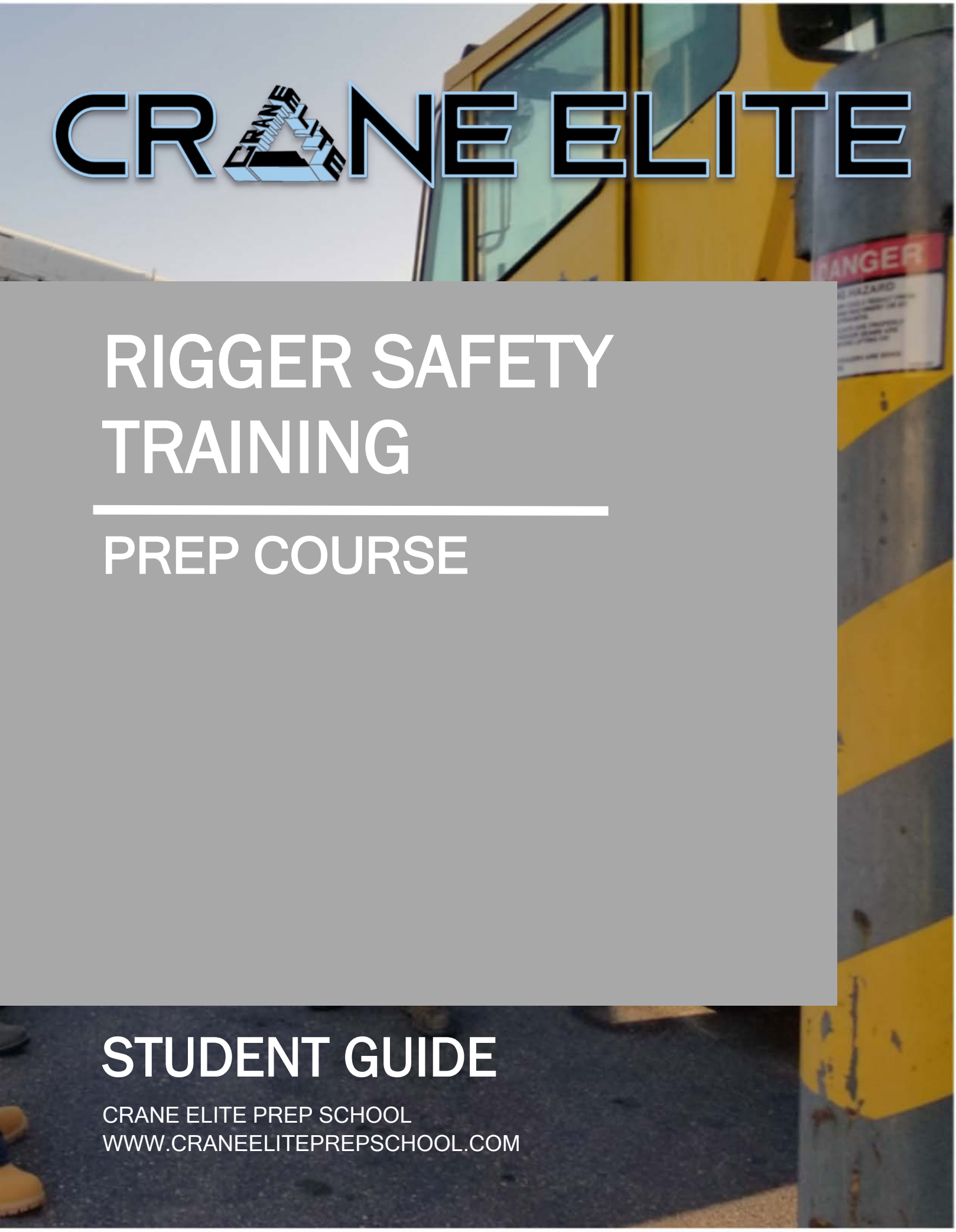

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SLINGS

Slings

1) Sling Types:

a) Alloy Steel Chain Slings

b) Wire Rope Slings

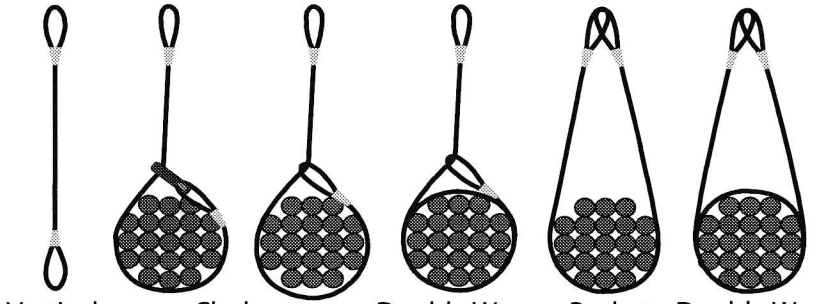
c) Metal Mesh Slings

d) Synthetic Fiber Rope Slings

e) Synthetic Web Slings

f) Synthetic Round Slings

2) Hitch Types:



3) Sling Design Factors

a) Alloy Steel Chain Slings – 4 (ASME 9-1.4)

b) Wire Rope Slings – 5 (OSHA 1926.251(c)(16) & ASME 9-2.4)

c) Metal Mesh Slings – 5 (ASME 9-3.4)

d) Synthetic Fiber Rope Slings – 5 (ASME 9-4.4)

e) Synthetic Web Slings – 5 (ASME 9-5.4)

f) Synthetic Round Slings – 5 (ASME 9-6.4)

4) Sling Identification

a) Alloy Chain Slings

(1) OSHA

(i) Size.

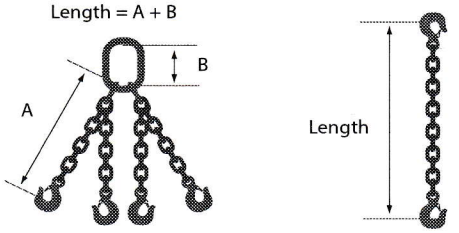
(ii) Grade. (80 or 100)

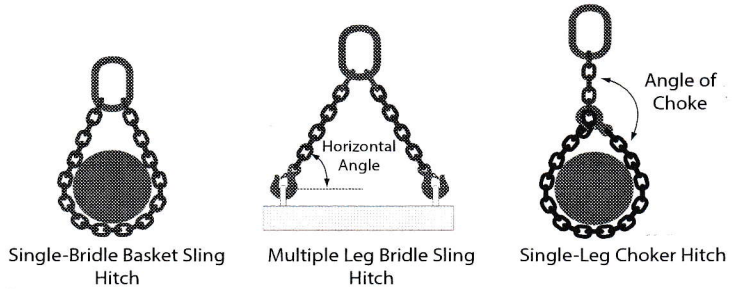
(iii) Rated Capacity.

(iv) Sling Manufacturer.

(2) ASME

(i) Rated load for at least one hitch type and the angle upon which it is based.





(ii) Grade.

(iii) Number of legs.

(iv) Chain Size.

(v) Trademark or Name of Manufacturer, or if repaired, entity that repaired it.

(vi) Length.

(3) Individual sling identification. (Serial Number)

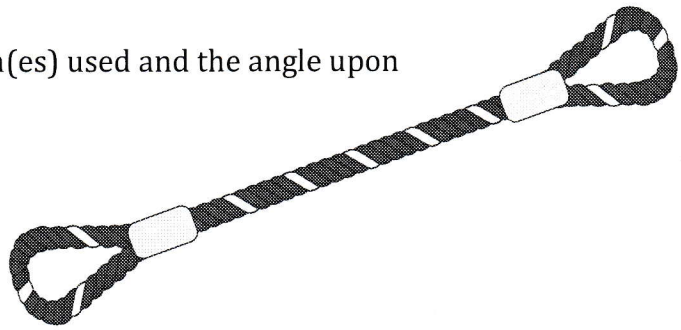
b) Wire Rope Slings

(1) OSHA

(i) Size.

(ii) Rated Capacity for the type(s) of hitch(es) used and the angle upon which it is based.

(iii) Number of legs, if more than one.



(2) ASME

(i) Rated load for at least one hitch type and the angle upon which it is based.

(ii) Number of legs, if more than one.

(iii) Diameter or Size.

(iv) Trademark or Name of Manufacturer, or if repaired, entity that repaired it.

c) Metal Mesh Slings

(1) OSHA

(i) Rated capacities for vertical basket and choker hitches.

(2) ASME

(i) Name or Trademark of manufacturer, or if repaired, entity that repaired it.

(ii) Rated load for at least one hitch type and the angle upon which it is based.

(iii) Width and gauge.

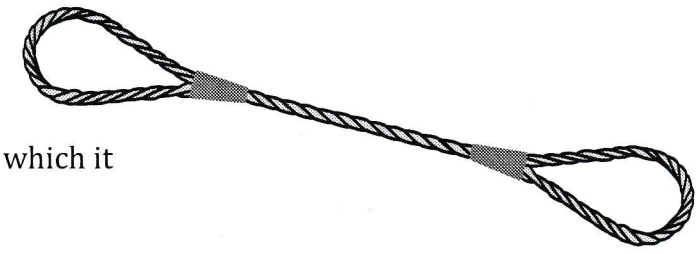
(iv) Number of legs, if more than one.

(v) Individual sling identification. (Serial number)

d) Synthetic Fiber Rope Slings

(1) OSHA

(i) Rated capacity for the type(s) of hitch(es) used and the angle upon which it is based.



(2) ASME

(i) Name or trademark of manufacturer, or if repaired, entity that repaired it.

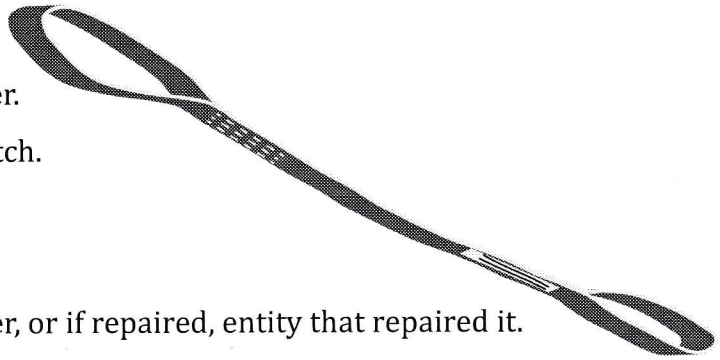
(ii) Manufacturer's code or stock number.

(iii) Rated load for at least one hitch type and the angle upon which it is based.

(iv) Type of material.

(v) Number of legs, if more than one.

e) Synthetic Web Slings



(1) OSHA

(i) Name or trademark of manufacturer.

(ii) Rated capacities for each type of hitch.

(iii) Type of synthetic material.

(2) ASME

(i) Name or trademark of manufacturer, or if repaired, entity that repaired it.

(ii) Manufacturer's code or stock number.

(iii) Rated load for at least one hitch type and the angle upon which it was based.

(iv) Type of synthetic material.

(v) Number of legs, if more than one.

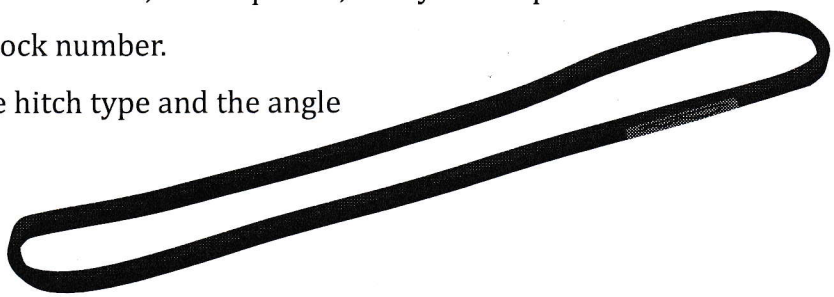
f) Synthetic Round Slings

(1) ASME

(i) Name or trademark of manufacturer, or if repaired, entity that repaired it.

(ii) Manufacturer's code or stock number.

(iii) Rated load for at least one hitch type and the angle upon which it was based.



(iv) Core material.

(v) Cover material, if different from core material.

(vi) Number of legs, if more than one.

5) Maintenance of Sling Identification

a) Sling identification should be maintained by the **USER.**

6) Replacement of Sling Identification

a) Replacement sling identification shall be completed by the manufacturer or a qualified person. Additional **proof testing is NOT required.**

7) General Sling Inspection Requirements

a) Inspections shall be performed by a "Competent Person".

b) Type of inspections:

(1) Frequent Inspection

(i) Visual inspection with **no records required.**

(ii) Frequent inspections must be performed:

(a) OSHA 1910.184

(1) Each **day prior to use** and during use as necessary.

(b) OSHA 1926.251

(1) Each **shift prior** to use and during use as necessary.

(c) ASME B30.9

(1) Each **day or shift** of use.

(2) Periodic Inspection

(i) Complete inspection of rigging equipment.

(ii) Records of the most recent periodic inspections shall be maintained.

(iii) Periodic inspection shall be performed **at least annually**. The frequency should be based on:

(a) Frequency of sling use.

(b) Severity of service conditions.

(c) Load handling activities.

(d) Experience gained by the use of sling in similar situations.

8) Sling Specific Removal Criteria

a) Alloy Chain Slings

(1) Missing or illegible ID.

(2) Excessive wear, nicks, or gouges.

(3) Stretched chain links or components.

(4) Cracks or breaks.

(5) Distortion.

(6) Heat damage.

(7) Weld spatter.

(8) Pitting and corrosion.

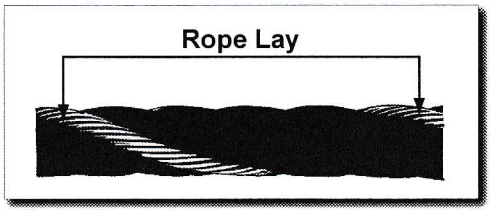
(9) Lack of chain flexibility.

(10) Visible damage.

b) Wire Rope Slings

(1) Missing or illegible ID.

(2) Broken Wires



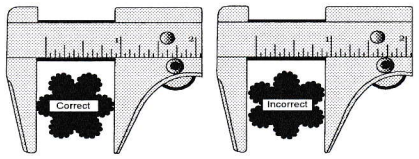
(i) For stand-laid or single-part, **10 randomly distributed broken wires in one rope lay, or 5 broken wires in one strand in one rope lay.**

(ii) For cable-laid slings, 20 broken wires per lay.

(iii) For less than 8-braid slings, 20 broken wires per braid length.

(iv) For eight-part or more braided slings, 40 broken wires per braid length.

(3) Severe localized abrasion or scraping resulting in a reduction from **nominal diameter of more than 5%.**



(4) Kinking, crushing, birdcaging, or any other damage resulting in damage to the rope structure.

(5) Evidence of heat damage.

(6) Fittings that are cracked, deformed, or worn to the extent that the strength of the sling is substantially affected.

(7) Severe corrosion of the rope or fittings.

c) Metal Mesh Slings

(1) Missing or illegible ID.

(2) Broken weld.

(3) Broken brazed joint on edge of sling.

(4) Broken wire in any part of the mesh.

(5) Reduction in wire diameter of **25% due to abrasion or 15% due to corrosion.**

(6) Lack of flexibility due to distortion of the mesh.

(7) Distortion of the choker fitting so the depth of the slot is increased by more than 10%.

(8) Distortion of either end fitting so the width of the eye opening is decreased by more than 10%.

(9) 15% reduction of the original cross-sectional area of any point around the hook opening of the end fitting.

(10) Visible distortion of either end fitting out of its plane.

(11) End fitting cracked or broken.

(12) Slings with the spirals locked or without free articulation shall **NOT** be used.

(13) Pitted, corroded, cracked, bent, twisted, gouged, or broken fittings.

(14) Visible damage

d) Synthetic Fiber Rope Slings

(1) Missing or illegible ID.

(2) Damaged area that reduced the rope diameter by 10%.

(3) Uniform breakage of the fiber along a major portion of the length of the rope.

(4) Fused, melted, or broken inside fiber at 10% of a strand or entire rope.

(5) Discoloration or rotting.

(6) Powered fiber between strands.

(7) Broken or cut fibers.

(8) Brittle or stiff areas on any part of the sling, which may mean chemical or ultraviolet/ sunlight damage.

(9) Excessive dirt on the interior portion of the rope.

(10) Foreign matter that has permeated the rope.

(11) Kinks or distortion.

(12) Charred, hard, or melted areas that affect more than 10% of strand or rope diameter.

(13) Poor condition of components.

e) Synthetic Web Slings or Synthetic Round Slings

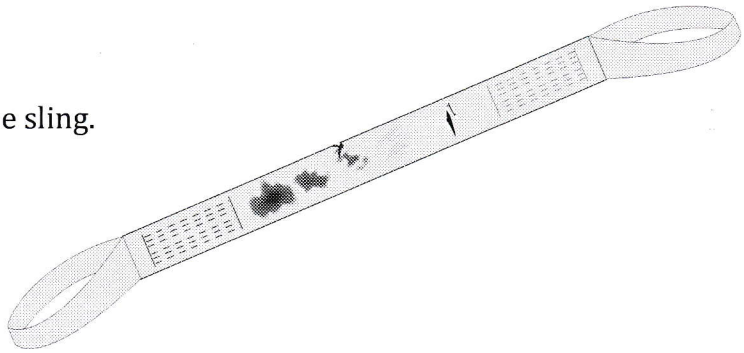
(1) Missing or illegible ID.

(2) Acid or caustic burns.

(3) Melting or charring of any part of the sling.

(4) Holes, tears, cuts, or snags.

(5) Broken or worn stitching in load bearing splices.



(6) Excessive abrasive wear.

(7) Knots in any part of the sling.

(8) Discoloration and brittle or stiff areas on any part of the sling, which may mean chemical or ultraviolet/sunlight damage.

(9) Fittings that are pitted, corroded, cracked, bent, twisted, gouged, or broken.

9) Environmental Issues Affecting Sling's Performance

a) Alloy Chain Slings

(1) Temperature extremes may reduce the performance of alloy chain slings. The sling manufacturer should be consulted when the slings are to be used in temperatures of **−40°F or below.**

(2) Rated load reductions for Grade 80 and Grade 100 alloy chain slings used at or after exposure to temperatures of **400°F**

b) Wire Rope Slings

(1) Wire rope slings should not be stored in an area where they will be subjected to damage, corrosives, moisture, extreme temperatures, or kinking.

(2) Fiber core wire rope slings exposed to degreasing or solvents because they could possibly damage the core.

c) Metal Mesh Slings

(1) The sling manufacturer should be consulted when slings are to be used at temperatures above **550°F or below –20°F.**

(2) The sling manufacturer, or a qualified person, should be consulted before slings are used in chemically active environments, as these environments can degrade the strength of the slings.

d) Synthetic Fiber Rope Slings

(1) Polyester and nylon rope slings shall not be used in contact with objects or at temperatures above **194°F or below –40°F.**

(2) The sling manufacturer, or a qualified person, should be consulted before slings are used in chemically active environments, as these environments can degrade the strength of the slings.

(3) The strength of synthetic rope slings is degraded by exposure to sunlight or ultraviolet light. The sling manufacturer, or a qualified person, should be consulted for additional requirements.

(4) Do not store nylon ropes in areas where they may become impregnated with rust.

(5) Slings exposed to salt water should be thoroughly rinsed with fresh water to prevent damage from salt crystals when the rope dries.

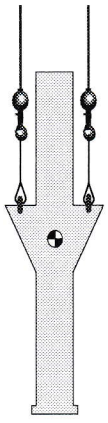
(6) Slings using aluminum fittings shall not be used where alkalis or acids are present.

e) Synthetic Web Slings

(1) Polyester and nylon webbing slings shall not be used in contact with an object, or at temperatures in excess of **194°F or below –40°F.**

(2) The sling manufacturer, or a qualified person, should be consulted before slings are used in chemically active environments, as these environments can degrade the strength of the slings.

(3) The strength of synthetic web slings is degraded by exposure to sunlight or ultraviolet light. The sling manufacturer, or a qualified person, should be consulted for additional requirements.



f) Synthetic Round Slings

(1) Polyester round slings shall not be used in contact with an object or at temperatures in excess of **194°F or below –40°F.**

(2) The sling manufacturer, or a qualified person, should be consulted before slings are used in chemically active environments, as these environments can degrade the strength of the slings.

10) General Sling Usage:

a) Slings shall **NOT** be used in excess of their rated capacity.

b) The rated load of the sling, as provided by the ID tag, should never be exceeded.

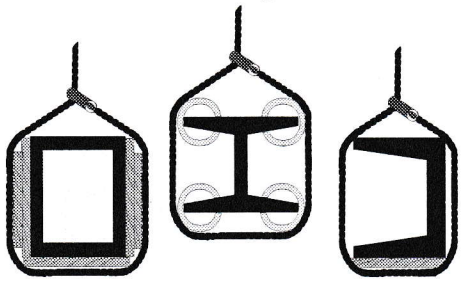
c) The load applied to the hook should be centered in the base (bowl) of the hook to prevent point loading on the hook, unless the hook is designed for point loading.

d) Attachment points should be above load center of gravity.

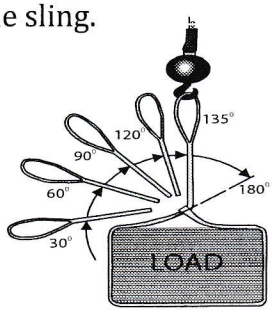
e) Slings should **NOT** be dragged on the floor or over an abrasive surface.

f) When using a basket hitch, the legs of the sling should contain or support the load from the sides, above the center of gravity, so that the load remains under control.

g) Slings in contact with edges, corners, or protrusions should be protected with a material of sufficient strength, thickness, and construction to prevent damage to the sling.



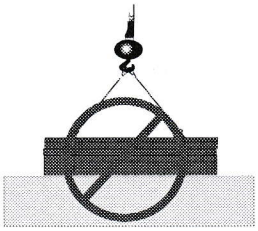
h) In a choker hitch, an angle of choke less than **120⁰** should not be used without reducing the rated load.



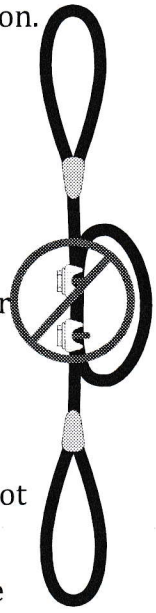
Angle of Choke	Rated Capacity
Over 120	100
90 - 120	87
60 - 89	74
30 - 59	62
0 - 29	49

i) Loads should **NOT** be rested on the sling.

j) Slings should **NOT** be pulled from under a load when the load's weight is resting on the sling.



k) Slings shall be shortened or adjusted only by methods approved by the sling manufacturer or a qualified person.



l) Shock loading is prohibited.

m) Twisting and kinking shall be avoided.

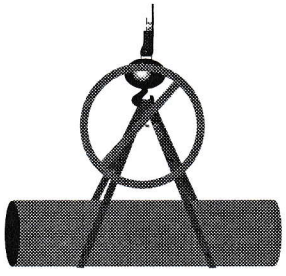
n) During lifting, with or without load, personnel shall be alert for possible snagging.

o) The sling shall be hitched in a manner providing control of the load.

p) Slings shall **NOT** be shortened or lengthened by knotting, twisting, or by wire rope clips.

q) Slings should **NOT** be constricted, bunched, or pinched by the load, hook, or any fitting.

r) In a choker hitch, the choke point should only be on the sling body, not on a splice or fitting.

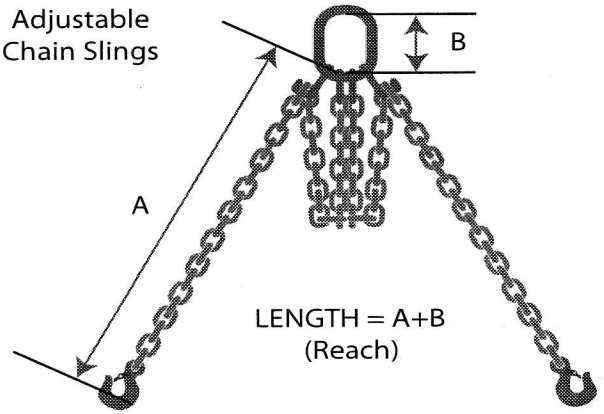


s) When using multiple basket or choker hitches, the load should be balanced and rigged to prevent the sling from slipping or sliding along the load. For multiple-leg slings used with a non-symmetrical load, a qualified person should be consulted.

t) Slings should **NOT** be used with a horizontal sling angle of less than 30⁰. (Except as recommended by the manufacturer or a qualified person.)

11) Specific Sling Usage

a) Alloy Chain Slings



(1) Grade 80 or 100 chain shall be used for sling fabrication.

(2) When a choker hitch is used the choker hitch rating shall be **80% of the vertical hitch rating,** unless otherwise provided by the manufacturer or a qualified person.

(3) Alloy chain slings shall only be shortened or adjusted by a method determined by the manufacturer or a qualified person.

(4) When an angle of **choke less than 120⁰** is used the rated load reduction shall be determined by the manufacturer or a qualified person.

(5) The rated load of a **quadruple-leg sling shall not exceed the rated load of a triple-leg sling.**

b) Wire Rope Slings

(1) When a choker hitch is used with a single-leg sling, the choker hitch rating shall be **75% of the vertical hitch rating,** unless otherwise provided by the manufacturer or a qualified person.

Angle of Choke	Rated Capacity
Over 120⁰	100
90⁰ - 120⁰	87
60⁰ - 89⁰	74
30⁰ - 59⁰	62
0⁰ - 29⁰	49

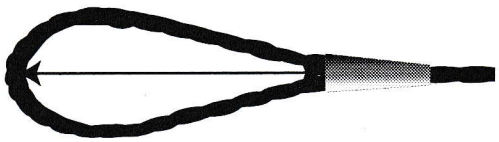
(2) When an **angle of choke less than 120⁰** is used the rated load reduction shall be determined by using the table or by consulting the manufacturer or a qualified person.

(3) Sling made with wire rope clips shall **NOT** be used as a choker hitch.

(4) When a choker hitch is used with a cable-laid sling, the choker hitch rating shall be **70% of the vertical hitch rating,** unless otherwise provided by the manufacturer or a qualified person.

(5) Sling and load shall not be allowed to rotate when hand tucked slings are used in a single leg vertical lift application.

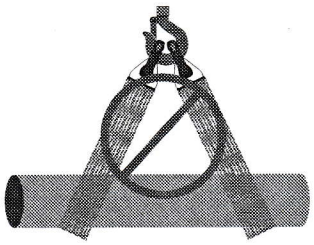
(6) Never place the eye over a fitting with a diameter smaller than the wire rope's diameter.



(7) An object in the eye of a sling should **NOT** be wider than **one-half the length of the eye.**

c) Metal Mesh Slings

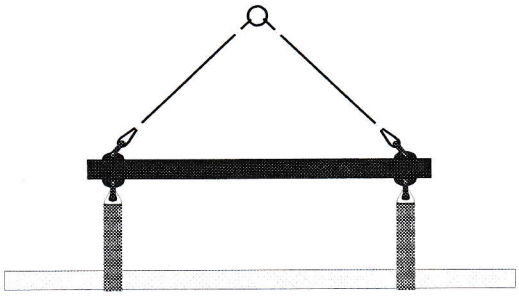
(1) When the choker hitch rating is not identified on the sling, the choker hitch rating shall be **100% of the sling's straight-line hitch rating,** unless other ratings are provided by the sling manufacturer or a qualified person.



(2) The load should be evenly distributed across the width of the metal mesh.

(3) In a choker hitch, the load should be balanced to prevent edge overload.

(4) Straightening a spiral or cross rod, or forcing a spiral into position, shall not be done.



(5) Sling handles and metal fabric must have the same rated capacity.

(6) Slings used in pairs should be attached to a spreader beam.

d) Synthetic Fiber Rope Slings

(1) When a choker hitch is used with a single-leg sling, the choker hitch rating shall be **75% of the vertical hitch rating,** unless otherwise provided by the manufacturer or a qualified person.

(2) An object in the eye of a sling should **NOT** be wider than **one-third the length of the eye.**

(3) Synthetic rope slings shall **NOT** be used to support suspended personnel platforms.

e) Synthetic Web Slings

(1) When a choker hitch is used the choker hitch rating shall be **80% of the vertical hitch rating**, unless otherwise provided by the manufacturer or a qualified person.

(2) Synthetic webbing slings shall **NOT** be used to support suspended personnel platforms.

(3) An object in the eye of a sling should **NOT** be wider than **one-third the length of the eye.**

f) Synthetic Round Slings

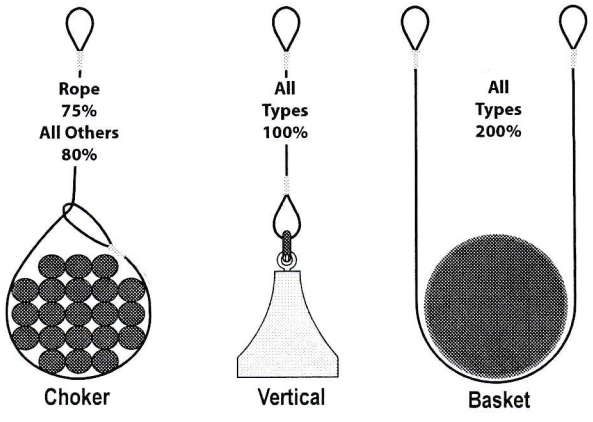
(1) When a choker hitch is used, the choker hitch rating shall be **80% of the vertical hitch rating**, unless otherwise provided by the manufacturer, or a qualified person.

(2) Consult the manufacturer, or qualified person whenever the expected load on the sling will exceed 80% of the sling's rated load.

(3) Polyester roundsling's shall **NOT** be used to support suspended personnel platforms.

12) Factors That Affect Sling Capacity

a) Hitch Strength (Weakest to Strongest)



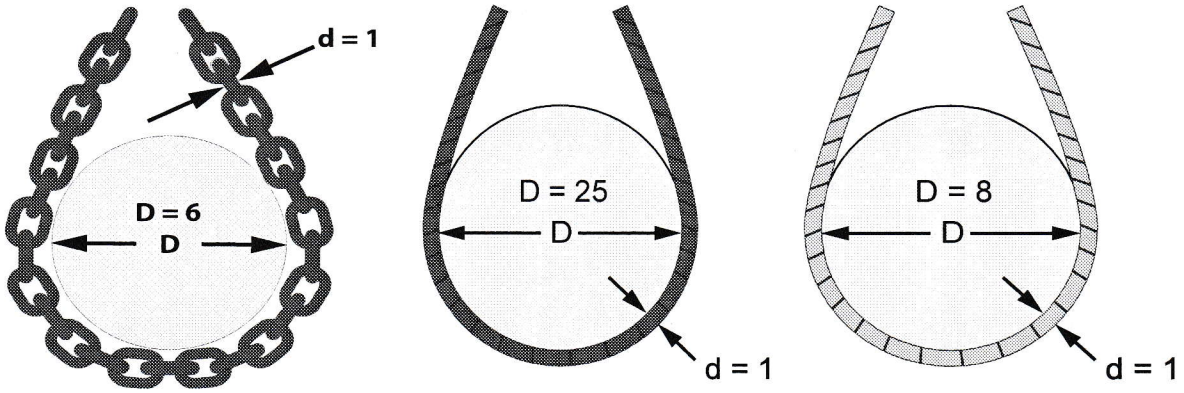
Basket Hitch Angle Reduction	
90^0	200%
60^0	170%
45^0	140%
30^0	100%

b) Minimum D/d Ratios

(1) Alloy Chain Slings – 6/1

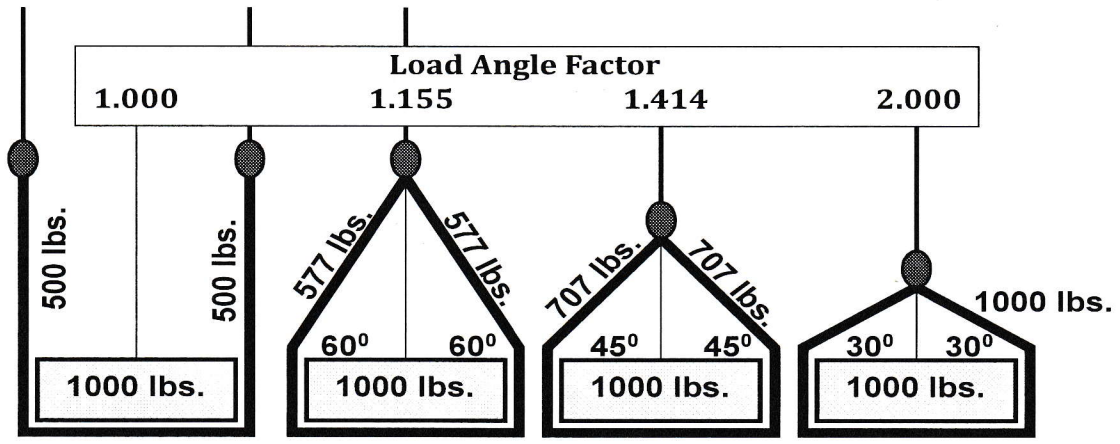
(2) Wire Rope Slings – Mechanical splice 25/1; Hand-tucked splice 15/1

(3) Synthetic Fiber Rope Slings – 8/1



c) Load Angle Factors

Horizontal Sling Angle	Load Angle Factor	Horizontal Sling Angle	Load Angle Factor
90°	1.000	45°	1.414
85°	1.004	40°	1.555
80°	1.015	35°	1.742
75°	1.035	30°	2.000
70°	1.064	25°	2.364
65°	1.104	20°	2.924
60°	1.155	15°	3.861
55°	1.221	10°	5.747
50°	1.305	5°	11.490



$$\text{Tension In Each Leg} = \frac{\text{Load}}{2} \text{ X Load Angle Factor}$$

Slings shall not be used at a horizontal sling angle of less than 30°, except as recommended by the sling manufacturer or a qualified person.

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TRAINING
SOLUTIONS

RIGGER SAFETY TRAINING PREP COURSE

RIGGING HARDWARE

Rigging Hardware

1) Types

a) Rigging Hardware includes shackles, turnbuckles, eyebolts, eye nuts, swivel hoist rings, wire rope clips, wedge sockets, links, rings, swivels, rigging blocks and detachable load-indicating devices.

2) Design Factors

a) Shackles – Up to 150 tons - 5

b) Shackles – Over 150 tons - 4

c) Turnbuckles – 5

d) Eyebolts - 5

e) Eye Nuts - 5

f) Swivel Hoist Rings - 5

g) Wire Rope Clips & Wedge Sockets – 80% minimum termination efficiency

h) Links, Rings & Swivels - 5

i) Rigging Blocks - 4

j) Detachable Load-Indicating Devices - 4

3) Identification Requirements

a) Rigging Hardware Identification Requirements

(1) Shackles

(i) Shackle Body

(a) Name or trademark of manufacturer.

(b) Rated load.

(c) Size.

(ii) Shackle Pin

(a) Name or trademark of manufacturer.

(b) Grade, material type, or load rating.

(2) Turnbuckle, Eyebolt and Eye Nut

(i) Name or trademark of manufacturer.

(ii) Size or rated load.

(iii) Grade for alloy eyebolts.

(3) Swivel Hoist Ring

(i) Name or trademark of manufacturer.

(ii) Rated load.

(iii) Torque value.

(4) Wire Rope Clips

(i) Name or trademark of manufacturer.

(ii) Size.

(5) Wedge Sockets

(i) Name or trademark of manufacturer.

(ii) Size.

(iii) Model, if required to match wedge to body.

(6) Links, Rings and Swivels

(i) Name or trademark of manufacturer.

(ii) Size or rated load.

(iii) Grade, if required to identify rated load.

(7) Rigging Blocks

(i) Name or trademark of manufacturer.

(ii) Rated load.

(iii) Rope size(s).

(8) Detachable Load-Indicating Device

(i) Name or trademark of manufacturer.

(ii) Rated load.

(iii) Serial number.

(iv) Model number.

(v) Controls.

4) General Rigging Hardware Inspection Requirements

a) A visual inspection shall be performed before each shift and during use on all shackles, turnbuckles, eyebolts, eye nuts, swivel hoist rings, wire rope clips, wedge sockets, rigging blocks or detachable load indicating devices.

b) All rigging hardware included in B30.26 shall be inspected for the following:

(1) Missing or illegible ID.

(2) Heat damage. (weld spatter, etc.)

(3) Excessive pitting.

(4) Distortion.

(5) Nicks or gouges.

(6) 10% of original dimension.

(7) Thread damage.

(8) Unauthorized welding.

(9) Visible damage.

5) Equipment Specific Inspection Criteria

a) Shackles

(1) Incomplete pin engagement.

b) Swivel Hoist Rings

(1) Lack of the ability to freely rotate and pivot.

c) Wire Rope Clips and Wedge Sockets

(1) Unauthorized replacement components.

(2) Insufficient number of wire rope clips.

(3) Improperly tightened wire rope clips.

(4) Indications of damaged wire rope.

(5) Indications of wire rope slippage.

d) Links, Rings and Swivels

(1) Lack of the ability to freely rotate when not loaded.

(2) Loose or missing nuts, bolts, cotter pins, snap rings, or other fasteners and retaining devices.

e) Rigging Blocks

(1) Misalignment or wobble in sheaves.

(2) Excessive sheave groove corrugation or wear.

(3) Loose or missing nuts, bolts, cotter pins, snap rings, or other fasteners and retaining devices.

f) Detachable Load Indicating Devices

(1) Any reduction of the original or catalog dimension at any point inside of the load-sensing zone.

(2) A 5% reduction of the original or catalog dimension at any point outside of the load-sensing zone.

(3) Illegible display or readout.

(4) Damaged or deformed component hardware.

6) General Rigging Hardware Usage

a) Contact with sharp edges or obstructions that could damage the rigging hardware should be avoided.

b) Shock loading should be avoided.

c) Rigging hardware and its components should be in good working condition.

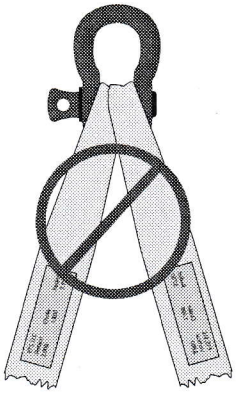
d) Rigging hardware should **NOT** be used in temperatures above 400^0 F or below -40^0 F without consulting the manufacturer or a qualified person.

7) Specific Rigging Hardware Usage

a) Shackles

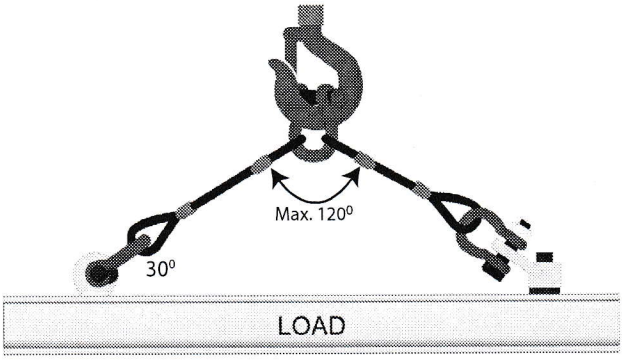
(1) Pin threads must be fully engaged. **NO** backing off of the pin.

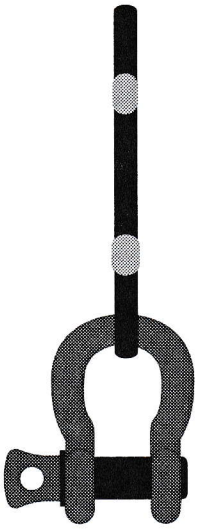
(2) Load applied should be centered on the bow to prevent side loading.

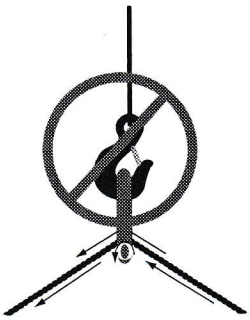


(3) Multiple sling legs should **NOT** be applied to the pin.

(4) Slings attached to shackles should **NOT** exceed **120 degree included angle**.





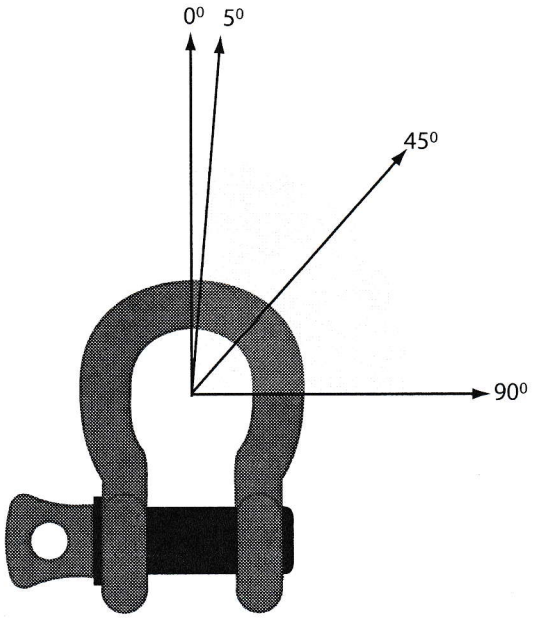


(5) Care must be taken when rigging with a shackle, **NOT** to use it in a manner that would allow the pin to unscrew.

(6) If choking with a shackle, the pin shall be attached to the choking eye of the sling.

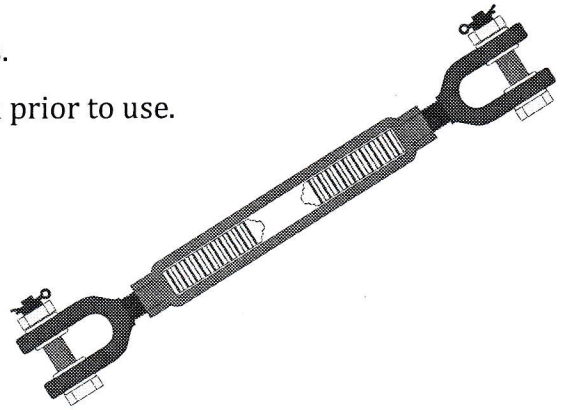
(7) The shackle is sized by the bow **NOT** the pin.

(8) No side loading without reducing the rated load of the shackle.



Side Loading Angle	% Rated Load Reduction
0° to 5°	0%
6° to 45°	30%
46° to 90°	50%
Over 90°	Consult Manufacturer or a Qualified Person

b) Turnbuckles



(1) Fully engage end fitting threads and body threads.

(2) Verify components are in good working condition prior to use.

(3) Load should be in line.

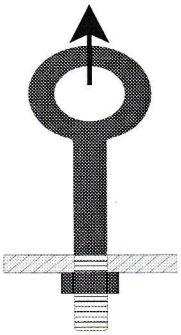
(4) Do **NOT** side load.

(5) Turnbuckles should be secured to prevent unscrewing.

(6) Turn only the turnbuckle body when adjusting.

c) Eyebolts

(1) Tighten against rotation during use.



(2) Inline load only for eyebolts with no shoulder.

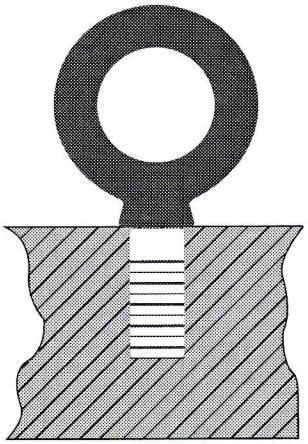
(3) Tapped blind hole application:

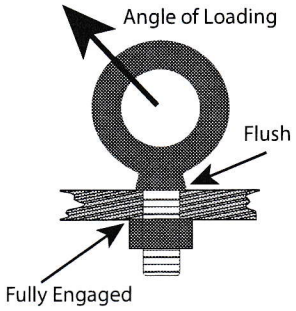
(i) Steel:

(a) Thread length 1.5 times the diameter of bolt.

(ii) Other material:

(a) Contact manufacturer or qualified person.



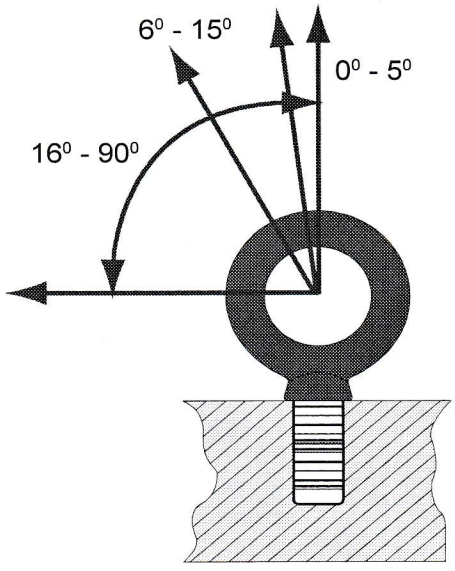


(4) Tapped through hole of less than 1 diameter application and Untapped through hole application:

(i) Fully engaged nut shall be used.

(5) Angular lifting: Shouldered eyebolts only.

(6) Eyebolt shall be flush and tightened.

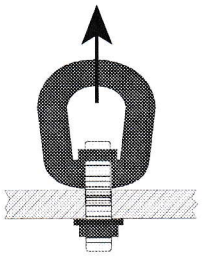


Vertical Angle	% of Rated Load
0⁰ - 5⁰	100%
6⁰ - 15⁰	55%
16⁰ - 90⁰	25%

(7) Plane of eye shall be in line with direction of loading.

d) Eye Nuts

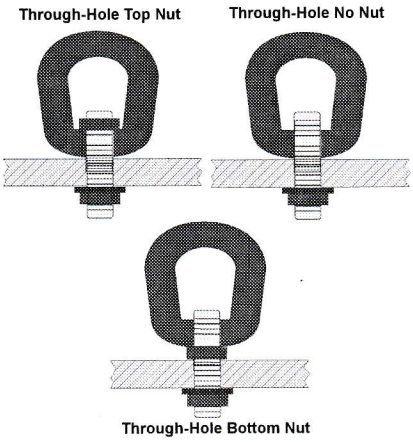
(1) Eye nuts should have full thread engagement and should be secured against rotation during lifting or load handling activities.



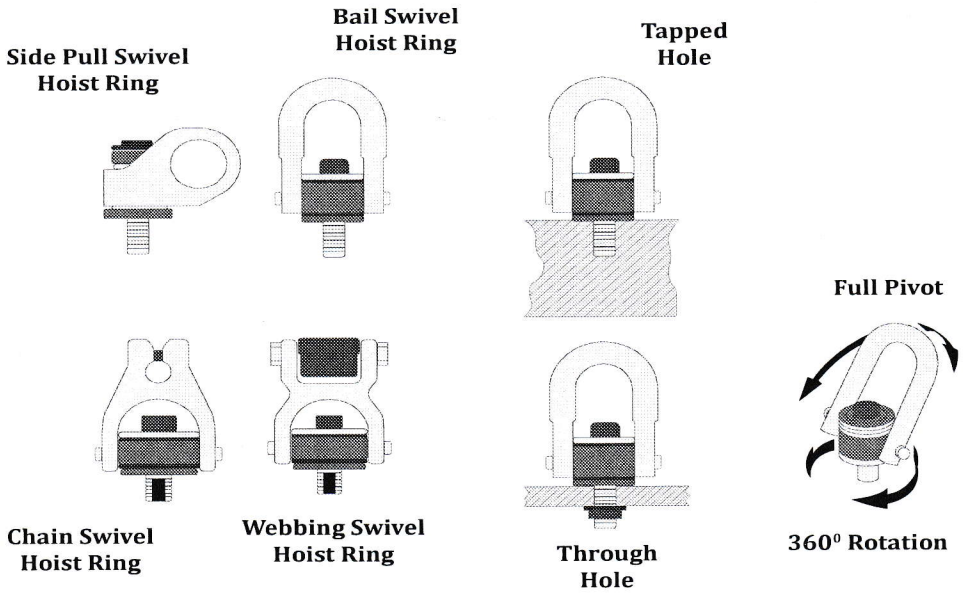
(2) The threads of the eye nut shall be **fully engaged.**

(3) Eye nuts shall only be used for **in-line loads.**

(4) The plane of the eye may be positioned with a flat washer(s) or locknut.



e) Swivel Hoist Rings



(1) Threaded hole application:

(i) Steel: Thread length shall be 1.5 times the diameter of the bolt.

(ii) Other material: Contact manufacturer or qualified person.

(2) Through hole application:

(i) Washer and nut shall be used. In accordance with manufacturer's recommendations.

(ii) Nut shall be fully engaged.

(iii) Bushing flange shall f**ully contact load surface.**

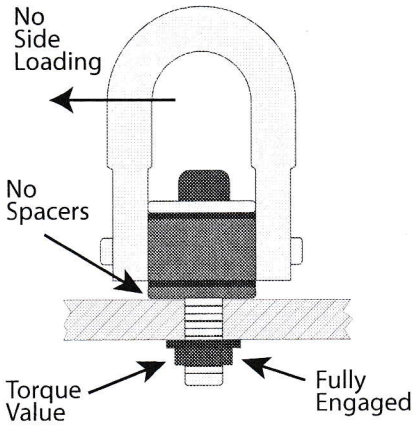
(iv) Spacers shall **NOT** be used.

(v) Shall freely rotate and pivot.

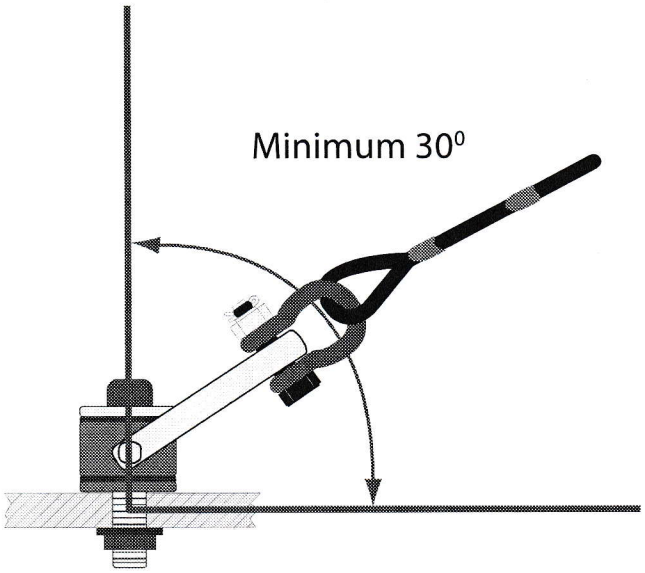
(vi) Torqued to manufacturer's specifications.

(vii) No side loading.

(viii) Do **NOT** exceed WLL (Working Load Limit).

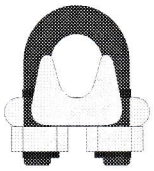


(ix) Do **NOT** exceed angular rigging tension.



Horizontal Angle	Stress Multiplier
90⁰	1.000
60⁰	1.155
45⁰	1.414
30⁰	2.000

f) Wire Rope Clips

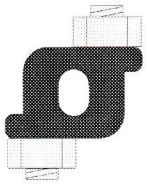


U-Bolt Type

(1) Do **NOT** use wire rope clips to fabricate slings.

(2) Do NOT drag wire rope clips on an abrasive surface.

(3) For U-bolt clips used to create end terminations, the saddle shall be placed on the live end of the wire rope, with the U-bolt on the dead-end side.



Double Saddle Type

(4) Use at least the minimum number of clips recommended by the manufacturer or a qualified person.

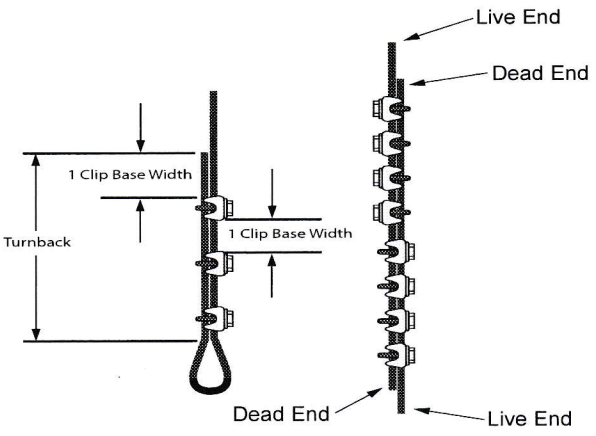
(5) The wire rope clip shall be tightened to the torque recommended by the manufacturer or a qualified person.

(6) The spacing and turn-back should be as recommended by the manufacturer or a qualified person.

(7) After assembled, the wire rope clip shall be loaded to at least the expected working load. After unloading, wire rope clips shall then be retightened to the torque recommended by the manufacturer or a qualified person.

Table 1

Clip Size (in.)	Rope Size (in.)	Minimum No. of Clips	Amount if Rope to Turn Back in Inches	Torque In Ft.Lbs.
1/8	1/8	2	3-1/4	4.5
3/16	3/16	2	3-3/4	7.5
1/4	1/4	2	4-3/4	15
5/16	5/16	2	5-1/4	30
3/8	3/8	2	6-1/2	45
7/16	7/16	2	7	65
1/2	1/2	3	11-1/2	65
9/16	9/16	3	12	95
5/8	5/8	3	12	95
3/4	3/4	4	18	130
7/8	7/8	4	19	225
1	1	5	26	225
1-1/8	1-1/8	6	34	225
1-1/4	1-1/4	7	44	360
1-3/8	1-3/8	7	44	360
1-1/2	1-1/2	8	54	360
1-5/8	1-5/8	8	58	430
1-3/4	1-3/4	8	61	590
2	2	8	71	750
2-1/4	2-1/4	8	73	750
2-1/2	2-1/2	9	84	750
2-3/4	2-3/4	10	100	750
3	3	10	106	1200
3-1/2	3-1/2	12	149	1200



g) Wedge Sockets

(1) Impacts can dislodge the wedge from the body and should be avoided.

(2) Wedge sockets should **NOT** be dragged on an abrasive surface.

(3) The live end of the wire rope in the wedge socket shall align with the socket's pin.

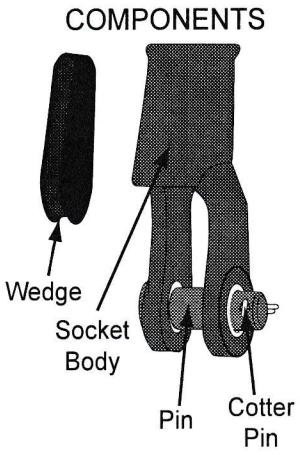
(4) Match the proper wedge with the socket for the wire rope to be installed.

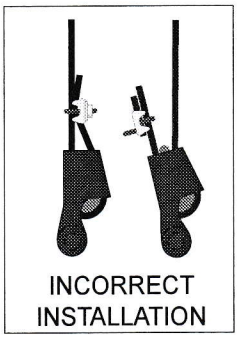
(5) Wedges shall **NOT** be interchanged between different manufacturers' sockets or models.

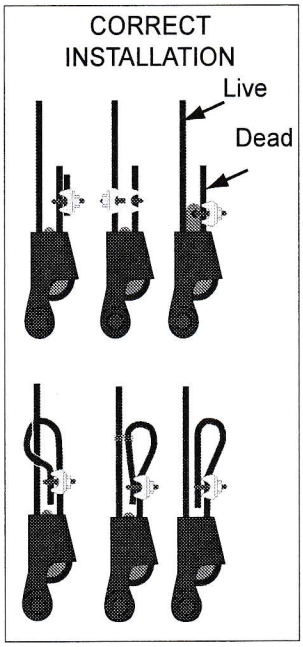
(6) The length of the dead-end tail of the wire rope and the manner in which it is secure shall be determined by the manufacturer or a qualified person.

(7) The dead end of the wire rope shall **NOT** be secured directly to the live end of the wire.

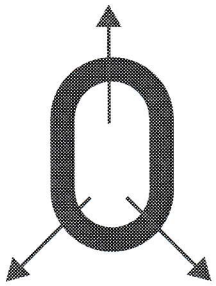
(8) After assembled, the wedge socket shall be loaded to fully seat the wedge before use.







h) Links and Rings



(1) Links and rings should **NOT** be dragged on an abrasive surface.

(2) The link or ring shall be of the proper shape and size to ensure that it seats properly in the hook, lifting device, or rigging hardware.

(3) Multiple slings or rigging hardware collected in a link or ring shall **NOT** exceed a 120^0 included angle.

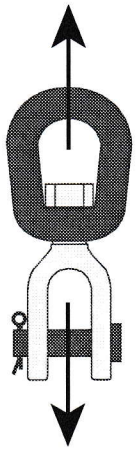
(4) The horizontal angle of loading shall **NOT** be less than 30^0, unless approved by a qualified person.

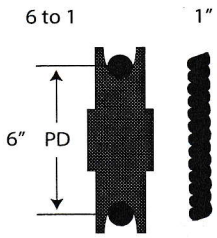
i) Swivels

(1) Swivels shall only be used for in-line loads.

(2) Swivels shall be of the proper shape and size to ensure that they seat properly in the hook, lifting device, or rigging hardware.

(3) Swivels are positioning hardware and are **NOT** intended to be used to rotate the load.





j) Rigging Blocks

(1) The rated load of the rigging block shall **NOT** be exceeded.

(2) The minimum sheave pitch diameter is **6 to 1.**

(3) Ensure personnel stand clear of the suspended load.

(4) Ensure personnel stand clear of rigging when it is under tension.

(5) Personnel shall **NOT** ride rigging blocks.

(6) Loads applied to the rigging block should be in-line with the sheave and load fitting(s).

(7) Ensure the rope is properly seated in the sheave groove when applying the load.

(8) The line load multiplied by the block load factor shall **NOT** exceed the rated load of the rigging block.

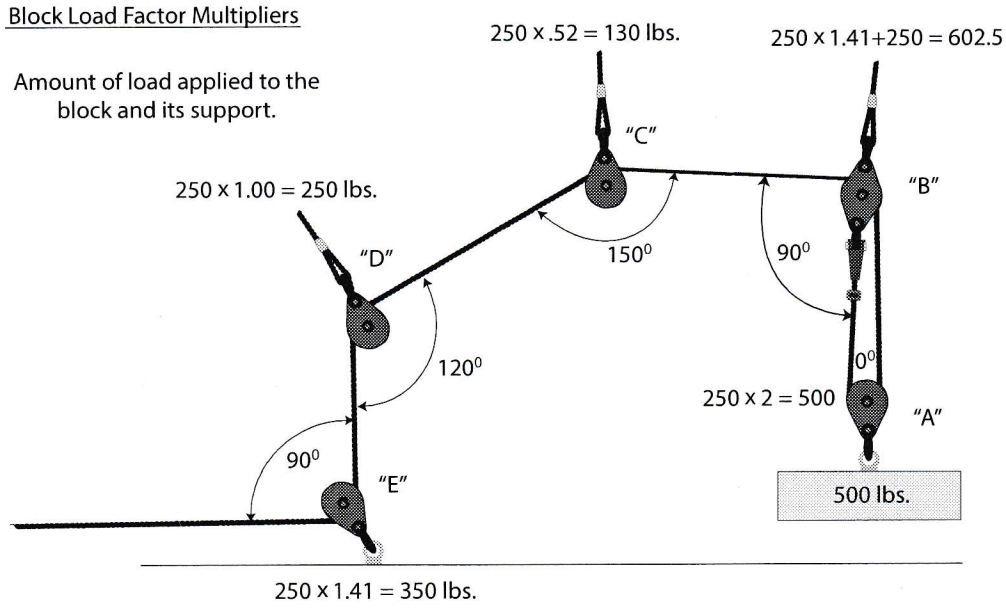
(9) Rigging blocks should **NOT** be dragged on an abrasive surface.

(10) Load line fittings shall **NOT** contact the rigging block sheave(s). T=(Two-Block)

(11) Ensure that all body parts are kept from between the rigging block, its running lines, and the load during lifting or load handling activities.

(12) Rigging blocks should **NOT** be used in temperatures above **150⁰ F or below 0⁰ F without** consulting the manufacturer or a qualified person.

(13) Care must be taken to consider the amount of load applied to the rigging block.

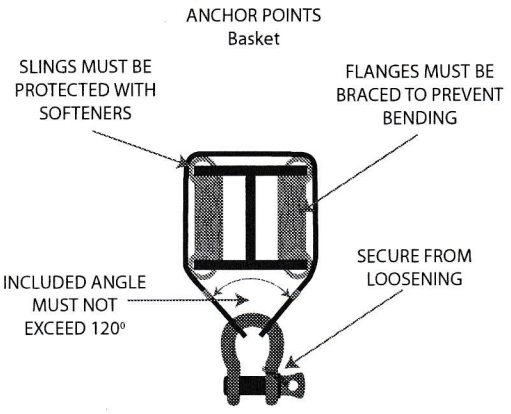


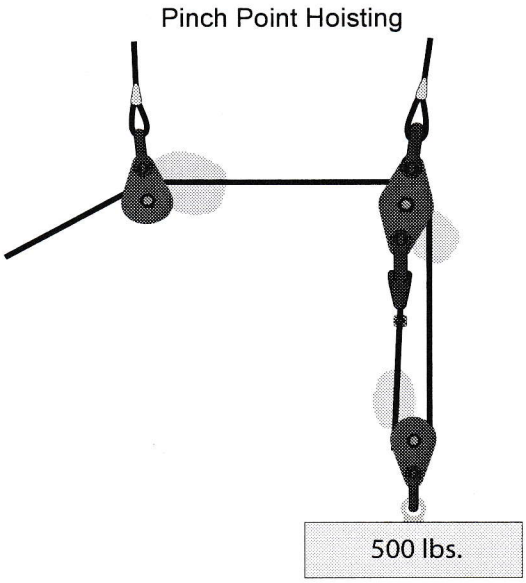
Angle, degrees	Factor	Angle, degrees	Factor
0	2.00	100	1.29
10	1.99	110	1.15
20	1.97	120	1.00
30	1.93	130	0.84
40	1.87	135	0.76
45	1.84	140	0.68
50	1.81	150	0.52
60	1.73	160	0.35
70	1.64	170	0.17
80	1.53	180	0.00
90	1.41		

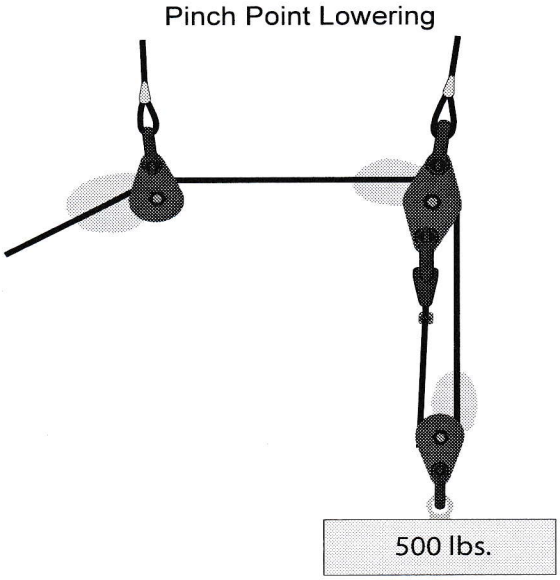
(14) Ensure the anchor points are protected from damage. (Softeners)

(15) When beams are used as anchor points, bracing must be used.

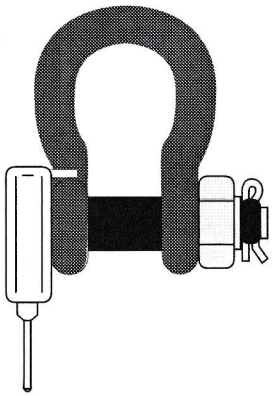
(16) Care must be taken to consider the dangers of pinch points when hoisting and lowering.







k) Detachable Load Indicating Devices



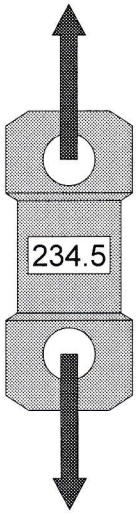
(1) The rigging components connected to the load indicating device shall be properly attached and secured.

(2) The load applied to the load indicating device should be on its centerline and in tension.

(3) Multiple slings should **NOT** be applied to the pin of a shackle with a load-indicating pin.

(4) The load indicating device shall **NOT** be side loaded.

(5) Load indicating devices should **NOT** be dragged on an abrasive surface.



(6) Load indicating devices should **NOT** be used in temperatures above **104⁰ F or below 14⁰ F** without consulting the manufacturer or a qualified person.

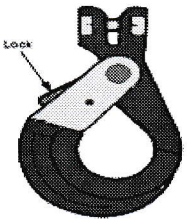
RIGGER SAFETY TRAINING PREP COURSE

HOOKS

Hooks

1) Basic Types:

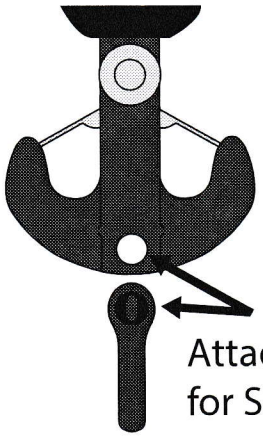
Self-Closing



Self-Locking

Sorting

Crane Hook



Duplex w/pinhole

Attachment Point for Single Sling

2) Design factor:

a) As a minimum, must be equal to those of the equipment or system in which the hook is a component.

3) Identification Requirements:

a) Manufacturer's identification.

b) Rated load.

c) Manufacturer's identification and rated load shall be forged, cast, or die stamped on **a low stress and non-wearing area** of the hook.

4) General Hook Inspection Requirements B30.10

a) Frequent:

(1) Visual inspection.

(2) Frequent inspection shall include observations during operation.

(3) Frequency: (ASME - B30.10)

(i) Normal service – **Monthly.**

(ii) Heavy service – **Weekly to monthly.**

(iii) Severe service – **Daily – weekly.**

(4) Frequency: (OSHA 1926.251; 1910.184)

(i) Each day prior to use and during use as needed.

(5) No written records are required

b) Periodic:

(1) Complete inspection of the hook.

(2) Written records are required.

(3) Frequency:

(i) Normal service – Yearly.

(ii) Heavy service – Semiannually.

(iii) Severe service – Quarterly.

5) Removal Criteria:

a) Distortion.

b) Cracks, nicks, or gouges.

c) Latch engagement.

d) Hook attachment.

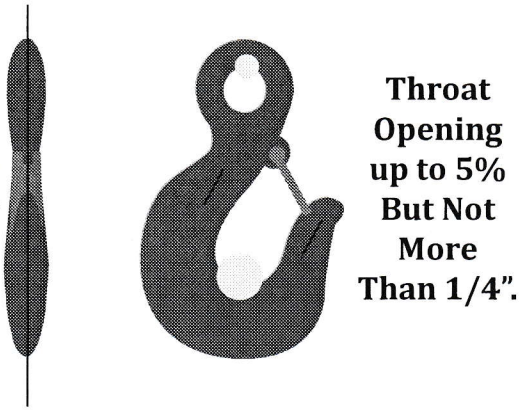
e) Deformation. (No Twist allowed) (ASME)

f) Throat opening – **Exceeding 5% but NOT to exceed ¼ inch.**

g) Wear – **NOT to exceed 10%.**

h) Inability to Lock.

i) Inoperative Latch.



6) General Hook Usage

a) Do **NOT** exceed load rating.

b) Hands and fingers shall be kept away from between the hook and the sling.

c) Do **NOT** use a hook in a manner for which it was not intended.

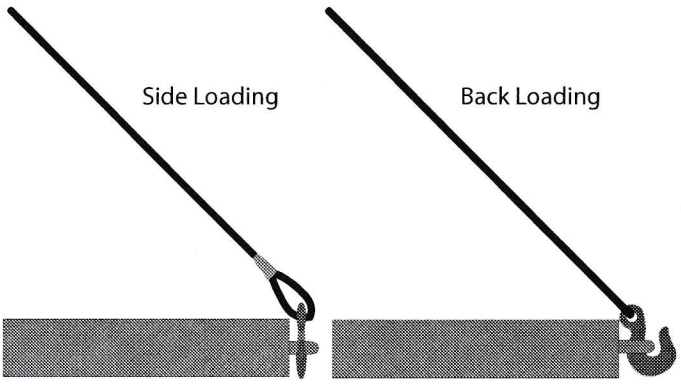
d) Do **NOT** shock load the hook.

e) Do **NOT** point load the hook.

f) Do **NOT** side or back load the hook.

g) Visually verify latch engagement.

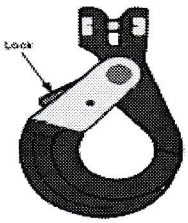
h) Make sure the latch is **NOT** supporting the load.



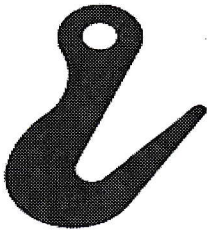
Hooks

1) Basic Types:

Self-Closing

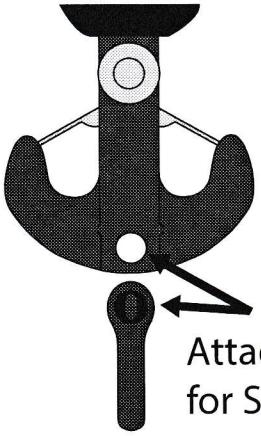


Self-Locking



Sorting

Crane Hook



Duplex w/pinhole

Attachment Point for Single Sling

2) Design factor:

a) As a minimum, must be equal to those of the equipment or system in which the hook is a component.

3) Identification Requirements:

a) Manufacturer's identification.

b) Rated load.

c) Manufacturer's identification and rated load shall be forged, cast, or die stamped on **a low stress and non-wearing area** of the hook.

4) General Hook Inspection Requirements B30.10

a) Frequent:

(1) Visual inspection.

(2) Frequent inspection shall include observations during operation.

(3) Frequency: (ASME - B30.10)

(i) Normal service – **Monthly.**

(ii) Heavy service – **Weekly to monthly.**

(iii) Severe service – **Daily – weekly.**

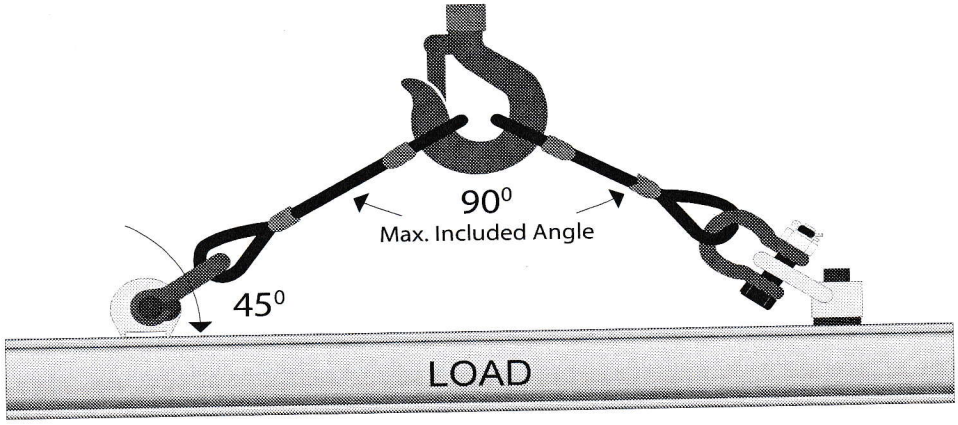
(4) Frequency: (OSHA 1926.251; 1910.184)

(i) Each day prior to use and during use as needed.

(5) No written records are required

i) Locking hook shall be locked during use.

j) Included angle shall **NOT exceed 90 degrees.**



k) When attaching a load with single sling to a duplex hook with a pinhole, **attach the shackle pin through the pinhole.**

l) Hooks should **NOT** be used in temperatures above **400⁰ F or below -40⁰ F** without consulting the manufacturer or a qualified person.

m) If a required latch is not working properly and cannot be immediately replaced or repaired, the hook shall be sufficiently **moused** to retain loose items, until the latch is replaced or repaired.

n) When using a single point hook a **ring, link, or shackle** should be used when **more than two slings** are placed in a hook or if the included angle exceeds 90⁰.

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BELOW THE HOOK LIFTING DEVICES

Below-the-Hook Lifting Device

1) Types

a) Structural and Mechanical Lifting Devices.

b) Vacuum Lifting Devices.

c) Close Proximity Operated Lifting Magnets.

d) Remotely Operated Lifting Magnets.

e) Scrap and Material-Handling Grapples.

2) Below-the-Hook Identification Requirements

a) Identification: All new lifting devices shall be marked with, but NOT limited to, the following information:

(1) Manufacturer's name and address.

(2) Serial number.

(3) Lifter weight.

(4) Cold current (amps) (when applicable).

(5) Electrical power requirements, (when applicable).

(6) Rated voltage (when applicable).

(7) Pressure and volume of compressed air required (when applicable).

(8) Rated load.

(9) Duty Cycle (when applicable).

3) General Below-the-Hook Lifting Device Inspection Requirements B30.20

a) Every Lift Inspections:

(1) Items such as the following shall be **inspected by the operator before and/or during every lift** for any indication of damage as specifically indicated, including observations during operation for any damage that might occur during the lift:

(i) Surface of the load for debris.

(ii) Condition and operation of the controls.

(iii) Condition and operation of the indicators and meters when installed.

b) Frequent Inspections

(1) Visual examination by the operator or designated person(s) with **records NOT required.**

(2) Frequent Inspection Intervals

(i) Normal service — monthly

(ii) Heavy service — weekly to monthly

(iii) Severe service — daily to weekly

(iv) Special or infrequent service — as recommended by a qualified person before and after each occurrence.

c) Periodic Inspection

(1) Visual inspection making records of apparent external conditions to provide the basis for a continuing evaluation.

(2) Period inspection shall be performed **at least annually.**

d) All lifters shall be inspected for the following:

(1) Structural members for deformation, cracks, or excessive wear on any part of the lifter.

(2) Missing or illegible operating control markings.

(3) Cracked housings, welds, and loose bolts.

(4) All electrical conductors visible without disassembly.

4) Equipment-Specific Frequent Inspection Criteria

a) Structural and Mechanical Lifting Devices

(1) Loose or missing guards, fasteners, covers, stops, or nameplates.

(2) All operating mechanisms that may interfere with operation of the lifter for correct adjustment.

b) Vacuum Lifting Devices

(1) The vacuum generator for output.

(2) All vacuum pad seal rings for cuts, tears, wear, and foreign particles.

(3) All vacuum lines and vacuum line connections for leakage, cuts, kinks, and collapsed areas of hoses.

(4) The vacuum reservoir for leaks and visual damage.

(5) The entire vacuum system, including indicator lights, gages, horns, bells, pointers or other warning devices, and vacuum level indicators.

c) Lifting Magnets

(1) Lifting magnet face for foreign materials and smoothness.

(2) Condition of lifting bail or sling suspension.

(3) Condition and operation of control handle.

(4) Condition and operation of indicators and meters, where applicable.

(5) For battery operated electromagnets, inspect for proper level of battery electrolyte and for corrosion of either the battery posts or connectors.

d) Scrap and Material Handling Grapples

(1) Pins and bushings.

(2) Hydraulic lines.

(3) Hydraulic cylinders.

5) General Usage Requirements

a) The lifting device shall **NOT** be loaded in excess of its rated load or handle any load for which it is not designed.

b) The lifter shall be applied to the load in accordance with the instruction manual.

c) Before lifting, the operator shall make sure that lifter ropes or chains are **NOT** kinked, and that multiple part lines are **NOT** twisted around each other.

d) Care should be taken to make certain the load is correctly distributed for the lifter being used.

e) The temperature of the load should **NOT** exceed the maximum allowable limits of the lifter.

f) The lifter shall be brought over the load in such a manner as to minimize swinging.

g) Care shall be taken that there is **NOT** sudden acceleration or deceleration of the load.

h) Do **NOT** allow load or lifter to come into contact with any obstruction.

i) The operator should **avoid carrying the load over people.**

j) The lifter shall **NOT** be used for side pulls or sliding the load, unless specifically authorized by a qualified person.

k) The operator shall **NOT** leave suspended loads unattended.

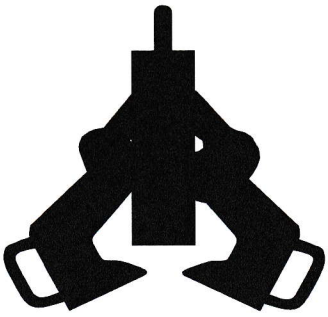
l) The operator shall **NOT** ride, or allow others to ride loads or the lifting device.

m) The operation of the lifter shall be observed before use and during a shift.

n) Loads shall be guided as to avoid endangering hands or body parts as the load is lowered, or if it falls.

6) Equipment Specific Usage Requirements

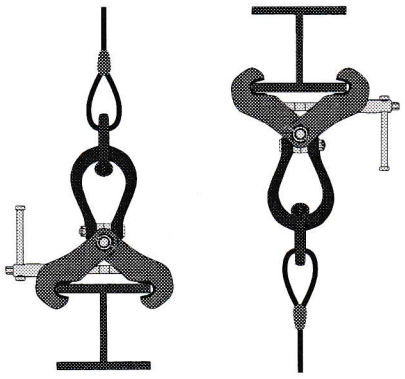
a) Beam Clamps



(1) Clamps should never be used on flanges outside the range specified.

(2) Most clamps are designed for use at **90⁰ to the flange.** For applications requiring angle loading, ensure the clamp is designed for that use.

(3) Beam clamps should be **centered on the flange and properly seated.**

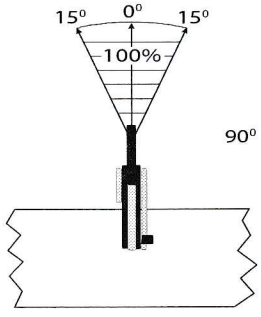


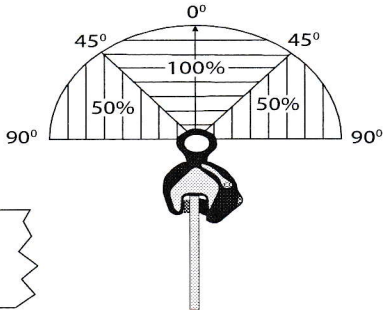
b) Plate Clamps

(1) Make sure to reduce the load rating when lifting on an angle exceeding the recommendations listed below.

Horizontal Plate Clamp

Vertical Plate Clamp





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MISCELLANEOUS HARDWARE

1) Jacks

a) Identification

(1) Name or trademark of manufacturer.

(2) Rated load of the load point and auxiliary load point.

(3) Model number or tracing code.

(4) Jack handle length and force required.

b) Inspection Requirements

(1) Frequent Inspection

(i) A visual and functional inspection shall be completed each shift before a jack is placed in service.

(ii) No records required.

(2) Periodic Inspection

(i) A complete inspection shall be conducted at least once a year.

(ii) Records should be kept until the next periodic inspection.

c) Removal Criteria

(1) Missing or illegible identification.

(2) Pawl or rack teeth that are damaged or excessively worn.

(3) Damaged jack housing.

(4) Excessive pitting or corrosion.

(5) Excessive nicks or gouges.

(6) Evidence of unauthorized welding.

d) Jacks should **NOT** be used in temperatures above 140^0 F or below -20^0 F without consulting the manufacturer or a qualified person.

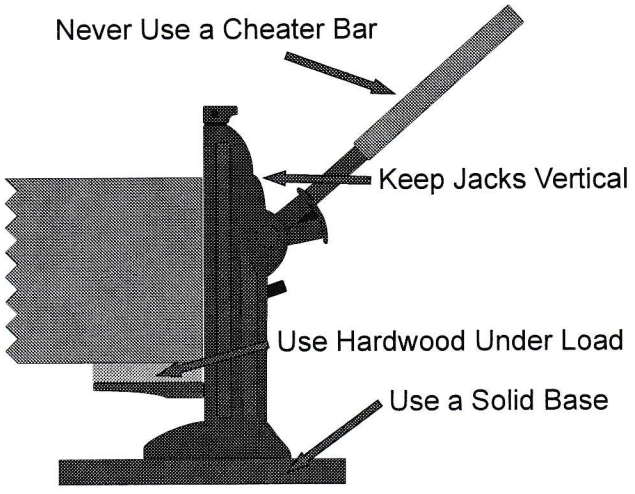
e) Safety Practices

(1) All mechanical jacks shall be used according to the manufacturer's recommendations.

(2) Avoid jacking the side or end of the load more than 4-in. lift over a 100-in. run (4% grade), unless approved by the manufacturer or a qualified person.

(3) When jacking one side or end of a load, ensure the opposing side or end is stabilized with sufficient blocking.

(4) When jacking a load, it should be raised in stages. Jack one side or end, insert blocking, and lower the load down to the blocking.



Jack from the opposite side or end, insert blocking, and then lower down to blocking. Reverse this process when lowering the load

(5) Always keep the jack **vertical.**

(6) For stability, avoid using only one jack.

(7) All jacks should be of the same type and capacity.

(8) Use a piece of hardwood between the jack and the load.

(9) Lifting outside on the ground, do **NOT** place jack directly on the ground.

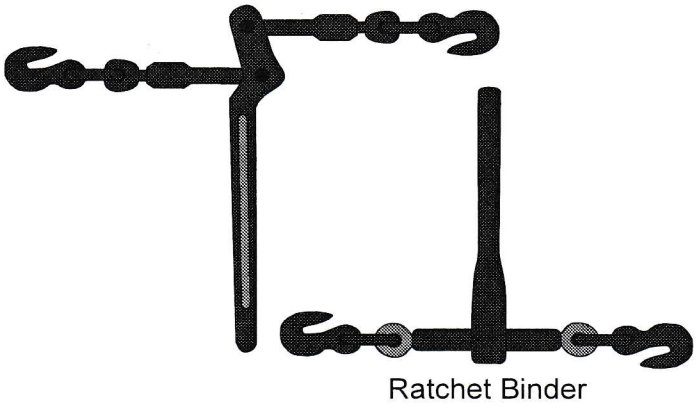
(10) When lifting one end or side, or all four corners, the jacks should be operated simultaneously.

(11) Do **NOT** overload a jack by using a cheater bar for extra lift.

(12) Do **NOT** leave the load on jacks for extended period. Use blocking or cribbing.

2) Load Binders

a) Safety Practices



(1) Hook the binder so it can be tightened while standing on the ground, pulling the lever downward. Have secure footing.

(2) Manufacturers recommend against using an extension for more leverage.

(3) Using an extension can overload the chain and damage the load. It could also be dangerous if it slips.

(4) After tightening, check that the handle is in the down position. Secure the handle by wrapping it with the load chain or a wire.

(5) Keep well clear when releasing a binder. NEVER use a pipe over the handle; use a pry bar and pry under the handle.

(6) When releasing by hand, push upward with an open palm.

(7) Be aware of the position of other personnel when tightening or releasing a binder.

3) Lifting Beams

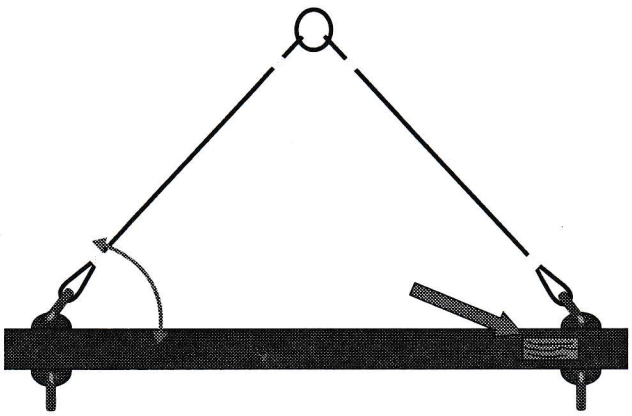
a) Lifting beams shall be clearly marked with:

(1) The manufacture's name.

(2) The serial number of the beam.

(3) The weight of the beam.

(4) The rated capacity of the beam.



b) Horizontal angle must be taken in consideration when planning the lifting operation. Angles less than 30^0 should be avoided.

4) Rollers

a) Safety Practices

(1) Personnel shall **NOT** place any part of their body between the roller and the load or blocking.

(2) Personnel shall **NOT** place any part of their body under the load.

(3) Avoid pinch points.

(4) Personnel should **NOT** ride a load.

(5) Handles should be used for steering the load.

(6) Personnel should have firm footing and handle control while steering the roller.

(7) Use an overhand grip (palm down) when manipulating the steering handle.

(8) Load control should be maintained at all times.

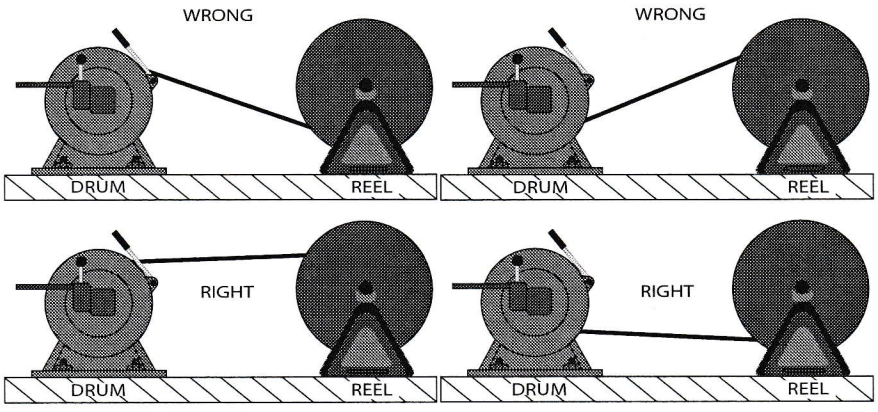
(9) When rolling on an incline, a qualified person should be consulted to determine the proper type and capacity of the restraint system.

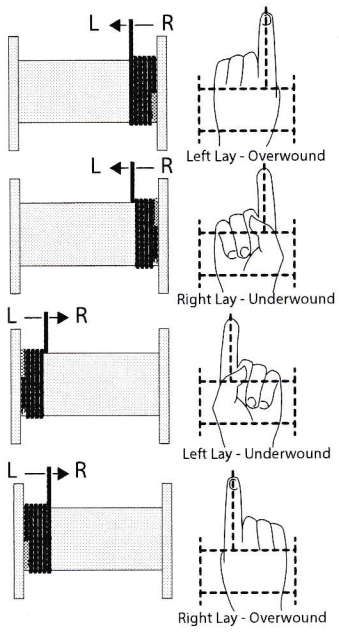
(10) Rollers should **NOT** be used in temperatures above **140^0 F or below -20^0 F** without consulting the manufacturer or a qualified person.

5) Wire Rope Spooling

a) Spooling left and right lay wire rope.

b) Reel to Drum Spooling.





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OVERHEAD AND LEVER HOISTS

Overhead Hoists

OSHA 1926.554(a)(6)

All overhead hoists in use shall meet the applicable requirements for construction, design, installation, testing, inspection, maintenance, and operation, as prescribed by the manufacturer.

1) Types:

a) Hand Operated.

b) Electric and Air Powered.

2) Overhead Hoist Identification Requirements B30.16

a) All overhead hoists shall be marked with:

(1) Name of manufacturer.

(2) Manufacturer's model or serial number.

(3) In addition, electric power must also be marked with voltage of AC or DC power supply. The phase and frequency of AC power supply, and the full load amperage (FLA).

(4) Air –Powered hoists must also be marked with the rated air pressure.

3) Labels

a) Hand operated and electric powered hoists must have a label attached to the hoist or load block, giving precautions pertaining to operating procedures. The label must include precautions against:

(1) Operating a malfunctioning hoist. (All types)

(2) Operating a hoist that has been damaged. (All types)

(3) Operating a hoist utilizing something other than hand power. (Hand)

(4) Operating a hoist when the load is **NOT** centered under the hoist. (All types)

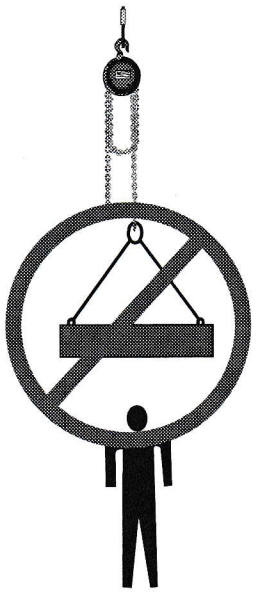
(5) Operating a hoist when the wire rope is **NOT** properly seated in its groove. (All types)

(6) Hoisting more than the rated load. (All types)

(7) Hoisting load over personnel. (All types)

(8) Hoisting personnel. (All types)

(9) Removing or damaging any label. (All types)



4) Overhead Inspection Requirements B30.16

a) Pre-operation inspection: Visual inspection by a designated person with **records NOT required**, performed before the first use of each shift.

(1) The following items shall be inspected:

(i) Operating mechanisms for proper operation, proper adjustment, and unusual sounds.

(ii) Hoist limit device(s) of electric- or air-powered hoists without a load on the hook. The load block shall be inched into its limit device, or run at slow speed on multispeed or variable-speed hoists.

(iii) Hoist braking system for proper operation.

(iv) Lines, valves, and other parts of air systems for leakage.

(v) Hoist rope for gross damage, which may be an immediate hazard, such as the following:

(a) Distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion.

(b) General corrosion.

(c) Broken or cut strands.

(d) Number, distribution, and type of visible broken wires.

(vi) Load chain for gross damage, which may be an immediate hazard, such as the following:

(a) Examine visually for gouges, nicks, weld spatter, corrosion, and distorted links.

(b) Test the hoist under load in lifting and lowering directions and observe the operation of the chain and sprockets.

(c) Hooks and hook latches in accordance with B30.10.

(d) Rope or chain reeving in accordance with the manufacturer.

b) Frequent inspection: Visual examinations by a designated person with **records NOT required.** Same as Pre-operation inspection conducted at the following intervals.

(1) Normal service — Monthly

(2) Heavy service — Weekly

(3) Severe service — Daily

c) Periodic inspection: Visual inspection by a designated person who makes records of external conditions to provide the basis for a continuing evaluation. An external coded mark on the hoist is an acceptable identification in lieu of records.

(1) Normal service — Yearly

(2) Heavy service — Semiannually

(3) Severe service — Quarterly

5) General Removal Criteria

a) Excessively worn or damaged braking components.

b) All damaged or worn suspension components.

c) Control systems of electric- and air-powered hoists.

d) Pitted or burned electrical contacts on electric-powered hoists.

e) Missing or illegible function and safety labels.

6) Equipment Specific Removal Criteria

a) Wire rope:

(1) Six randomly distributed broken wires in six rope diameters, or three broken wires in one strand in six rope diameters.

(2) In rotation-resistant ropes, two randomly distributed broken wires in six rope diameters, or four randomly distributed broken wires in thirty rope diameters.

(3) One outer wire broken at the contact point with the core.

(4) Kinking, crushing, birdcaging, or any other type of damage resulting in distortion of the rope structure.

(5) Heat damage.

(6) Corrosion.

(7) Reduction of rope diameter due to loss of core support.

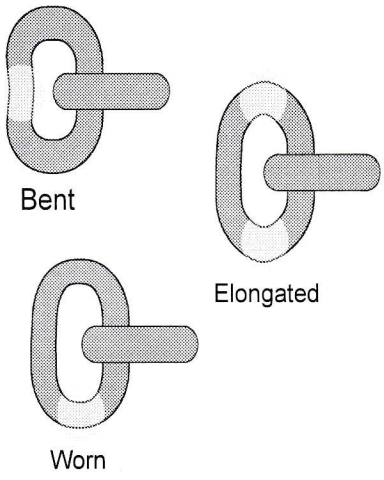
(8) Reductions from rope diameter greater than 5%.

(9) Once a rope reaches any one of the specified removal criteria, it may be allowed to operate to the end of the work shift, based on the judgment of qualified person.

b) Welded chain:

(1) Heat damage. (weld spatter, etc.)

(2) Corrosion.



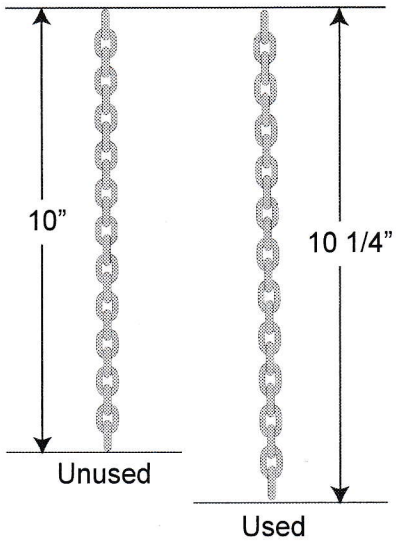
(3) Distortion.

(4) Nicks, gouges, corrosion, bent or distorted links, or weld splatter determined by a designated person to be a safety hazard.

(5) Chain Stretch:

(i) For hand operated hoists, chain is 2.5% longer than unused chain.

(ii) For powered hoists, chain is 1.5% longer than unused chain.



c) Roller chain:

(1) Pins turned from their original position.

(2) Rollers that do **NOT** run freely.

(3) Joints that cannot be flexed easily by hand.

(4) Side plates that are spread open.

(5) Corrosion, pitting, or discoloration of chain.

(6) Gouges, nicks, or weld spatter.

7) Overhead General Usage Requirements

a) All personnel using an overhead hoist must follow:

(1) The safe working load of the overhead hoist, as determined by the manufacturer, shall be indicated on the hoist, and this safe working load shall **NOT** be exceeded.

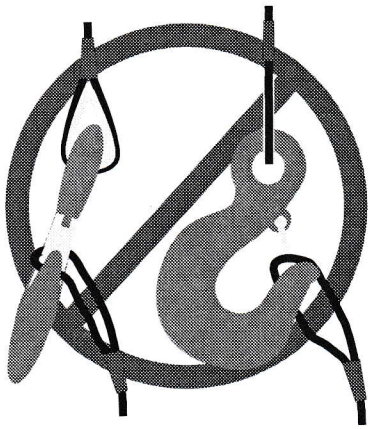
(2) The supporting structure to which the hoist is attached shall have a safe working load equal to that of the hoist.

(3) No more than one person pulling on the chain of hand-operated hoist.

(4) Never wrap the rope or chain around the load for lifting operations.

(5) Never point-load the hook.

(6) Never operate the hoist with kinked or twisted chain or rope.



(7) Never operate the hoist if the chain or rope are **NOT** properly seated on the drum and sheave grooves, or on the sprocket.

(8) Always use the hook latch when provided.

(9) Never allow the hook safety latch to support any part of the load.

(10) Never expose the chain or rope to weld spatter, or allow the electrode to touch the rope or chain.

(11) Never lift or rotate a load until you have verified that the load and hoist are clear of all obstacles.

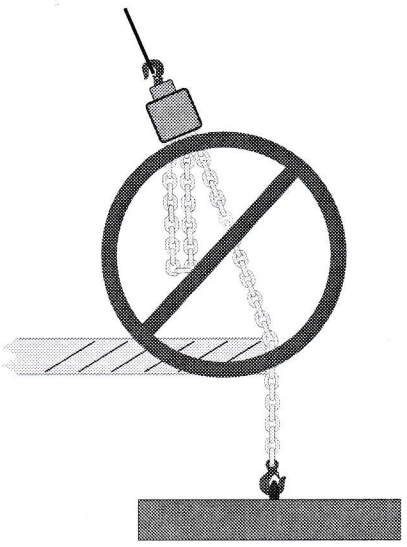
(12) Never operate a hoist until full attention can be given to the lift operation.

(13) Always ensure the load, sling, or lifting device is seated in the bowl of the hook.

(14) Avoid carrying the load over personnel.

(15) Limiting devices for electric and air-powered hoists:

(i) The upper limit switch must be tested by the operator prior to commencing lift operations to ensure the proper operation of the limiting device. This must be completed at the beginning of each shift.



(16) Ensure all personnel shall stay clear of a suspended load.

(17) The hoist shall **NOT** be used to lift or lower personnel.

(18) Hoists shall be used to lift loads vertically without side pull, except when approved by the manufacturer(s) or a qualified person.

(19) The support shall be arranged so as to provide for free movement of the hoist and shall **NOT** restrict the hoist from lining itself up with the load.

(20) A load-limiting device shall **NOT** be used to measure the weight of the load.

(21) Gloves that interfere with the operation of the controls shall **NOT** be worn.

(22) The harness or belt (when provided) shall be used with the controller, or the controller shall be placed in the location intended for its support.

(23) The safety devices on the controller shall **NOT** be overridden.

(24) The controller shall be stored in a designated and protected location.

(25) The controller shall be shut off when a power failure occurs.

(26) When two or more hoists are used to lift a single load, one designated person shall be in charge of the operation.

(27) The operator shall test the hoist brake(s) at the start of each shift for proper operation. This shall be accomplished by lifting the load a few inches and applying the brake(s).

(28) The load shall **NOT** be lowered below the point where less than two wraps of rope remain on each hoisting drum unless a lower-limit device is provided, in which case no less than one wrap shall remain.

8) Environmental Issues Affecting Hoist Performance

a) Wherever exposed to ambient temperatures at the rope in excess of 180°F, rope having an independent wire-rope core, wire-strand core, or other temperature damage-resistant core shall be used.

Lever Hoists

1) Lever Hoist Identification Requirements B30.21

a) Name of manufacturer.

b) Manufacturer's model or serial number.

2) Labels

a) Precaution Labels shall be attached to the hoist or load block.

b) Operating a malfunctioning or damaged hoist.

c) Hoisting more than the rated load.

d) Operating a hoist when it is deterred from forming a straight line with the direction of loading.

e) Operating a hoist with a damaged rope, chain or web.

f) Operating a hoist utilizing an extension to the lever.

g) Prohibiting hoisting a load over personnel.

h) Prohibiting the hoisting of personnel.

i) Removing or damaging any label.

3) General Lever Hoists Inspection Requirements B30.21

a) Pre-operation inspection: Visual inspection by a designated person with **records NOT required**. Shall be performed before the first use of each shift.

b) The following items shall be inspected:

(1) Operating mechanisms for proper operation, proper adjustment, and unusual sounds.

(2) Hooks and latches in accordance with B30.10.

(3) Load chain, rope, or web strap for gross damage.

(4) Load chain, rope, or web strap reeving.

(5) Overtravel restraint for proper attachment.

(6) Hoist body and lever for deformation, cracks, and/or other damage.

(7) Supporting structure or trolley, if used, for damage.

c) Frequent Inspections: **Visual inspection** by a designated person with **records NOT required.** Shall be performed at the following intervals:

(1) Normal Service - Monthly

(2) Heavy Service – Weekly to Monthly

(3) Severe Service – Daily to Weekly

d) Periodic Inspections: **Documented visual inspection** to provide the basis for a continuing evaluation. An external coded mark on the hoist is an acceptable identification in lieu of records. Shall be performed at the following intervals:

(1) Normal Service - Yearly

(2) Heavy Service – Semiannually

(3) Severe Service – Quarterly

e) Hoists Not in Regular Service

(1) A hoist that has been idle for a period of 1 month or more, but less than 1 year, shall have a frequent inspection prior to going back into use.

(2) A hoist that has been idle for a period of 1 year or more shall have a periodic inspection before going back into use.

(3) Overtravel restraint for proper attachment.

(4) Hoist body and lever for deformation, cracks, and/ or other damage supporting structure or trolley, if used, damage.

4) General Removal Criteria

a) Excessively worn components such as friction disks, ratchets, pawls, and pawl springs.

b) Critical parts including load suspension components that are cracked, broken, bent, or excessively worn.

c) Bent, cracked, or damaged levers.

d) Worn, corroded, or otherwise damaged load chain, rope, or web strap.

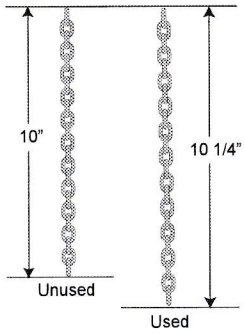
e) Hooks in accordance with ASME B30.10.

f) Missing or illegible warning labels.

g) Components that are missing.

5) Equipment Specific Removal Criteria

a) Welded Link Chain



(1) If the used chain exceeds the hoist manufacturer's recommended length, or in the absence of such recommendation, or if the used chain is 2.5% longer than the unused chain, the chain should be replaced.

(2) Gouges, nicks, corrosion, weld spatter, or distorted links.

b) Roller and Rollerless Chain

(1) Elongation exceeds that ¼" in 12", the chain should be replaced.

(2) If the twist in any 5" section exceeds 15^0, the chain should be replaced.

(3) If a side bow exceeds ¼" in any 5' section, the chain should be replaced.

c) Wire Rope

(1) In running ropes, **six randomly distributed broken wires in six rope diameters, or three broken wires in one strand in six rope diameters,**

(2) In rotation-resistant ropes, **two randomly distributed broken wires in six rope diameters, or four randomly distributed broken wires in thirty rope diameters.**

(3) One outer wire broken at the contact point with the core.

(4) Kinking, crushing, birdcaging, or any distortion of the rope structure.

(5) Heat damage from any cause.

(6) Reduction of rope diameter due to loss of core support.

(7) Reductions from nominal diameter greater than 5%.

d) Web Strap

(1) The web strap should be replaced prior to the equipment being used by the next work shift.

(2) Badly worn end connections.

(3) Distortion of the web strap structure.

(4) Heat damage.

(5) The web strap shall be removed from service when damage such as the following is discovered:

(i) Melting, charring, acid or caustic burns.

(ii) Weld spatter.

(iii) Broken stitching, cuts or tears.

(iv) Damaged eyes or fittings.

(v) Abrasion.

(vi) Knots.

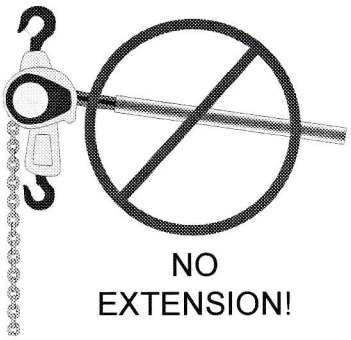
(vii) Discoloration.

(viii) Brittle fibers.

(ix) Hard or stiff areas that may indicate ultraviolet damage.

6) Lever Hoist General Usage Requirements

a) The operator shall have adequate access to the operating lever.



b) The operator shall **NOT** adjust or repair a hoist unless qualified to perform maintenance on the hoist.

c) Hoists shall **NOT** be operated with an extension on the lever.

d) No loads in excess of rated load. A load indicating device may be used to determine the load applied.

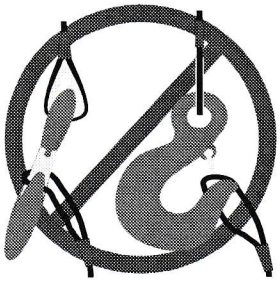
e) No more than one person pulling on the lever.

f) Never wrap the chain, wire rope, or web strap around the load for lifting operations.

g) Never point-load the hook.

h) Never operate the hoist with kinked or twisted chain, wire rope or web strap.

i) Operator must have stable footing before operating the hoist.



j) Never operate a hoist until the rigging is properly seated in the bowl of the hook.

k) Never allow the hook safety latch to support any part of the load.

l) Never expose the chain, wire rope, or web strap to weld spatter or allow the electrode to touch the chain.

m) Never utilize the hoist for grounding purposes.

n) Never operate the hoist unless the load is directly in line with the hook.

o) Never lift or rotate a load until you have verified that the load and hoist are clear of all obstacles.

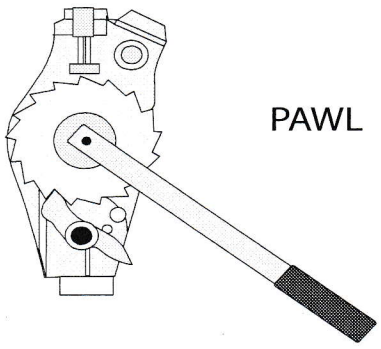
p) Never lift or lower a load until all personnel are clear.

q) Never operate a hoist until full attention can be given to the lift operation.

r) Avoid carrying the load over personnel.

s) Never release the lever until the pawl is engaged.

t) Operator should lift the load a few inches then determine if the braking system is working.



1926.1401 - Definitions

Competent person means one who is capable of identifying existing and predictable hazards in their surroundings or working conditions, which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt, corrective measures to eliminate them.

Qualified rigger - is a rigger who meets the criteria for a qualified person.

Qualified person - means a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, successfully demonstrated the ability to solve/resolve problems relating to the subject matter, the work, or the project.

1926.1403 – Assembly/Disassembly selection of manufacturer or employer procedures.

Note: The employer must follow manufacturer procedures when an employer uses synthetic slings during assembly or disassembly rigging.

(g) Capacity limits. During all phases of assembly/disassembly, rated capacity limits for loads imposed on the equipment, equipment components (including rigging), lifting lugs and equipment accessories, must **NOT** be exceeded for the equipment being assembled/disassembled.

(h)(i)(5) Boom and jib pick points. The point(s) of attachment of rigging to a boom (or boom sections or jib or jib sections) must be suitable for preventing structural damage and facilitating safe handling of these components.

(r) Rigging. In addition to following the requirements in 29 CFR 1926.251 and other requirements in this and other standards applicable to rigging, when rigging is used for **assembly/ disassembly, the employer must ensure that:**

(1) The rigging work is done by a **qualified rigger**.

(2) Synthetic slings are to be protected from: Abrasive, sharp or acute edges, and configurations that could cause a reduction of the sling's rated capacity, such as distortion or localized compression. Slings shall be padded or protected from the sharp edges of their loads.

(3) When synthetic slings are used, the synthetic sling manufacturer's instructions, limitations, specifications and recommendations must be followed.

1926.1410 - Power line safety (all voltages) — equipment operations closer than the Table A zone.

(d)(4)(v)(B)(5) Non-conductive rigging if the rigging may be within the Table A of §1926.1408 distance during operation.

1926.1425 – Keeping clear of the load.

(c) 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:

(3) The materials must be **rigged by a qualified rigger**.

1926.1431 Hoisting personnel

(g) Attachment and rigging.

(1) Hooks and other detachable devices.

(i) Hooks used in the connection between the hoist line and the personnel platform (including

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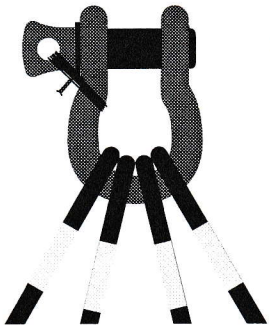
hooks on overhaul ball assemblies, lower load blocks, bridle legs, or other attachment assemblies or components) must be:

(A) Of a type that can be closed and locked, eliminating the throat opening.

(B) **Closed and locked when attached.**



(ii) Shackles used in place of hooks must be of the alloy anchor type, with either:

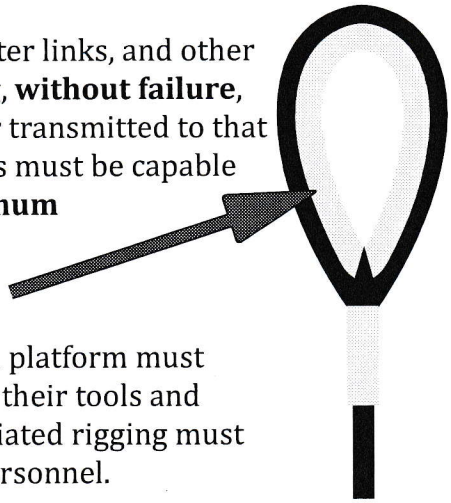
(A) A bolt, nut and retaining pin in place; or

(B) Of the screw type, with the screw pin secured from accidental removal.

(iii) Where other detachable devices are used, they must be of the type that can be closed and locked to the same extent as the devices addressed in paragraphs (g)(1)(i) and (ii) of this section. Such devices must be closed and locked when attached.

(2) Rope bridle. When a rope bridle is used to suspend the personnel platform, **each bridle leg must be connected to a master link or shackle** in a manner that ensures that the load is evenly divided among the bridle legs.

(3) Rigging hardware (including wire rope, shackles, rings, master links, and other rigging hardware) and hooks must be capable of supporting, **without failure**, at least **five times the maximum intended load** applied or transmitted to that component. Where rotation resistant rope is used, the slings must be capable of supporting **without failure** at least **ten times the maximum intended load.**



(4) Eyes in wire rope slings must be fabricated with **thimbles**.

(5) Bridles and associated rigging for suspending the personnel platform must be used only for the platform and the necessary employees, their tools and materials necessary to do their work. The bridles and associated rigging must **NOT** have been used for any purpose other than hoisting personnel.

(j) Proof testing.

(1) At each jobsite, prior to hoisting employees on the personnel platform, and after any repair or modification, the platform and rigging must be proof tested to **125 percent of the platform's** rated capacity. The proof test may be done concurrently with the trial lift.

(3) After proof testing, **a competent person must inspect the platform and rigging to determine if the test has been passed.** If any deficiencies are found that pose a safety hazard, the platform and rigging must **NOT** be used to hoist personnel unless the deficiencies are corrected, the test is repeated, and a competent person determines that the test has been passed.

1926.753(e) - Multiple lift rigging procedure.

(1) A multiple lift shall only be performed if the following criteria are met:

(i) A multiple lift rigging assembly is used;

(ii) A **maximum of five** members are hoisted per lift;

(iii) Only beams and similar structural members are lifted; and

(v) No crane is permitted to be used for a multiple lift where such use is contrary to the manufacturer's specifications and limitations.

(2) Components of the multiple lift rigging assembly shall be specifically designed and assembled with a maximum capacity for total assembly and for each individual attachment point. This capacity, certified by the manufacturer or a qualified rigger, shall be based on the manufacturer's specifications with a 5 to 1 safety factor for all components.

(3) The total load shall **NOT** exceed:

(i) The rated capacity of the hoisting equipment specified in the hoisting equipment load charts;

(ii) The rigging capacity specified in the rigging rating chart.

(4) The multiple lift rigging assembly shall be rigged with members:

(i) Attached at their center of gravity and maintained reasonably level;

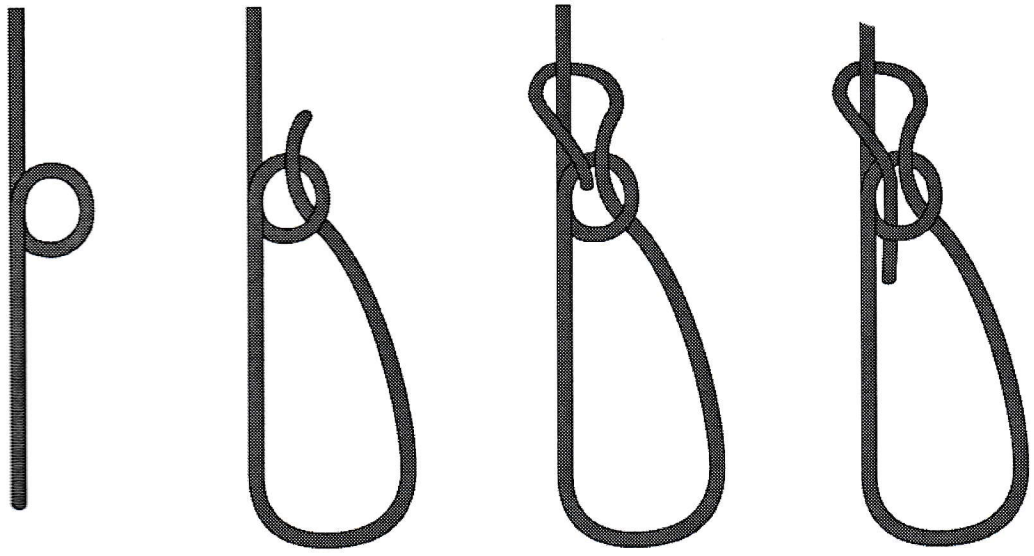
(ii) Rigged from **top down;** and

(iii) Rigged at least **7 feet apart.**

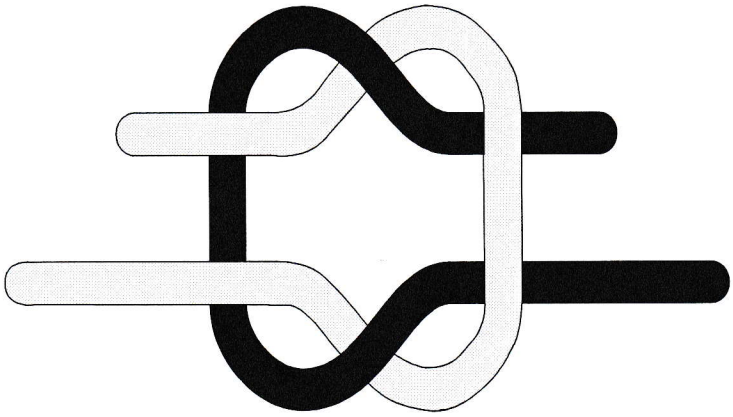
KNOTS

Knots:

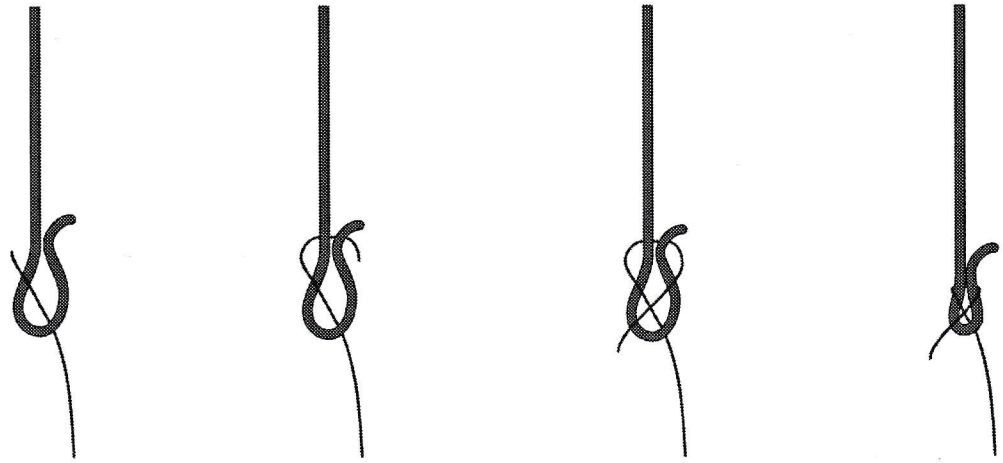
Inside Bowline: **Best knot for tying a tagline to an eye of a sling eye.**



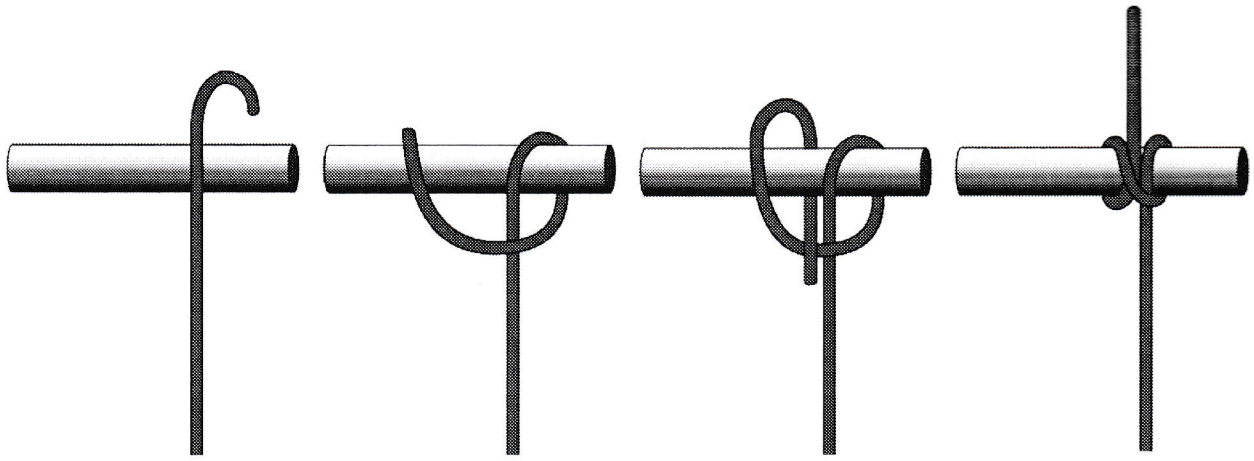
Square Knot:



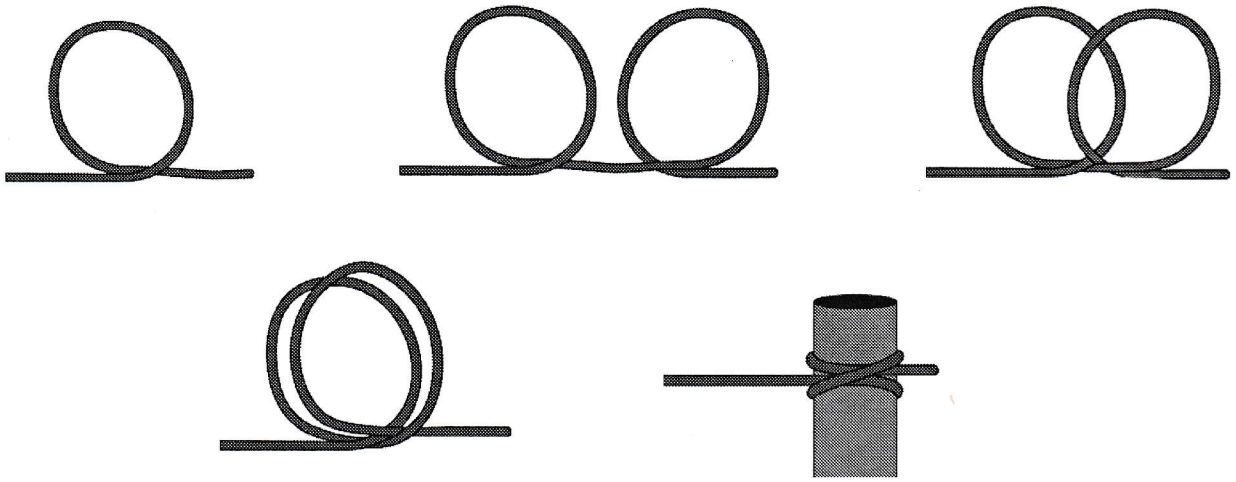
Sheet Bend: **For attaching a small diameter rope to a larger diameter rope.**



Clove Hitch:



Alternative Clove Hitch:



Two Half-Hitches: