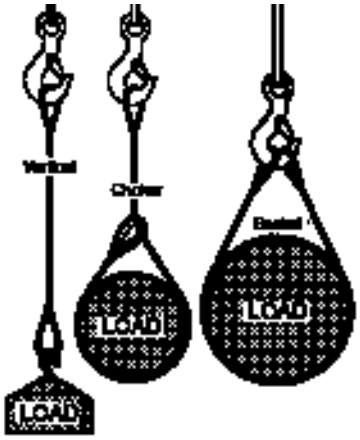
Some Things Every User Should Know About Use and Care of Wire Rope Slings



Every Lift uses 1 of 3 Basic Hitches

VERTICAL, or straight, attachment is simply using a sling to connect a lifting hook or other device to a load. Full rated load of the sling may be used, but never exceeded. A tagline should be used on such a lift to prevent rotation which can damage the sling.
A sling with a hand-tucked splice may unlay and fail if the sling is allowed to rotate.

CHOKER hitches reduce lifting capacity of a sling, since this method of rigging affects the ability of the wire rope components to adjust during the lift, places angular loading on the body of the sling, and creates a small diameter bend in the sling at the choke point.

BASKET hitches distribute the load equally between the two legs of a sling, within limitations imposed by the angles at which legs are rigged to the load. (See discussion of sling angles)

Basic Factors concerning the use of Wire Rope Slings

1. RATED CAPACITY (Rated Load, WLL) of a wire rope sling is based upon the Nominal Breaking Strength of the wire rope used in the sling, AND FACTORS which affect the overall strength of a sling. These factors include ATTACHMENT or SPLICING EFFICIENCY, the number of parts of rope in the sling, type of hitch (see above), DIAMETER AROUND WHICH THE BODY OF THE SLING IS BENT, and the diameter of pin (or hook) over which the eye of the sling is rigged.

2. RATED CAPACITY of a sling is different for each of the three basic methods of rigging (see above). These rated loads are listed in this catalogue. The RATED CAPACITIES apply to UNIROPE slings ONLY and may be indicated on optional tags (if requested).

3. WARNING: A hand tucked (hand spliced) eye sling can unlay (unravel) and FAIL if the sling is allowed to rotate during use.

4. NEVER "SHOCK LOAD" a sling. There is no practical way to estimate the actual force applied by shock loading. The rated capacity of a wire rope sling can easily be exceeded by a sudden application of force, and damage can occur to the sling. The sudden release of a load can also damage a sling.

5. The BODY of a wire rope sling should be protected with corner protectors, blocking or padding against damage by sharp edges or corners of a load being lifted. Sharp bends that distort the sling body damage the wire rope and reduce its strength.

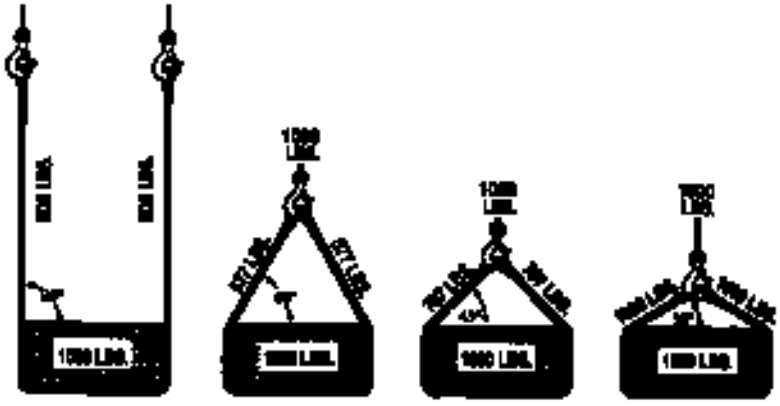
6. ANY ANGLE other than vertical at which the sling is rigged, increases the loading (tension) on the sling.

7. A sling should be given a VISUAL INSPECTION BEFORE EACH LIFT OR USAGE to determine if it is capable of safely making the intended lift.

   An inspection should include such things as:
   - Broken wires.
   - Kinks or distortions of the sling body.
   - Condition of eyes and splices, and any attachment hardware.
   - Reduction in diameter of the rope.
   - Any damage.
   - Corrosion.

8. Whenever a sling is found to be deficient, the eyes must be cut, or other end attachments or fittings removed to prevent further use, and the sling body discarded.

9. A SLING EYE should never be used over a hook or pin with a body diameter larger than the natural width of the eye. NEVER FORCE AN EYE ONTO A HOOK. The eye should always be used on a hook or pin with AT LEAST THE DIAMETER OF THE ROPE.

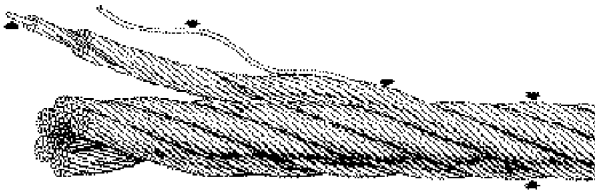


Sling Angles affect the Load on the Legs of a Sling

SLING ANGLE (also called Angle of Loading) is the angle measured between a horizontal line and the sling leg or body. This angle is very important and can have a dramatic effect on the rated load of a sling. As illustrated here, when this angle DECREASES, the LOAD ON EACH LEG INCREASES. This principle applies whether one sling is used with legs at an angle in a basket hitch, or for multi-leg bridle slings. Angles less than 30 degrees should not be used.

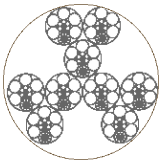
Slings made from Wire Rope

Wire rope slings have become the workhorse in the sling field. Although they have sound safety features, they must be chosen carefully for the service in which they are to be placed since they also have certain limitations.
Their most outstanding feature is the ease of inspection. They do not deteriorate without ample warning, nor do they rely on a single load bearing system like chain. They withstand a large amount of physical abuse and, unlike web slings, are not easily cut nor do they deteriorate in sunlight. Wire rope slings are constructed from a large number of individual load bearing components, the single wires. If one of the hundreds of individual wires fails, the wire rope sling itself will not fail in a so called 'catastrophic' manner. This is what sometimes is referred to as a 'redundant' system. The only other sling type which has a similar 'redundancy' characteristic are Twin-Path® slings which are composed from two totally independent load carrying systems.



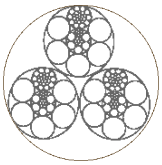
Wire rope is made from hundreds of individual load carrying members.The failure of one wire will not cause the entire sling to fail.

Chains rely on EACH individual link. If ONE link fails, the entire sling system fails.



Gator-Flex®

The choice for ultimate flexibility and strength. Ideal for tight choker hitches. Capacities to over 300 tons. Maximum diameter is 10"

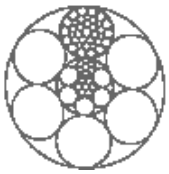


Tri-Flex®

A 300% increase in flexibility over the regular 6x19 steel core rope. Best compromise between ease of handling, strength, cost, and crush resistance.

6 x 37 Fiber Core

The MOST flexible 6-strand sling. Same strength as 6x19 Fiber Core, but handles far better. Available in selected sizes only. Ask for details.

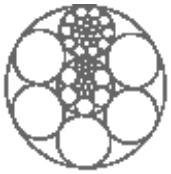


6 x 36 Steel Core

More flexible than even 6x19 Fiber Core, same strength as 6x19 Steel core, good resistance to kinking, good crush resistance.

6 x 19 Fiber Core

A little more flexible, less expensive, but Rated Capacities (WLL's) are 10% lower than slings made with with Steel Core.



6 x 19 Steel Core

The standard construction for Unirope slings. Very good crush and abrasion resistance, but larger diameters are not very flexible.

The Flexibility of Slings

Wire rope for slings comes in many different constructions. For the user the most important difference is 'flexibility', that is the ease with which a sling can be bent by hand. Flexibility of a wire rope sling is dependent on the total number of single wires in the rope, and whether the rope has a steel core or a fiber core.
Generally, a 'stiffer' wire rope will withstand more crushing and abrasion than a wire rope which is 'flexible' but has rather 'fine' and 'thin' single wires. The 'thinner' the strand wires become, the easier it is to damage them.
The more flexible a sling is, the higher the number of individual wires. The total number of individual wires in a sling can vary between 114 and more than 2000 wires.
Furthermore, flexibility is a somewhat subjective term. A 3/8" diameter 6x19 wire rope has the same 'construction flexibility' as a 1" diameter 6x19 rope yet, for us humans, the 1" diameter rope appears to be far 'stiffer'; it just requires more 'muscle' to bend it around an object.
The requirement for wire rope sling 'flexibility' may also depend on the application and may even be dependent on the sling type. A simple single leg sling which is constantly used in a choker hitch requires more 'flexibility' than a multiple leg sling with a master link which may get used in a straight connection between the hook and the load only. On the other hand a 'stiffer' sling can easily be pushed though under loads, steel bundles, pallets, etc.

Unirope slings come in the following flexibility grades (in order from 'flexible' to 'stiff'):

54 strands, GATOR-FLEX®, 3x3x6x19/36 (Steel Core)
18 strands, TRI-FLEX®, 3x6x19/36 (Steel Core)
6 strands, 6x37 Fiber Core
6 strands, 6x36 Steel Core
6 strands, 6x19/26/25 Fiber Core
6 strands, 6x19/26/25 Steel Core

Depending on sling diameter we also carry 8x19 Steel Core, 19x7 and 34x7 rotation resistant types, and various high strength Python® constructions.

Aside from flexibility the other difference between sling rope constructions is the way the end terminations (or splices) are done. See next page for details.

Types of Wire Rope Sling Terminations

Flemish Eye Splice

The most popular splicing method. It's safety relies mainly on the craftsmanship of the correct splicing method. The sleeve's function is to secure the strand ends around the rope body. Steel sleeves are very rugged and withstand a lot of abuse. The flemish eye splice is the preferred method in the construction industry and for most industrial sling applications.

The flemish eye splicing method can ONLY be used for 6-strand ropes and standard Tri-Flex® sling types.

Standard 6-strand UNI-LOC® swaged Flemish Eye Sling

Loop end terminations for rotation resistant- and non-rotating ropes, and for ropes having more than 6 strands require either aluminum- or loop-back steel sleeves.

Flemish eye sleeves are also available in stainless steel to be used on stainless steel rope.

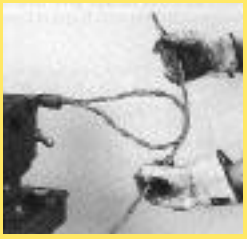
Note: Stainless steel slings which have sleeves made from regular carbon or aluminum metal may experience accelerated deterioration due to an electro-chemical reaction between the two metals. Particularly, if the slings are used in saltwater or corrosive environments.

UNI-LOC® swaged TRI-Flex® Flemish Eye 3-part Sling

The principle of a UNI-LOC® Flemish Eye Splice

1500 ton swager for wire rope flemish eye slings up to 2-1/2" diameter. One of a total of 8 rope swagers to meet any and every demand.

The end of a rope is opened up and divided into 2 equal sections.



The strands are crossed over to form a complete wire rope.

The strands are 'rolled' back until the eye is formed.

The ends of the strands are laid around the body. The eye is ready and develops about 70% of the required sling strength.

Main function of the sleeve is to secure the ends around the rope body

The sleeve is pressed onto the splice end. This cold forming process lets the soft sleeve metal flow into all rope gaps.

Types of Wire Rope Sling Terminations

DIN 3088 Aluminum Sleeve Thimble Loop Back Splice

DIN 3088 Aluminum Sleeve Thimble
Loop Back Splice in a 19x7 rotation resistant wire rope.

DIN 3088 Aluminum Sleeve Standard Loop Back Splice.

Aluminum Sleeve Loop Back Splice

This splice is fabricated by forming a loop eye and pressing an aluminum sleeve over both rope parts. The strength depends 100% upon the integrity of the pressed sleeve. Unirope fabricates these splices according to the strict European standard DIN 3088, using original specification sleeves and dies as specified in that standard.
This method is used for 8-, 9-, and 10 strand as well as non-rotating rope types (19x7, 19x19, 24x7, 34x7), and when Tri-Flex® and Gator-Flex® slings are requested with Thimbles at the ends.

Steel Sleeve Loop Back Splice

Essentially the same method as aluminum loop back splices but fabricated using steel sleeves slightly smaller in diameter. Available also in stainless steel, these sleeves are sometimes used on larger diameter stainless steel ropes. Special UNI-LOC® steel sleeves are used on Gator-Flex® slings.

The rope is 'looped back' into a sleeve (steel or aluminum) which is swaged to form a permanent load bearing bond between the two rope parts.

UNI-LOC® Steel Sleeve Loop Back Splice.

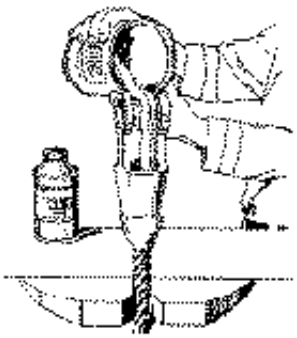
UNI-LOC® Steel Sleeve 9-part GATOR-FLEX® splice

Swaged Fittings

The rope is inserted into the fitting bore and the fitting is then swaged onto the rope. This method is used for buttons, threaded studs, open and closed sockets, and to attach a load hook directly onto the rope. This method can be used with nearly all rope constructions and produces a high efficiency bond. Unirope manufactures a wide variety of custom made swaged fittings to meet your specific demands.
See our special UNI-LOC® ASSEMBLY catalogue.

Spelter Sockets

While some people may debate whether spelter socket terminations are true 'sling' fittings, they are generally included in such catalogue sections. This type of end termination has traditionally been the method for determining the rope's actual breaking strength. All other end terminations are being compared to the strength efficiency of spelter sockets which is considered 100% of the true actual rope strength.



Some Useful Guidelines

WLL and Design Factor

Unirope® wire rope slings are manufactured to ensure a design factor of 5:1. This design factor is a factor which is divided into the nominal strength of a sling to arrive at the WLL (or Rated Capacity). This factor is necessary to allow for wear, abrasion, damage, and variations in load which are not always readily apparent to the sling user BUT DOES NOT COVER FOR INSUFFICIENT D/d RATIOS.

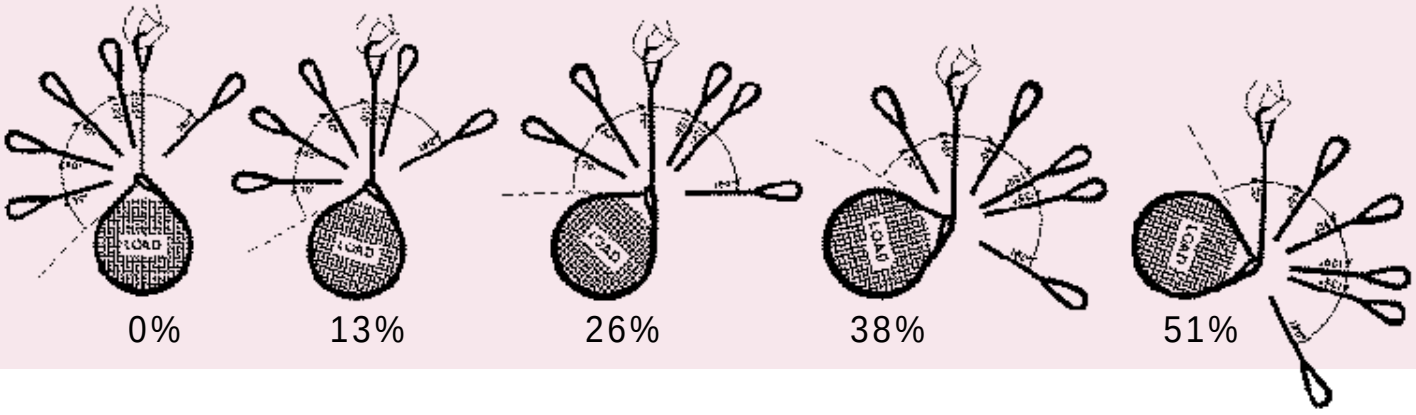
The following section does not substitute for proper training. It is not a complete 'Rigging Manual' as published by the Construction Safety Association of Ontario, nor a 'Wire Rope Users Manual' as published by the Wire Rope Technical Board. The following are some guidelines as published by both organizations and some guidelines developed by Unirope. For a complete discussion refer to the above mentioned manuals or consult ASTM B 30.9. Unirope Limited provides RIGGING INSPECTION seminars covering proper rigging gear inspection but not rigging practices. If you require RIGGING TRAINING contact the 'Construction Safety Association of Ontario', or the 'Accident Prevention Association of Ontario'. Some Ontario colleges offer special Rigging Training Classes. Or ask us for the SLINGMAX® Rigging Training Video, titled "Rigger's Mortis of the '90's"

Choker Hitches

Choker Hitch configurations affect the WLL of a sling. This is because the sling leg or body is passed around the load, through one end attachment or eye and is suspended by the other end attachments or eye. The contact of the sling body with the end attachment or eye causes a loss of sling strength at the choke point. When the load is hanging free, and the choke was not forced down towards the load, the normal choke angle is about 135 degree. When the angle is less than 135 degree the WLL of the sling must be downrated.

In some trades it became practice to use 2 slings in a choker configuration at less than 30 degrees with the choke points facing each other. Although it makes a nice 'tight' choke around pipes and bundles of steel - remember that this practice reduces your sling capacity by more than 50% !

Reduction of CHOKER Sling Capacity (WLL)



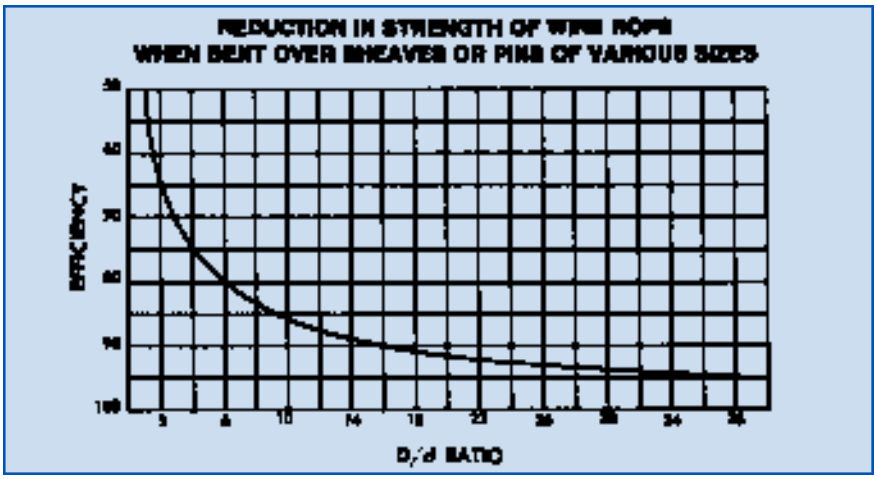
D/d Ratio and the effect on sling capacity

The D/d Ratio is the ratio of the diameter around which the sling is bent divided by the body diameter of the sling.

Example: A 1/2" diameter wire rope is bent around a 10" diameter pipe; the D/d Ratio is 10" divided by 1/2" = D/d Ratio of 20:1

This ratio has an effect on the rated capacity of slings.

Table -A-



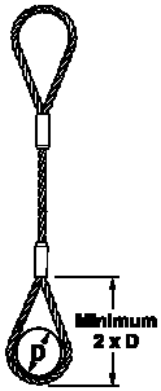
When a wire rope is bent around any sheave or other object there is a loss of strength due to this bending action. As the D/d ratio becomes smaller this loss of strength becomes greater and the rope becomes less efficient. This curve relates the efficiency of a rope diameter to different D/d ratios. This curve is based on static loads and applies to 6-strand class 6x19 and 6x37 wire rope.

Some Useful Guidelines

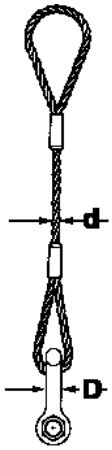
Eye & Eye Slings

The LOOP of an eye & eye sling has nearly DOUBLE the strength of it's body. For this reason the D/d ratio in the LOOP is just half as critical as opposed to when the sling is used in BASKET hitch.
In most cases the shackle or hook over which the sling is placed will have a sufficient D/d ratio. On the other hand, do not place too LARGE an object into the sling eye as this will result in splitting forces affecting the sling splice and sling safety. The object (a shackle, a crane hook, a steel bar,....) you place into the sling eye must not be larger than 1/2 of the sling eye length.

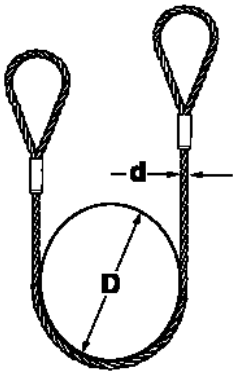
When a sling is used in a BASKET- or CHOKER HITCH with D/d ratios smaller than listed in the capacity tables, the rated capacities (or WLL's) must be decreased.
For example: The BASKETand CHOKER hitch capacities listed (in all Standards and Regulations) for 6-strand ropes are based on a minimum D/d ratio of 25:1
An object you place into a 1" diameter 6-strand wire rope sling using a basket- or choker hitch must have a minimum diameter of 25". If the object is smaller than the listed 25:1 D/d ratio the capacity (or WLL) must be decreased. Table A) illustrates the percentage of decrease to be expected.
Note: The minimum D/d ratio for GATOR-FLEX® and for TRI-FLEX® slings are just 5:1. If you need to lift small objects and don't want your sling to kink or bend permanently use these types.



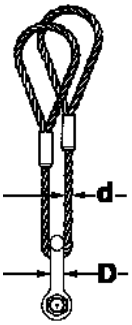
Eye length must NOT be smaller than twice the object (e.g. a hook) diameter.



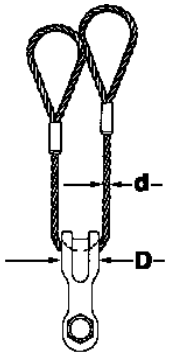
If the shackle body has AT LEAST the same diameter as the sling (D/d 1:1) the capacity need not to be adjusted



If the object lifted with a 6-strand wire rope sling in a basket hitch is at least 25 x larger than the sling diameter (D/d 25:1) the basket capacity need not to be adjusted.



If the shackle or object has 2 times the diameter of a 6-strand wire rope sling (D/d 2:1) the basket sling capacity must be reduced by 40%

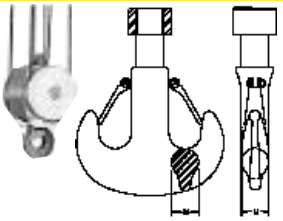


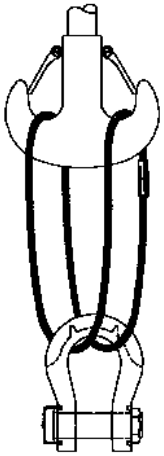
It is better to use a larger shackle or a Wide Body shackle type. If the shackle or object has at least 5x the sling diameter (D/d 5:1) the basket sling capacity must still be reduced by about 25%.

Crosby® Wide Body shackles are available in capacities ranging from 75 tons to 1000 tons.

Standard shackles have round stock bodies and come in capacities ranging from 1/3 tons to 400 tons

Load Hooks must have sufficient thickness to ensure proper sling D/d ratio, particularly when using slings in an inverted basket hitch; that is the sling BODYis placed into the hook and the sling EYES are facing downward

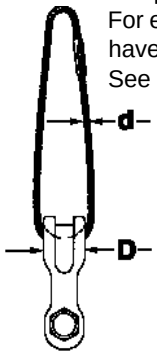




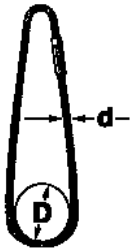
Use large enough hooks AND large diameter shackles to avoid crushing and kinking of the sling.

Endless Slings

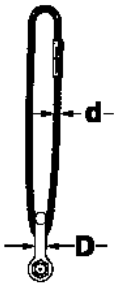
Endless (or Grommet) slings DO NOT HAVE A LOOP which has double the strength of the sling body. Prior to EVERY lift YOU, the user, has to determine if the D/d ratio is equal or higher than the ones listed in the capacity tables.
For endless 6-strand and Gator-Flex endless type wire rope slings the rated capacities have already been adjusted to be used at a D/d Ratio of 5:1.
See the WLL Tables for details.

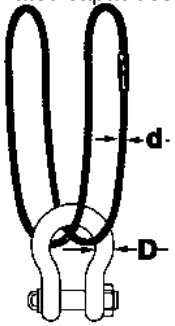


If possible use Wide-Body shackles. They increase the D/d ratio and you gain sling strength.

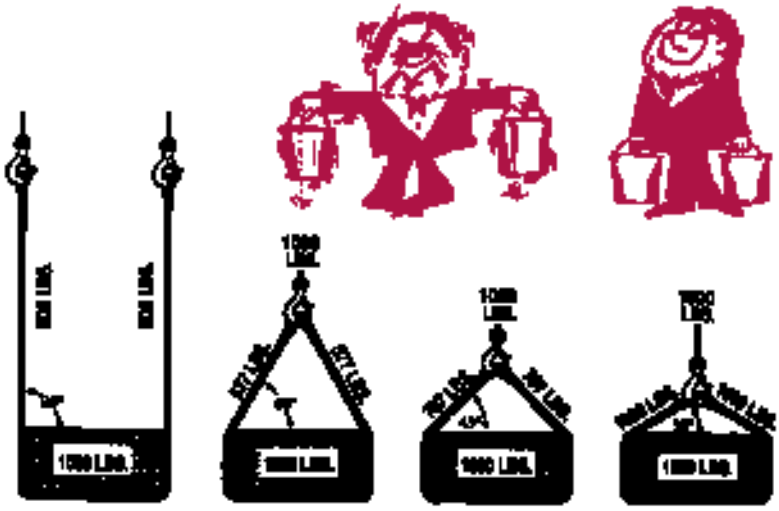


Proper D/d ratio for the sling capacity. If the sling is too short you may have to adjust the capacity because of the sling angle.





Small diameter shackles reduce the sling strength and, most likely, that small diameter shackle also has insufficient capacity for that job.
Shackle or not, objects to be lifted and all hook up points MUST at least ensure a D/d Ratio of 5:1.

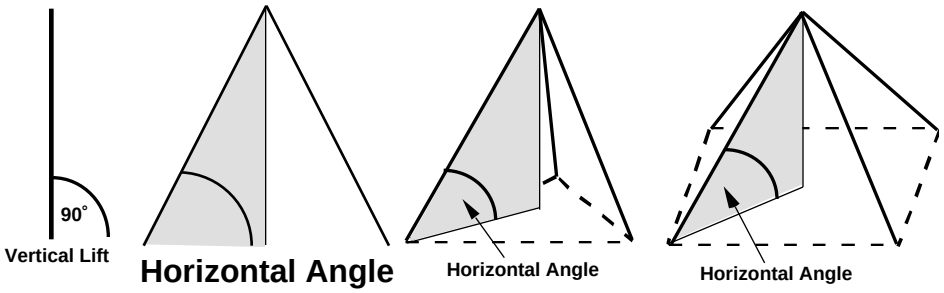


Sling Angles

All Sling angles as mentioned in this catalogue are measured from the horizontal.
As the angle decreases the stress imposed on the leg of a sling increases. A simple demonstration makes this very clear. Imagine one carries a weight with one's arm hanging down, and then try lifting the same weight sideways up and away from your body. When computing sling capacities always take this most important factor into account. As can be seen from the table sling stresses increase tremendously with angles smaller than 45˚.
Only where headroom is a limiting factor should sling angles smaller than 30˚ be applied and careful computation made to ensure that a sling of proper size is used to provide safe working conditions.

Which Angle Applies ?

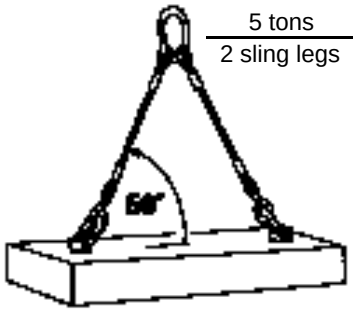
One of the most frequenly asked questions.
ALWAYS apply the HORIZONTAL sling angle. If you use slings of unequal length apply the SMALLEST sling angle.



Angularity Factor (AF)

Although the known trigonometrical functions apply to all stress calculations, many trade publications and standards give specific sling strength calculation examples which one can follow.
For a 'day-to-day' practical calculation we found the following method the easiest way to determine the wire rope sling size required.

Example:
A 5 ton load has to be lifted with a 2-leg bridle sling. The horizontal sling angle is 50˚, the slings legs have equal length, and the center of gravity is in the center of the load (if not, see next page).
Solution to find wire rope size:



$$\frac{5 \text{ tons}}{2 \text{ sling legs}} \times AF \;\; 1{,}305 = 3.26 \text{ tons}$$

3.26 tons is the VERTICAL capacity required for each leg. Look up the table and select the rope size required. In this case you must use a 5/8" diameter 6-strand IWRC wire rope for your 2-leg bridle sling.

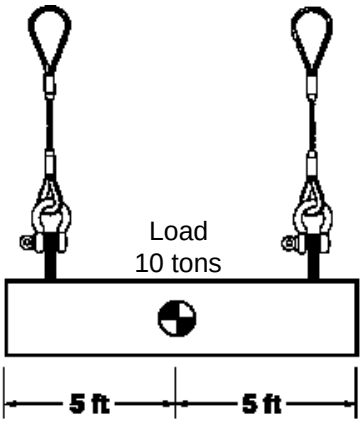
Horizontal Angle:	Angularity Factor AF:
90	1.000
85	1.003
80	1.015
75	1.035
70	1.064
65	1.103
60	1.154
55	1.220
50	1.305
45	1.414
40	1.555
35	1.743
30	2.000
(25)	(2.366)
(20)	(2.924)
(15)	(3.863)
(10)	(5.759)

Vertical lifting capacity for 6-strand IWRC wire rope	
WLL tons	Diameter inch
1.3	3/8
1.8	7/16
2.3	1/2
2.8	9/16
3.5	5/8
5.1	3/4
6.9	7/8
8.9	1
11	1-1/8
13	1-1/4
16	1-3/8
19	1-1/2
26	1-3/4
33	2
43	2-1/4
52	2-1/2

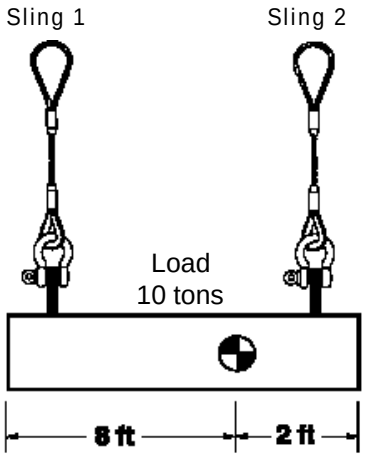
NOTE: Remember to apply additional reduction factors as required; e.g. Choker Hitch & D/d reduction factors.
(..) Angles below 30˚ should be avoided.

Center of Gravity (CG)

The location of the Center of Gravity (CG) of the load to be lifted is a very important consideration. If the CG is not exactly centered it will affect the tension in each sling and, if the sling legs are of equal length, the load will tilt when lifted. There are many considerations and to find the exact CG is not always an easy task.



When lifted vertically the load will be shared equally if the center of gravity is placed between the pick points. If the weight of the load is 10 tons, then each sling will be subjected to a tension of 5 tons. Required is a 3/4" diameter, 6-strand IWRC wire rope sling.



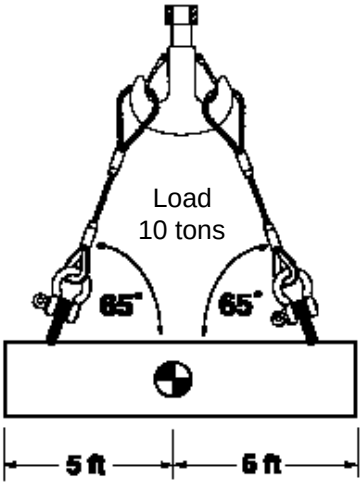
When the center of gravity is not equally spaced between the pick points, the sling and fittings will not carry an equal share of the load. The sling connected to the pick point closest to the CG will carry the greatest share of the load.

$$\text{Sling 1} = \frac{10 \text{ tons} \times 2}{(8+2)} = 2 \text{ tons}$$

$$\text{Sling 2} = \frac{10 \text{ tons} \times 8}{(8+2)} = 8 \text{ tons}$$

If in doubt ask someone who knows (e.g. your safety supervisor or an engineer).
Off-center loads can severely overload your slings.

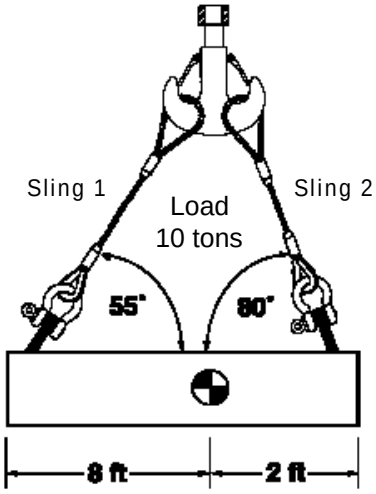
The following are simplified examples of the basic considerations.



In this example the 10 ton load is equally centered between the pick points but we lift at a sling angle of 65°. We know that each sling is subjected to 5 tons VERTICALLY. In applying the calculation from the previous section (Angularity)we arrive at

$$\frac{10 \text{ tons}}{2 \text{ sling legs}} \times \text{AF } 1{,}103 = 5.52 \text{ tons}$$

Hence, looking up the wire rope capacity of 5.52 ton from the previous table we must use 7/8" diameter 6-strand IWRC wire rope slings.



From the calculation on the left we know that sling 1) is tensioned to 2 tons, and sling 2) is tensioned to 8 tons. However both slings are on an angle, hence we must apply the angularity factor for EACH sling:

Sling 1 = 2 tons x AF 1.220 (55°) = 2.44 tons

Sling 2 = 8 tons x AF 1.015 (80°) = 8.12 tons

Looking up the wire rope capacity of the greatest load of the two slings (8.12 tons), we must use 1" diameter 6-strand IWRC wire rope slings (of unequal lengths to keep the load level).

Some Useful Guidelines

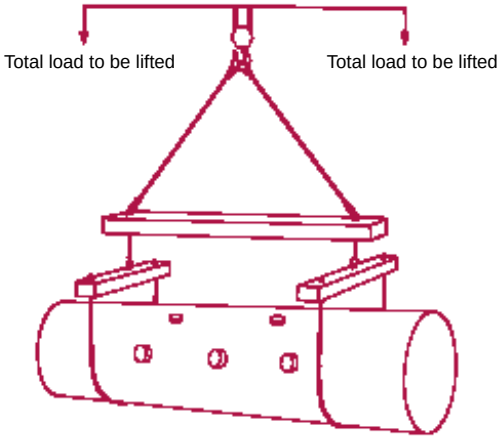
The following section does not substitute for proper training. It is not a complete 'Rigging Manual' as published by the Construction Safety Association of Ontario, nor a 'Wire Rope Users Manual' as published by the Wire Rope Technical Board. The following are some guidelines as published by both organizations and some guidelines developed by Unirope. For a complete discussion refer to the above mentioned manuals or consult ASTM B 30.9. Unirope Limited provides RIGGING INSPECTION seminars covering proper rigging gear inspection but not rigging practices. If you require RIGGING TRAINING contact the 'Construction Safety Association of Ontario', or the 'Accident Prevention Association of Ontario'. Some Ontario colleges offer special Rigging Training Classes. Or ask us for the SLINGMAX® Rigging Training Video, titled "Rigger's Mortis of the '90's"

Know the load weight BEFORE the lift

Safe lifting practice starts with one very important basic information:

KNOW THE WEIGHT OF THE LOAD TO BE LIFTED.

This seems to be 'common sense', however, having seen so many slings which obviously had been overloaded we can't stress this point enough.
Make sure loads are NOT BOLTED TO THE FLOOR. In winter, make sure that the load is not FROZEN TO THE GROUND.
Also, add all rigging and spreader bars to the weight of the load.
EVERYTHING below the crane hook has to be supported BY THE HOOK.



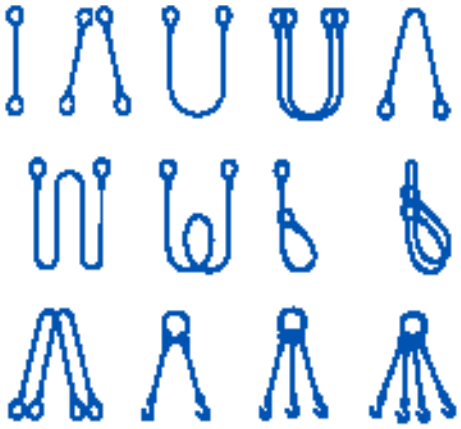
Type of Hitch

Before you select a sling for a specific lift, determine the most effective hitch to do the job, protect the load, and protect the sling.

The type of hitch you select may determine the type of sling body that will best do the job, as well as the length of the sling that will be needed. Lifting height, overhead clearance and hook travel will affect the choice of hitch and length of sling.

Choose a sling body type (6-strand, Tri-Flex®, Gator-Flex®) which will best support the load while providing adequate rated capacity. If there is too much uncertainty as to the damage a steel wire rope sling may impose to the load select a Twin-Path® or Uni-Web® sling. Also, keep in mind that wire rope slings are heavy. If you have to rig a load in tight areas or are 'short handed' select a light and less 'backbreaking' Twin-Path® EXTRA sling.

Type of Hitch determines choice of Sling



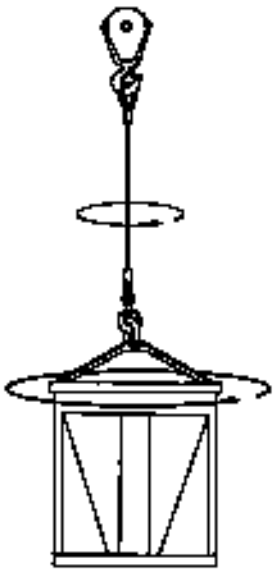
Single Leg Slings

Except for non-rotating ropes EVERY regular type 6-, 8-, 9-, or 10 strand, Tri-Flex® and Gator-Flex® sling rope has the tendency to UNWIND if used in a straight lift, or if a LOAD BEARING swivel (rotates under load) is attached to their ends.
Note: This may not apply to load POSITIONING swivels and load POSITIONING swivel hooks, e.g. Crosby type 401-403 and 322, which are not supposed to rotate under load

A condition as shown on the right will cause the load to rotate and slowly unlay the sling strands resulting in an unpredictable strength loss of the sling.

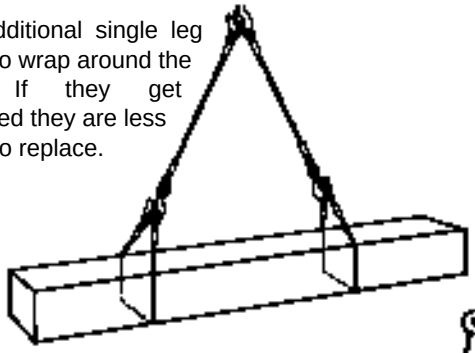
ANYTIME a load is lifted beyond arm's reach with a single part load line or a single leg wire rope sling, use a tagline to prevent load rotation.

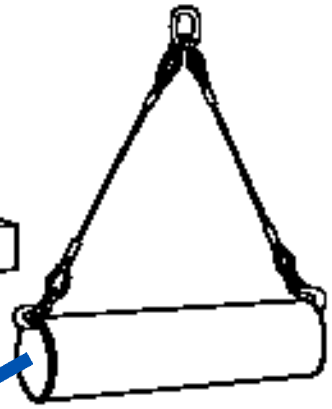
This basic principle also applies to concrete bucket lifts. The fact that you may have 'always' done it like that doesn't make it right nor does the problem 'go away'.



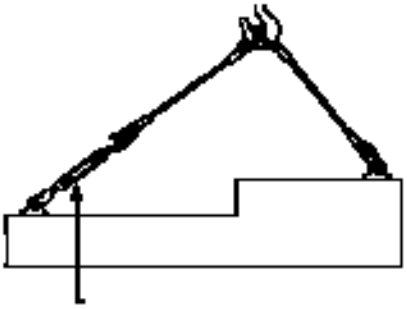
Multiple Leg Slings

Use additional single leg slings to wrap around the load. If they get damaged they are less costly to replace.

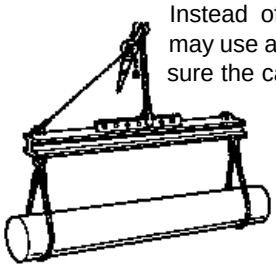




When lifting pipes make sure you do it with the right hooks. Point loading the hook tips only may result in bent hooks.

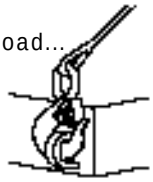


If you lift an off-center load the sling leg can be fitted with a turnbuckle to level the load. Instead of a turnbuckle you may use a come-along but be sure the capacity fits the job.

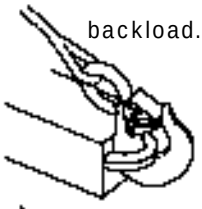


DO NOT ....

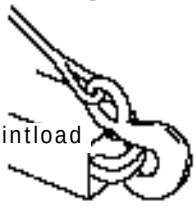
sideload...

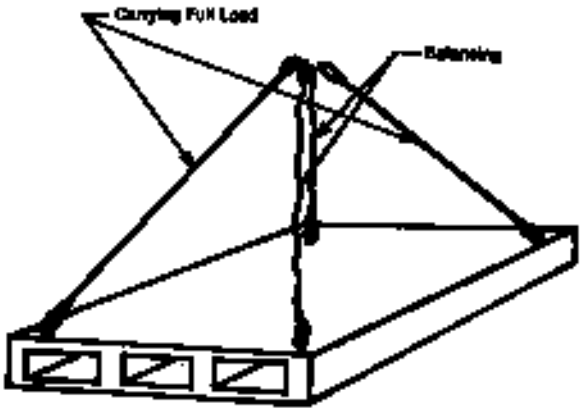


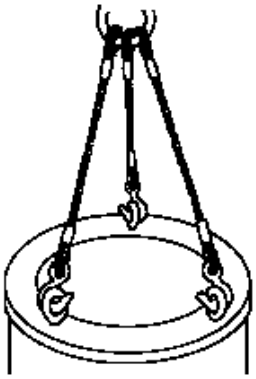
backload...



or pointload



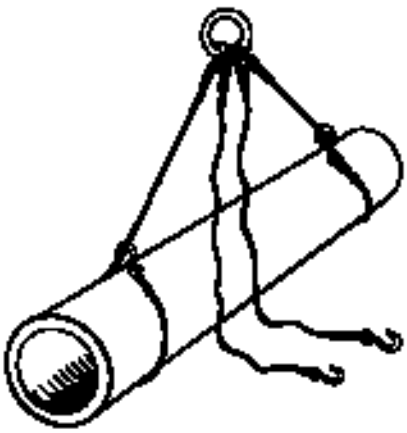


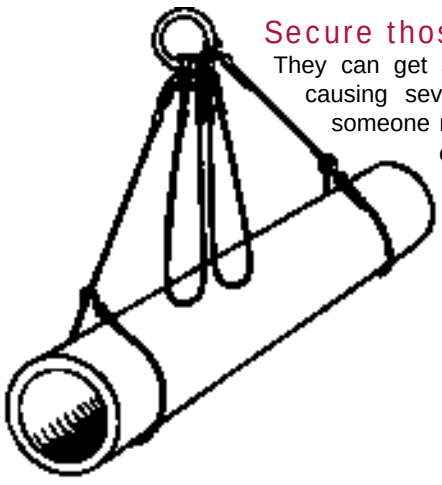


Are all sling legs loaded equally?

The load in 3- and 4-leg slings may only be supported by 2 legs while the others are only balancing the load. Unequal length sling legs may be one reason, off-center or buckling loads another. YOU, the user, must evaluate each lift taking into consideration the type of load, and the type of sling. Same capacity sling legs will stretch unequally if loaded unequally.

All wire rope sling capacity tables (e.g. in ASTM B30.9 and Wire Rope Users Manual) consider ALL legs sharing EQUAL loads.





Secure those legs

They can get stuck under another piece of equipment causing severe overload of the crane or hoist, or someone may trip over them. Do not lift when loose equipment is not secured.

Slings and Eye Bolts

Many types of equipment either come with Eye Bolts or are fitted with Eye Bolts for lifting purposes. There are some considerations when you use such Eye Bolts:

1) Eye Bolts are marked with their thread size, NOT with their rated capacities. ONLY Swivel Hoist Rings are marked with their rated capacities.

2) If you assume that a standard eye bolt has the same angularity strength loss factor as your sling, YOU ARE WRONG.
A sling used at a horizontal angle of (for example) 45˚ retains 71% of its VERTICAL capacity.
A standard eye bolt used with that same 45˚ horizontal angle retains just a mere 30% of its VERTICAL capacity. This is important if you shackle an eye bolt into a sling and assume that if the VERTICAL sling capacity matches the VERTICAL eye bolt capacity you have a safe sling system. Nothing is farther from the truth !

3) NEVER, and that means NEVER, rig a sling through eye bolts. You severely increase the stress on the eye bolt and the bolt can break.

4) Although eye bolts can be used down to a 30˚ horizontal angle, we DO NOTRECOMMEND this practice. The strength loss of an eye bolt approaches 75% of vertical rated capacity, and any even slight decrease in horizontal lifting angle may break the bolt.

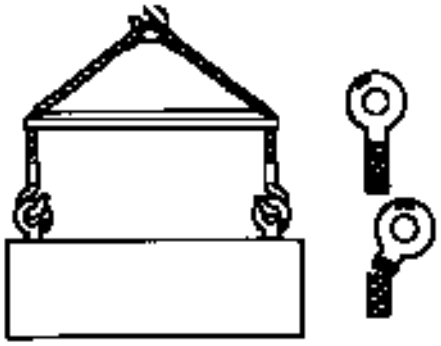
5) Use only eye bolts which are designed for LIFTING. Do not use 'no name' products. You cannot determine the steel grade by 'feel' or 'look'.

6) Use Shoulder (Machinery) Eye Bolts for angled lifts.

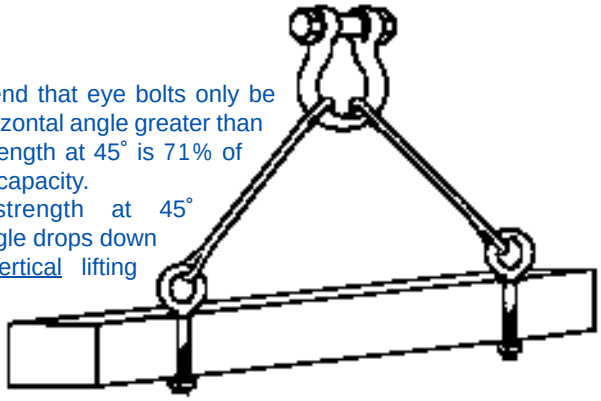
7) It is BEST to use Swivel Hoist Rings for EVERY angled lift. They adjust to any sling angle by rotating around the bolt and the hoisting eye pivots 180˚.

8) For a further discussion on how to safely use eye bolts please refer to our CROSBY® catalogue, or ask your local UNIROPE representative for advice.

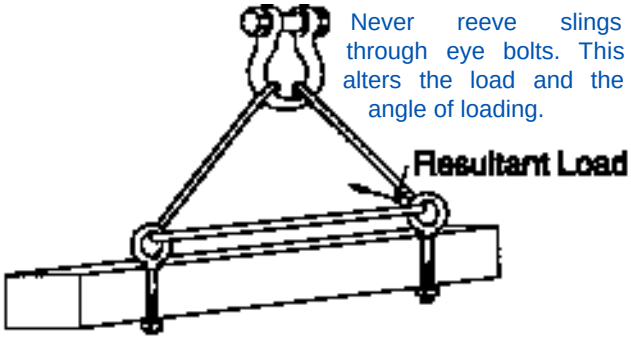
With Regular (non Shoulder)eye bolts use a spreader bar to keep the lift angle at 90˚ to the horizontal.



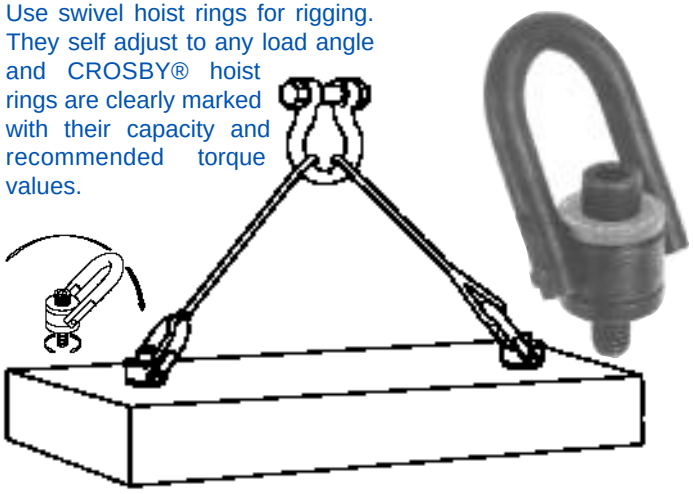
We recommend that eye bolts only be used at a horizontal angle greater than 45˚. Sling strength at 45˚ is 71% of vertical sling capacity.
Eye bolt strength at 45˚ horizontal angle drops down to 30% of vertical lifting capacity.

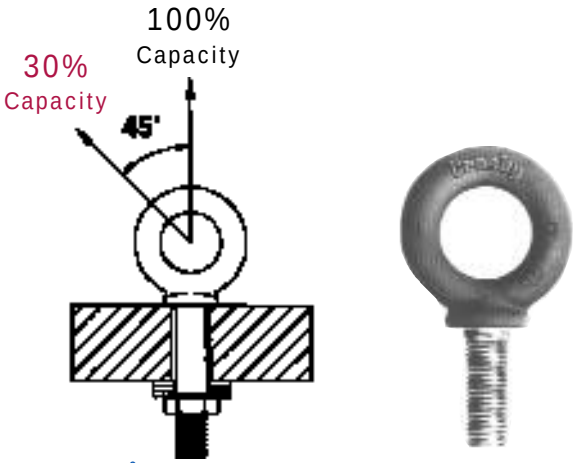


Never reeve slings through eye bolts. This alters the load and the angle of loading.



Use swivel hoist rings for rigging. They self adjust to any load angle and CROSBY® hoist rings are clearly marked with their capacity and recommended torque values.

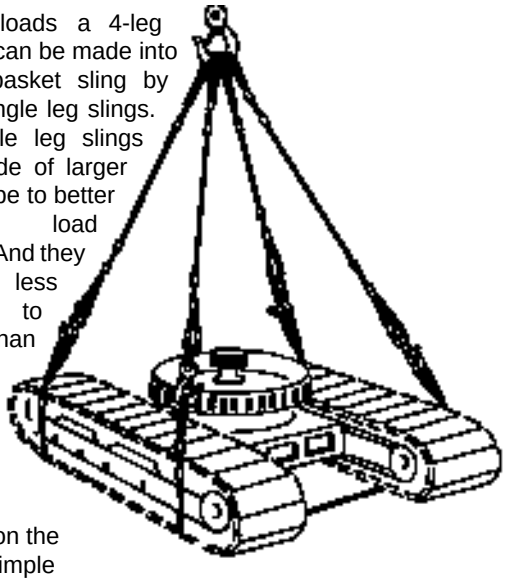


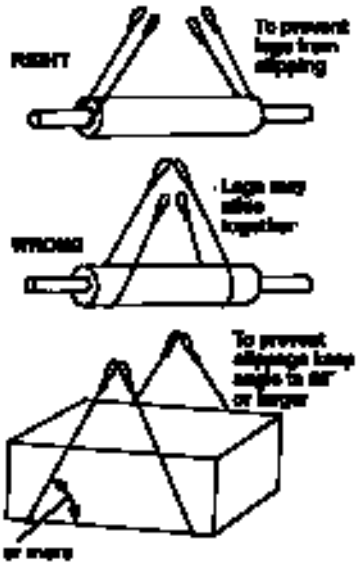


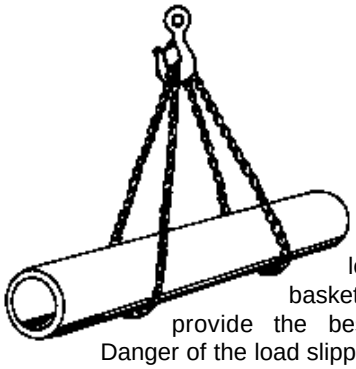
AT 45˚ lifting angle eye bolts have just 30% of their rated VERTICAL capacity.
A sling (any type) used at the same 45˚ angle retains 71% of it's vertical capacity.

Choker and Basket Hitches

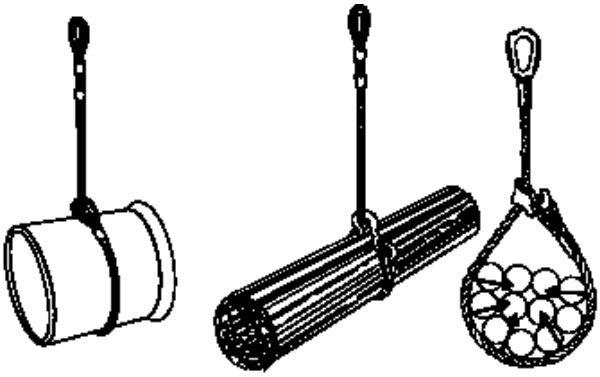
For large loads a 4-leg bridle sling can be made into a double basket sling by adding 2 single leg slings. These single leg slings can be made of larger diameter rope to better withstand load conditions. And they are less expensive to replace than the entire 4-leg sling.



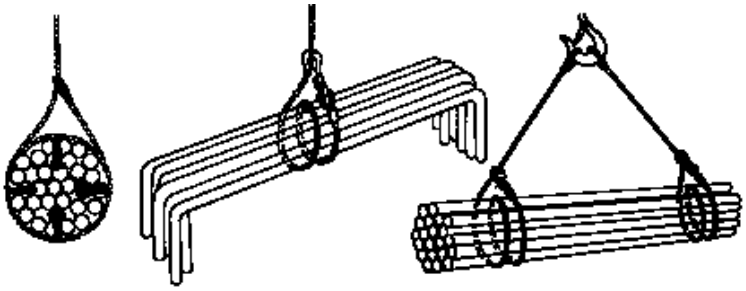




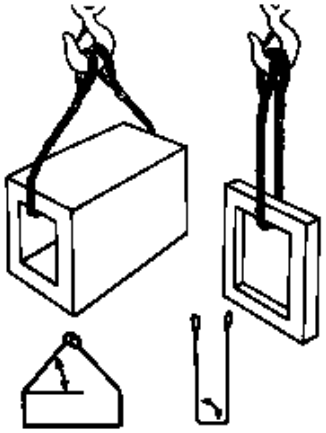
Depending on the load a simple basket hitch may not provide the best load stability. Danger of the load slipping out of the sling



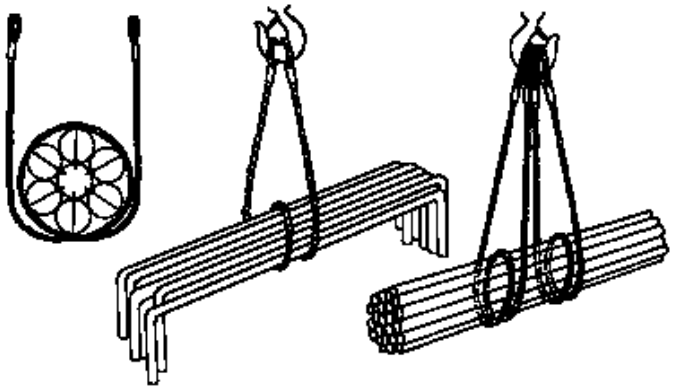
Standard choker hitches provide better load control as long as the loads are short. When lifting longer bundled loads there is the danger that some of the bundle content may slide out of the sling. As can be seen, a standard choker hitch compresses the load from three sides only



A better way to do the same lift. Use a double wrap choker hitch and for long loads use 2 slings. The double wrap compresses the load on all 4 sides and provides far better load control.
Observe the choker hitch reduction factors as outlined on page -8-.

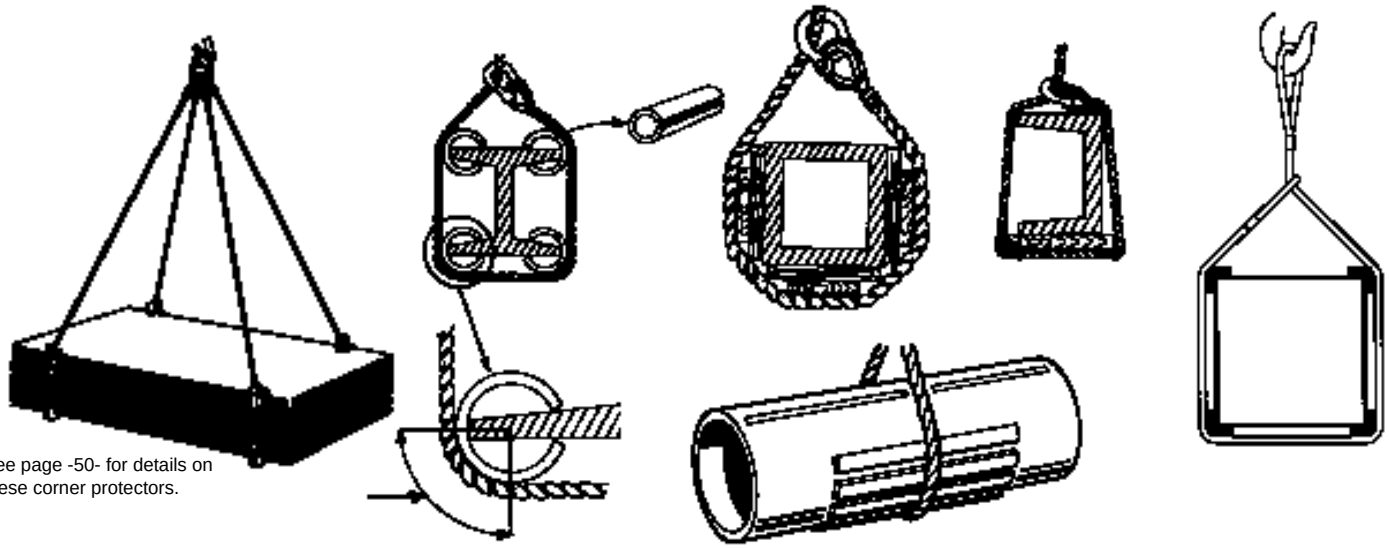


When using a basket hitch you must take the sling angle into account. Make sure the load is properly padded to prevent sling damage.



The same principle as above, but here we use a plain double wrap hitch. Both sling eyes are placed into the load hook. You do not have to consider choker hitch reduction factors, but when loads get wider you may have to reduce the sling capacity due to the angularity factor.

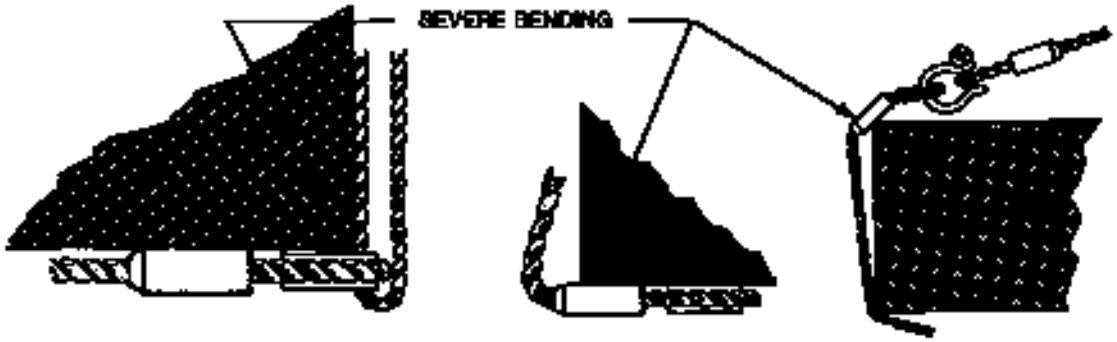
Prevent Damage to the Sling AND the Load



See page -50- for details on these corner protectors.

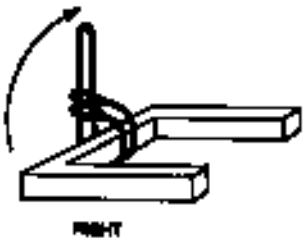
Use proper corner protection. A sharp steel edge will cut through any wire rope sling; at least it will permanently damage the sling. Sliced steel pipes have proven to an effective corner protector. For square and round objects proper wooden padding will be sufficient. Before making the final lift do a trial lift and check if the padding is strong enough and does not crack under the load weight.

Do not Damage the Rope Sleeves

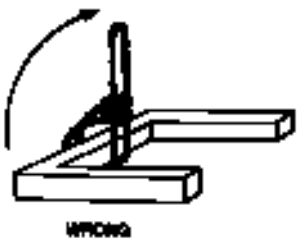


Do not place the splice sleeves, rope thimbles, or sling hooks around corners. A sleeve failure under these condition will result in the failure of the sling and you WILL drop the load. Check the sleeves regularly for nicks and cracks. Rope sleeves are NOT designed to be hooked under loads and be used as a swaged button; rope sleeves secure the rope ends and are not intended to lift the load.
DO NOT WELD ANYTHING ONTO THE ROPE SLEEVE OR TO ANY ROPE END ATTACHMENT.

Turning the Load



Turning the load with a double choker (that is a loop & loop sling used inverted) gives good load control. To rig place both sling eyes on top of the load, pointing in the OPPOSITE direction of the turn. The body of the sling is then passed under the load and through both eyes.



Sling Inspection

If required UNIROPE® provides ON SITE INSPECTION SERVICE. Our factory trained inspection personnel will provide you with a full WRITTEN inspection report and a complete LISTING of all inspected slings in service at your plant or construction site. Where necessary we will proof load the slings and issue a PROOF TEST CERTIFICATE. This service not only covers slings made from wire rope but also slings made from chain and synthetic fibers.

Basic Inspection Criteria For Wire Rope Slings

The goal of a sling inspection is to evaluate the remaining strength in a sling, which has been used previously, to determine if it is suitable for continued use.

Specific inspection intervals and procedures are required by local safety regulations (e.g. in Ontario see OHSA) and by ASTM B30.9. The responsibility for having the inspection done is placed upon the SLING USER.

As a starting point, the same work practices which apply to all "working" wire ropes also apply to wire rope slings. Therefore, a good working knowledge of wire rope design and construction will not only be useful but essential in conducting a wire rope sling inspection.

Since a wire rope is a rather complex "machine", no precise rules can be given to determine exactly when a wire rope sling should be replaced. There are many variables, and all must be considered.

We recommend that a wire rope sling shall be removed from service immediately if any of the following conditions are present:

1. Broken Wires: For 6-strand wire rope slings, 10 randomly distributed broken wires in one rope lay, or five broken wires in one strand of one rope lay. For Gator-Flex® and Tri-Flex® slings these same rules apply to each of the component ropes.
2. Metal Loss: Wear or scraping of one-third the original diameter of outside individual wires. This is quite difficult to determine on slings and you require some experience to perform this evaluation.
3. Distortion: Kinking, crushing, birdcaging, or other damage which distorts the rope structure. The main thing to look for are wires or strands that are pushed out of their original position in the rope. Slight bends in a rope where wires or strands are relatively in their original position would not be considered serious damage. But good judgement is indicated.
4. Heat Damage: Any metallic discolouration caused by exposure to heat.
5. Bad End Attachments: Cracked, bent or broken end fittings caused by abuse, wear or accident.
6. Bent Hooks: No more than 15% over the normal throat openings, measured to the narrowest point, or twisting is permissible. Replace hooks if latches do not close against the tip of the hook. Replace any missing- or damaged latches.
7. Corrosion: Severe corrosion of the rope or end attachments which has caused pitting or binding of wires should be cause for replacement. Light rusting usually does not affect the strength of a sling.
8. Pulled Eye Splices: Any evidence that eye splices have slipped, tucked strands have moved, or pressed sleeves show serious damage may be sufficient cause to reject a sling.
9. Mechanical Damages: One of the most common causes of damage is the kink which results from pulling the sling body through the loop (choker hitching), thus causing wires or strands to be deformed and pushed out of their original position. This unbalances the sling, reducing its strength.
10. Disposition: The best inspection program available is of no value if slings which are worn out and have been retired are not disposed of properly. Retired slings should be tagged DO NOT USE to prevent any further usage. The sling should be destroyed as soon as possible by cutting the eye and fittings from the rope.

Frequency of Inspections

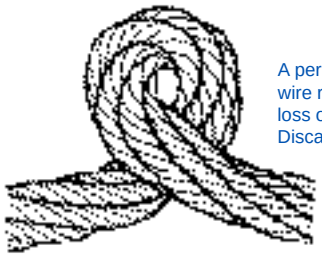
Both ASTM B.30.9 and most Provincial Regulations require that wire rope slings receive two types of inspections: a PRIOR TO USE visual inspection, and additional inspections where severe conditions warrant.

Daily inspections are intended to detect serious damage or deterioration which would weaken the sling. Look for obvious things, such as broken wires, kinks, crushing, broken attachments, severe corrosion.

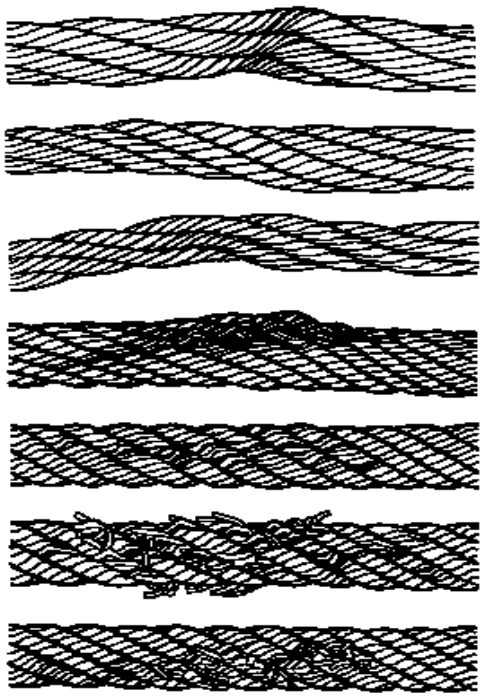
Additional inspections must be carried out by a designated person who must have good knowledge of wire rope. The frequency of these regular inspections should be based on
(1) frequency of sling use
(2) severity of service conditions
(3) nature of lifts
(4) prior experience based on service life of slings used in similar circumstances.

An accurate WRITTEN and dated record of all conditions observed should be kept.

For further details please consult your local Provincial Regulations or applicable Health and Safety Act.

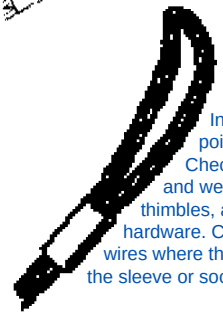


A permanent kink in a wire rope sling causes loss of strength. Discard the sling !



Check Sling for mechanical damages.

Check sling for broken wires. Flexing the rope exposes hidden wire breaks.



Inspect the bearing point of the eye. Check for deformation and wear of sleeve, thimbles, and all attached hardware. Check for broken wires where the rope enters the sleeve or socket.

An increase in lay length indicates that the sling was allowed to rotate under load and untwisted itself. Remove sling from service !