Subject: Tech.inf 2018-04

A Glance On Marine Equipment and Their Inspection for MWS

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All respectful ICS' Surveyors
With Gratitude,

The attached items which include Marine Equipment and their inspection for Marine Warranty Surveyor has been sent as technical information

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موضوع: اطلاعیه فنی ۲۰۱۸-۰٤

نگاهی به تجهیزات دریایی و بازرسی آنها، ارتباط آن با بازرس تضمین عملیات

شماره: ۳۲/۹٦/۰۰۹۵

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کلیه بازرسان محترم ICS

با سلام و احترام

بپیوست مواردی در خصوص تجهیزات دریایی، بازرسی آنها و ارتباط آن با بازرس تضمین عملیات، در قالب اطلاعیه فنی حضورتان ایفاد می گردد.

نسخه الکترونیکی اطلاعیه فنی مذکور در شبکه داخلی موسسه با آدرس ذیل قابل دسترسی می‌باشد:

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همچنین نسخه الکترونیکی این سند از طریق پست الکترونیکی به کلیه مشتریان و بازرسان محترم موسسه ارسال می گردد.

رضوان پناه
مدیر واحد کنوانسیون ها و مقررات دریایی
موسسه رده بندی ایرانیان

ترک دعوی: اگرچه در گردآوری کلیه راهنماهای فنی ارائه شده توسط موسسه رده بندی ایرانیان ،تا حد ممکن تلاش در دقت و صحت محتوا صورت گرفته است،این موسسه متحمل مسئولیتی در قبال هرگونه اشتباهات ،خسارت های احتمالی و جرائمی که ممکن است در ارتباط با بکار گیری مفاهیم و مطالب ارائه شده رخ دهد،نمیباشد.

Code: ICS32F016/2

A Glance On Marine Equipment and Their Inspection for Marine Warranty Surveyors:

The purpose of an inspection is to identify whether work equipment can be operated, adjusted and maintained safely – with any deterioration detected and remedied before it results in a health and safety risk. Not all work equipment needs formal inspection to ensure safety and, in many cases, a quick visual check before use will be sufficient. However, inspection is necessary for any equipment where significant risks to health and safety may arise from incorrect installation, reinstallation, deterioration or any other circumstances. The need for inspection and inspection frequencies should be determined through risk assessment.

Marine Warranty Surveyor should inspect work equipment if your risk assessment identifies any significant risk (for example, of major injury) to operators and others from the equipment's installation or use. The result of the inspection should be recorded and this record should be kept at least until the next inspection of that equipment. Records do not have to be made in writing but, if kept in another form (eg on a computer), these should be held securely and made available upon request by any enforcing authority.

What should the inspection cover?
This will depend on type of work equipment, Operation and condition of the operational equipment. its use and the conditions to which it is exposed. This should be determined through risk assessment and take full account of any manufacturer's recommendations.

Mostly, the marine warranty surveyor should only check and make sure about the certificate and functional test reports of the equipment and inpection and testing the equipment, directly, seems a rare process for an individual operation. But in case, any marine warranty surveyors should be aware about the projects equipment functionality, performance and the methods of inspection of them.
An inspection can vary in its extent, as the following demonstrate:

- ✓ quick checks before use (eg electric cable condition on hand-held power tools, functional testing of brakes, lights on mobile machinery)
- ✓ Frequently checks
- ✓ more extensive examinations, undertaken every few months or longer

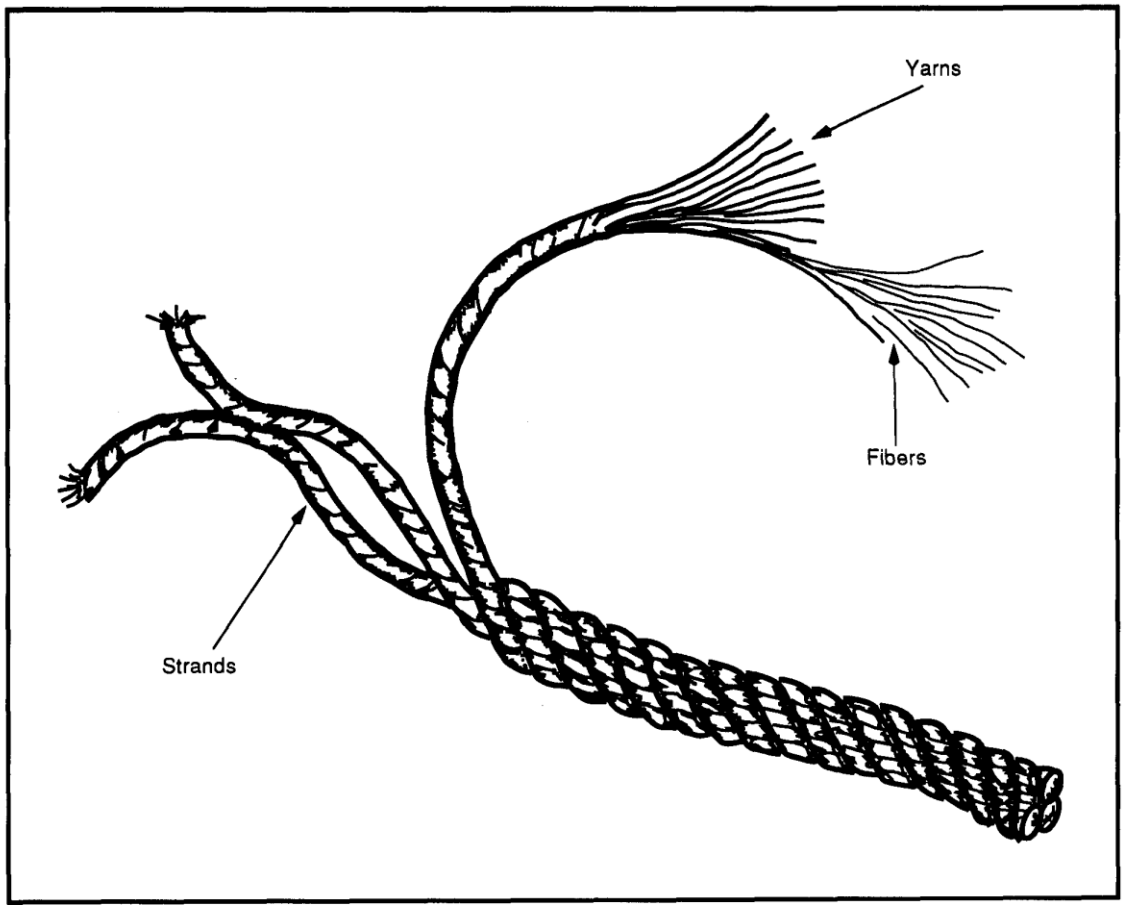
The use of checklists can assist but these, and the records made, should be tailored to the particular type of work equipment to minimize the burden to what is strictly necessary for safety. Requiring too much detail too often can lead to inspection activity becoming burdensome with the risk of a superficial 'tick box' approach or even, in some cases, the inspection activity ceasing altogether. You only need to inspect what is necessary for safety.
Here after at this part of marine warranties unifying attitude program, it is tried to having a comprehensive explanation about the marine equipment, having the potential of being used at the offshore projects and their inspection method statements are described.

ROPES:

Equipment Title:	Ropes
Application:	Almost All Kinds Of Offshore Projects

Fiber Rope:

In the fabrication of fiber rope, a number of fibers of various plants are twisted together to form yarns. These yarns are then twisted together in the opposite direction of the fibers to form strands. The strands are twisted in the opposite direction of the yarns to form the completed rope. The direction of twist of each element of the rope is known as the "lay" of that element. Twisting each element in the opposite direction puts the rope in balance and prevents its elements from unlaying when a load is suspended on it. The principal type of fiber rope is the three-strand, right lay, in which three strands are twisted in a right-hand direction.
Four-strand ropes, which are also available, are slightly heavier but are weaker than three-strand ropes of the same diameter.



Cordage of Rope Construction

Types of Fibers:

The term cordage is applied collectively to ropes and twines made by twisting together vegetable or synthetic fibers.

Vegetable Fibers:

The principal vegetable fibers are abaca (known as Manila), sisalana and henequen (both known as sisal), hemp, and sometimes coir, cotton, and jute. The last three are relatively unimportant in the heavy cordage field.
Abaca, sisalana, and henequen are classified as hard fibers. The comparative strengths of the vegetable fibers, considering abaca as 100, are as follows:

Sisalana	80
Henequen	65
Hemp	100

Manila

This is a strong fiber that comes from the leaf stems of the stalk of the abaca plant, which belongs to the banana family. The fibers vary in length from 1.2 to 4.5 meters (4 to 15 feet) in the natural states. The quality of the fiber and its length give Manila rope relatively high elasticity, strength, and resistance to wear and deterioration.
The manufacturer treats the rope with chemicals to make it more mildew resistant, which increases the rope's quality. Manila rope is generally the standard item of issue because of its quality and relative strength.

Sisal

Sisal rope is made from two tropical plants, sisalana and henequen, that produce fibers 0.6 to 1.2 meters (2 to 4 feet) long. Sisalana produces the stronger fibers of the two plants, so the rope is known as sisal. Sisal rope is about 80 percent as strong as high quality Manila rope and can be easily obtained. It withstands exposure to sea water very well and is often used for this reason.

Hemp

This tall plant is cultivated in many parts of the world and provides useful fibers for making rope and cloth. Hemp was used extensively before the introduction of Manila, but its principal use today is in fittings, such as ratline, marline, and spun yarn. Since hemp absorbs much better than the hard fibers, these fittings are invariably tarred to make them more water-resistant. Tarred hemp has about 80 percent of the strength of untarred hemp. Of these tarred fittings, marline is the standard item of issue.

Coir and Cotton

Coir rope is made from the fiber of coconut husks. It is a very elastic, rough rope about one-fourth the strength of hemp but light enough to float on water. Cotton makes a very smooth white rope that withstands much bending and running. These two types of rope are not widely used in the military; however, cotton is used in some cases for very small lines.

Jute

Jute is the glossy fiber of either of two East Indian plants of the linden family used chiefly for sacking, burlap, and cheaper varieties of twine and rope.

Synthetic Fibers

The principal synthetic fiber used for rope is nylon. It has a tensile strength nearly three times that of Manila. The advantage of using nylon rope is that it is waterproof and has the ability to stretch, absorb shocks, and resume normal length. It also resists abrasion, rot, decay, and fungus growth.

Characteristics Of Fiber Rope

Fiber rope is characterized by its size, weight, and strength.

Size

Fiber rope is designated by diameter up to 5/8 inch, then it is designated by circumference up to 12 inches or more. For this reason, most tables give both the diameter and circumference of fiber rope.

Weight

The weight of rope varies with use, weather conditions, added preservatives, and other factors. Below table, lists the weight of new fiber rope.

Strength

Below able lists some of the properties of Manila and sisal rope, including the breaking strength (B S), which is the greatest stress that a material is capable of withstanding without rupture. The table shows that the minimum BS is considerably greater than the safe load or the safe working capacity (SWC). This is the maximum load that can safely be applied to a particular type of rope. The difference is caused by the application of a safety factor. To obtain the SWC of rope, divide the BS by a factor of safety (FS):

$$SWC = BS/FS$$

A new l-inch diameter, Number 1 Manila rope has a BS of 9,000 pounds. To determine the rope's SWC, divide its BS (9,000 pounds) by a minimum standard FS of 4. The result is a SWC of 2,250 pounds. This means that you can safely apply 2,250 pounds of tension to the new l-inch diameter, Number 1 Manila rope in normal use. Always use a FS because the BS of rope becomes reduced after use and exposure to weather conditions.

In addition, a FS is required because of shock loading, knots, sharp bends, and other stresses that rope may have to withstand during its use. Some of these stresses reduce the strength of rope as much as 50 percent. If tables are not available, you can closely approximate the SWC by a rule of thumb. The rule of thumb for the SWC, in tons, for fiber rope is equal to the square of the rope diameter (D) in inches:

$$SWC = D^2$$

The SWC, in tons, of a l/2-inch diameter fiber rope would be 1/2 inch squared or ¼ ton. The rule of thumb allows a FS of about 4.

Care of Fiber Rope

The strength and useful life of fiber rope is shortened considerably by improper care. To prolong its life and strength, observe the following guidelines:

- ✓ Ensure that it is dry and then stored in a cool, dry place. This reduces the possibility of mildew and rotting.
- ✓ Coil it on a spool or hang it from pegs in a way that allows air circulation.
- ✓ Avoid dragging it through sand or dirt or pulling it over sharp edges. Sand or grit between the fibers cuts them and reduces the rope's strength.
- ✓ Slacken taut lines before they are exposed to rain or dampness because a wet rope shrinks and may break.
- ✓ Thaw a frozen rope completely before using it; otherwise the frozen fibers will break as they resist bending.
- ✓ Avoid exposure to excessive heat and fumes of chemicals; heat or boiling water decreases rope strength about 20 percent.

Nominal Diameter (inches) Circumference (inches) Pounds per Foot			Number 1 Manila		Sisal	
			Breaking Strength (pounds)	Safe Load (pounds) FS = 4	Breaking Strength (pounds)	Safe Load (pounds) FS = 4
1/4	3/4	0.020	600	150	480	120
3/8	1 1/8	0.040	1,350	325	1,080	260
1/2	1 1/2	0.075	2,650	660	2,120	520
5/8	2	0.133	4,400	1,100	3,520	880
3/4	2 1/4	0.167	5,400	1,350	4,320	1,080
7/8	2 3/4	0.186	7,700	1,920	6,160	1,540
1	3	0.270	9,000	2,250	7,200	1,800
1 1/8	3 1/2	0.360	12,000	3,000	9,600	2,400
1 1/4	3 3/4	0.418	13,500	3,380	10,800	2,700
1 1/2	4 1/2	0.600	18,500	4,620	14,800	3,700
1 3/4	5 1/2	0.895	26,500	6,625	21,200	5,300
2	6	1.080	31,000	7,750	24,800	6,200
2 1/2	7 1/2	1.350	46,500	11,620	37,200	9,300
3	9	2.420	64,000	16,000	51,200	12,800

NOTES:
1. Breaking strengths and safe loads given are for new rope used under favorable conditions. As rope ages or deteriorates, reduce safe loads progressively to one-half of values given.
2. Safe working load may be computed using a safety factor of 4, but when the condition of the rope is doubtful, divide the computed further load by 2.

Properties of Manila and Sisal Ropes

Handling of Fiber Rope

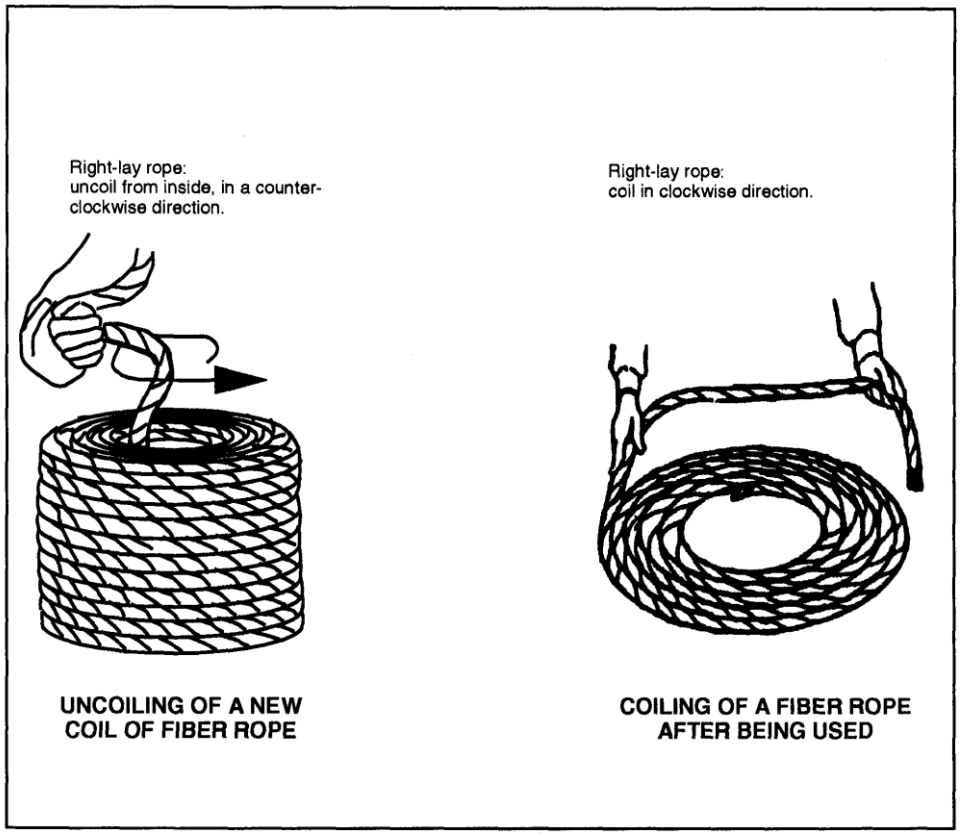
New rope is coiled, bound, and wrapped in burlap. The protective covering should not be removed until the rope is to be used. This protects it during storage and prevents tangling. To open the new rope, strip off the burlap wrapping and look inside the coil for the end of the rope. This should be at the bottom of the coil. If it is not, turn the coil over so the end is at the bottom. Pull the end up through the center of the coil. As the rope comes up, it unwinds in a counterclockwise direction.

Inspection of Fiber Rope

The outside appearance of fiber rope is not always a good indication of its internal condition.

Rope softens with use. Dampness, heavy strain, fraying and breaking of strands, and chafing on rough edges all weaken it considerably. Overloading rope may cause it to break, with possible heavy damage to material and serious injury to personnel. For this reason, inspect it carefully at regular intervals to determine its condition. Untwist the strands slightly to open a rope so that you can examine the inside.

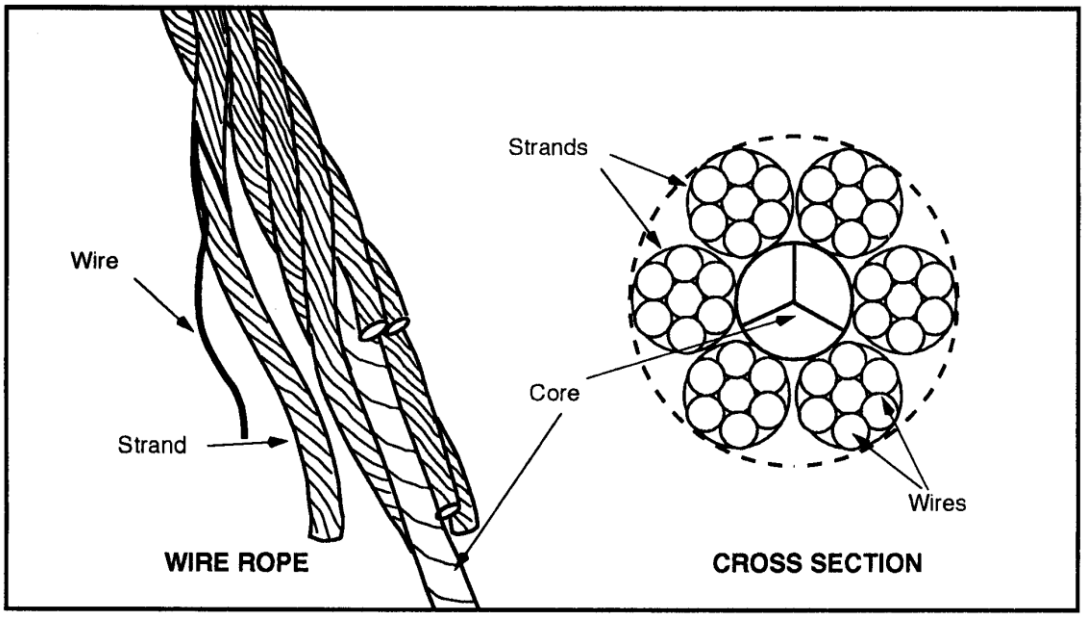
Mildewed rope has a musty odor and the inner fibers of the strands have a dark, stained appearance. Broken strands or broken yarns ordinarily are easy to identify.
Dirt and sawdust-like material inside a rope, caused by chafing, indicate damage.
In rope having a central core, the core should not break away in small pieces when examined. If it does, this is an indication that a rope has been overstrained.
If a rope appears to be satisfactory in all other respects, pull out two fibers and try to break them. Sound fibers should offer considerable resistance to breakage. When you find unsatisfactory conditions, destroy a rope or cut it up in short pieces to prevent its being used in hoisting. You can use the short pieces for other purposes.



Coil & Un-Coil The Ropes

Wire Rope

The basic element of wire rope is the individual wire, which is made of steel or iron in various sizes. Wires are laid together to form strands, and strands are laid together to form rope. Individual wires are usually wound or laid together in the opposite direction of the lay of the strands. Strands are then wound around a central core that supports and maintains the position of strands during bending and load stresses.
In some wire ropes, the wires and strands are performed. Preforming is a method of presetting the wires in the strands (and the strands in the rope) into the permanent helical or corkscrew form they will have in the completed rope. As a result, preformed wire rope does not contain the internal stresses found in the non-preformed wire rope; therefore, it does not untwist as easily and is more flexible than non-preformed wire rope.



Elements Of Wire Rope Construction

Types of Wire Rope Cores

The core of wire rope may be constructed of fiber rope, independent wire rope, or a wire strand.

Fiber-Rope Cores

The fiber-rope core can be of vegetable or synthetic fibers. It is treated with a special lubricant that helps keep wire rope lubricated internally. Under tension, wire rope contracts, forcing the lubricant from the core into the rope. This type of core also acts as a cushion for the strands when they are under stress, preventing internal crushing of individual wires. The limitations of fiber-rope cores are reached when pressure, such as crushing on the drum, results in the collapse of the core and distortion of the rope strand.

Furthermore, if the rope is subjected to excessive heat, the vegetable or synthetic fibers may be damaged.

Independent, Wire-Rope Cores

Under severe conditions, an independent, wire-rope core is normally used. This is actually a separate smaller wire rope that acts as a core and adds strength to the rope.

Wire-Strand Cores

A wire-strand core consists of a single strand that is of the same or a more flexible construction than the main rope strands.

Classification of Wire Ropes:

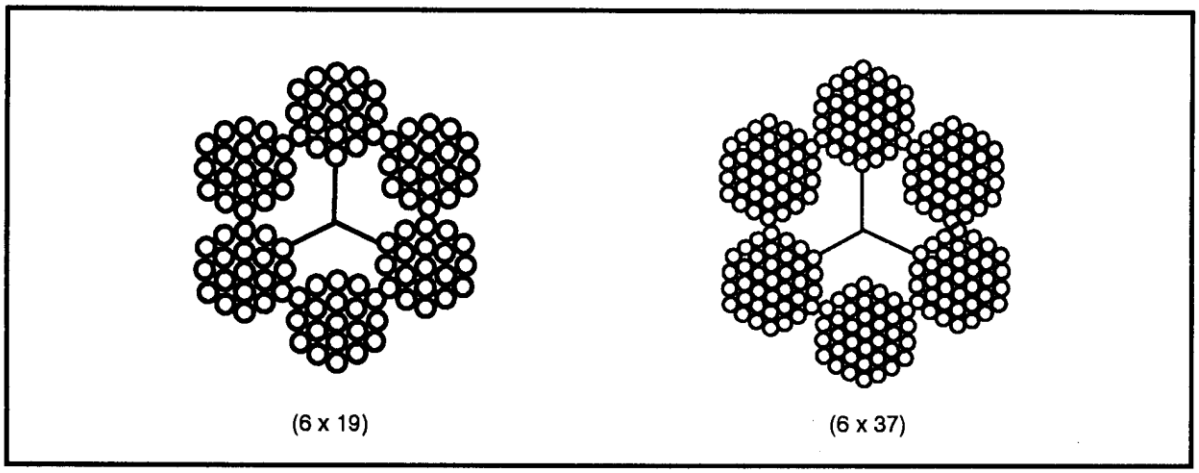
Wire rope is classified by the number of strands, the number of wires per strand, the strand construction, and the type of lay.

Wire and Strand Combinations

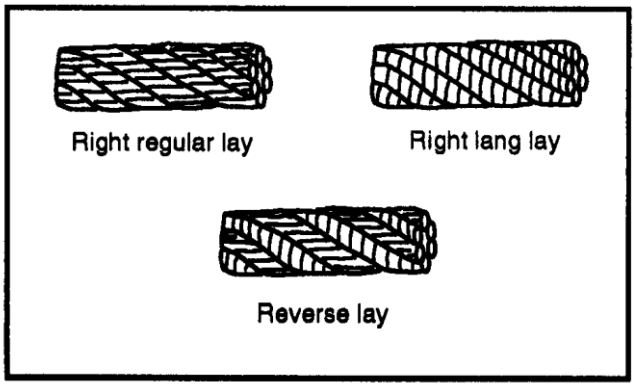
Wire and strand combinations vary according to the purpose for which a rope is intended. Rope with smaller and more numerous wires is more flexible; however, it is less resistant to external abrasion. Rope made up of a smaller number of larger wires is more resistant to external abrasion but is less flexible.
The 6-by-37 wire rope (6 strands, each made up of 37 wires) is the most flexible of the standard six-strand ropes. This flexibility allows it to be used with small drums and sheaves, such as on cranes. It is a very efficient rope because many inner strands are protected from abrasion by the outer strands.
The stiffest and strongest type for general use is the 6-by-19 rope. It may be used over sheaves of large diameter if the speed is kept to moderate levels. It is not suitable for rapid operation or for use over small sheaves because of its stiffness. The 6-by-7 wire rope is the least flexible of the standard rope constructions. It can withstand abrasive wear because of the large outer wires.

Lay

Lay refers to the direction of winding of wires in strands and strands in rope. Both may be wound in the same direction, or they may be wound in the supported load, such as in drill rods and tubes for deep-well drilling.



Arrangement of Strands in Wire Rope



Wire Rope Lays

opposite directions. The three types of rope lays are:

- ✓ Regular.
- ✓ Lang.

- ✓ Reverse.

Regular Lay

In regular lay, strands and wires are wound in opposite directions. The most common lay in wire rope is right regular lay (strands wound right, wires wound left). Left regular lay (strands wound left, wires wound right) is used where the untwisting rotation of the rope counteracts the unscrewing forces in the supported load, such as in drill rods and tubes for deep-well drilling.

Lang Lay

In lang lay, strands and wires are wound in the same direction. Because of the greater length of exposed wires, lang lay assures longer abrasion resistance of wires, less radial pressure on small diameter sheaves or drums by rope, and less binding stresses in wire than in regular lay wire rope. Disadvantages of lang lay are its tendencies to kink and unlay or open up the strands, which makes it undesirable for use where grit, dust, and moisture are present. The standard direction of lang lay is right (strands and wires wound right), although it also comes in left lay (strands and wires wound left).

Reverse Lay

In reverse lay, the wires of any strand are wound in the opposite direction of the wires in the adjacent strands. Reverse lay applies to ropes in which the strands are alternately regular lay and lang lay. The use of reverse lay rope is usually limited to certain types of conveyors. The standard direction of lay is right (strands wound right), as it is for both regular-lay and lang-lay ropes.

Characteristics of Wire Rope

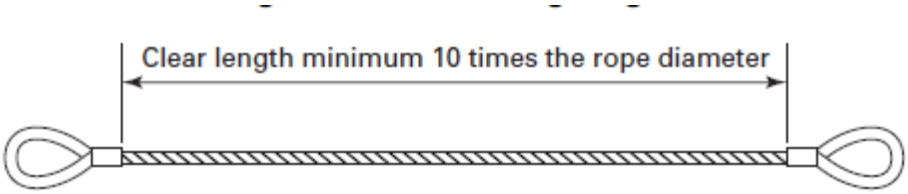
Wire rope is characterized by its size, weight, and strength.

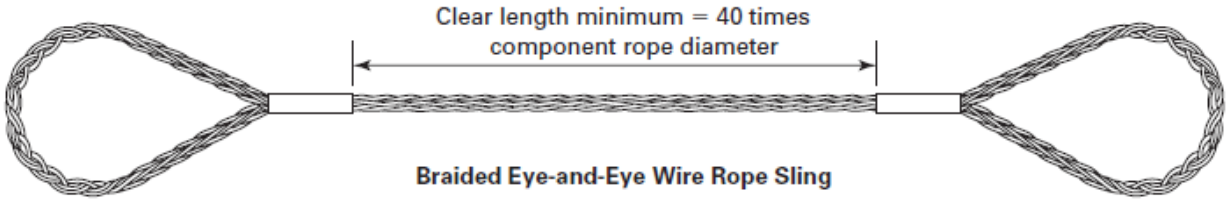
Size

The size of wire rope is designated by its diameter in inches. To determine the size of a wire rope, measure its greatest diameter.

Weight

The weight of wire rope varies with the size and the type of construction. No rule of thumb can be given for determining the weight.





Braided Eye-and-Eye Wire Rope Sling

Strength

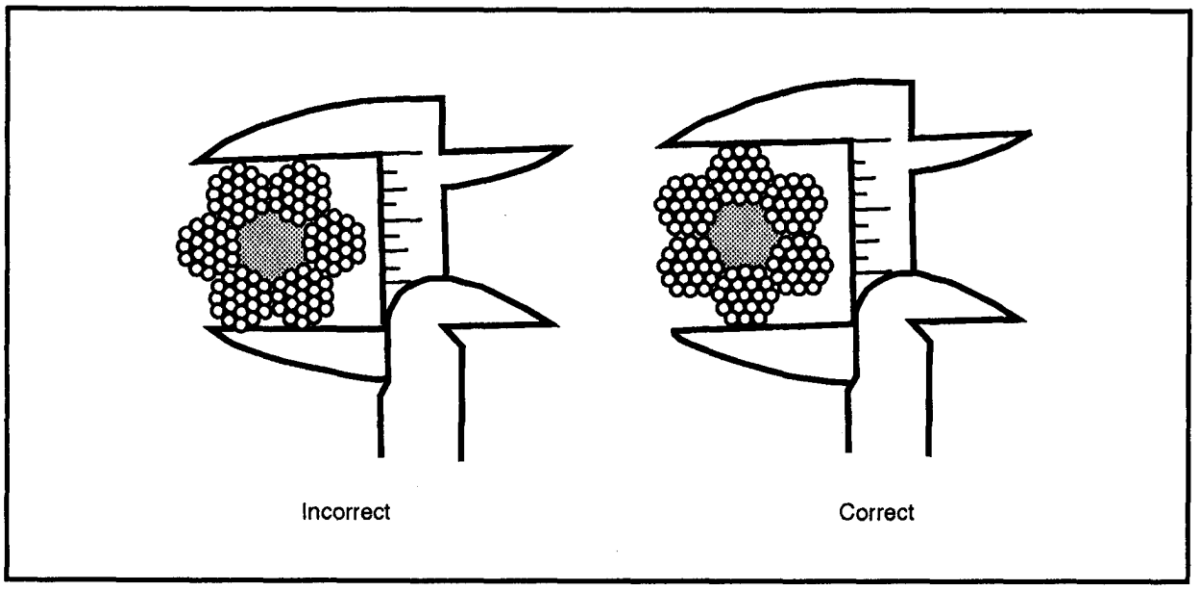
The strength of wire rope is determined by its size and grade and the method of fabrication. The individual wires may be made of various materials, including traction steel, mild plow steel (MPS), improved plow steel (IPS), and extra IPS. Since a suitable margin of safety must be provided when applying a load to a wire rope, the BS is divided by an appropriate FS to obtain the SWC for that particular type of service.

You should use the FS given in below Table in all cases where rope will be in service for a considerable time. As a rule of thumb, you can square the diameter of wire rope in, inches, and multiply by 8 to obtain the SWC in tons:

$$SWC = 8D2$$

A value obtained in this manner will not always agree with the FS given in below Table. The table is more accurate. The proper FS depends not only on loads applied but also on the Speed of the operation.

- ✓ Type of fittings used for securing the rope ends.
- ✓ Acceleration and deceleration.
- ✓ Length of the rope.



Measuring Wire Rope

Nominal Diameter (Inches) Approximate Weight (pounds per foot) Iron			Breaking Strength, Tons of 2,000 Pounds*			
			Traction Steel	Plow Steel	Improved Plow Steel	Extra Improved Plow Steel
1 1/2	3.60	29.7	56.6	108.92	123.43	123.43
1/4	0.10	1.4	2.6	2.39	2.74	
3/8	0.23	2.1	4.0	5.31	6.10	7.55
1/2	0.40	3.6	6.8	9.35	10.70	13.30
5/8	0.63	5.5	10.4	14.50	16.70	20.60
3/4	0.90	7.9	14.8	20.70	23.80	29.40
7/8	1.23	10.6	20.2	28.00	32.20	39.80
1	1.60	13.7	26.0	36.40	4.18	51.70
1 1/8	2.03	17.2	32.7	45.70	52.60	65.00
1 1/4	2.50	21.0	40.6	56.20	64.60	79.90
1 1/2	3.60	29.7	56.6	80.00	92.00	114.00
1 3/4				108.00	124.00	153.00
2				139.00	160.00	198.00

*The maximum allowable working load is the breaking strength divided by the appropriate factor of safety (*see Table 1-3*).

Breaking Strength of 6 by 19 Standard Wire Ropes

- ✓ Number, size, and location of sheaves and drums.
- ✓ Factors causing abrasion and corrosion.
- ✓ Facilities for inspection.
- ✓ Possible loss of life and property if the rope fails.

Care of Wire Rope

Caring for wire rope properly includes reversing the ends and cleaning, lubricating, and storing it. When working with wire rope, you should wear work gloves.

Type of Service	Minimum FS
Track cables	3.2
Guys	3.5
Miscellaneous hoisting equipment	5.0
Haulage ropes	6.0
Derricks	6.0
Small electric and air hoists	7.0
Slings	8.0

Wire Rope FS

Reversing or Cutting Back Ends

To obtain increased service from wire rope, it is sometimes advisable to either reverse or cut back the ends. Reversing the ends is more satisfactory because frequently the wear and fatigue on rope are more severe at certain points than at others. To reverse the ends, detach the drum end of the rope from the drum, remove the rope from the end attachment, and place the drum end of the rope in the end attachment. Then fasten the end that you removed from the end attachment to the drum. Cutting back the end has a similar effect, but there is not as much change involved. Cut a short length off the end of the rope and place the new end in the fitting, thus removing the section that has sustained the greatest local fatigue.

Cleaning

Scraping or steaming will remove most of the dirt or grit that may have accumulated on a used wire rope. Remove rust at regular intervals by using a wire brush. Always clean the rope carefully just before lubricating it. The object of cleaning at that time is to remove all foreign material and old lubricant from the valleys between the strands and from the spaces between the outer wires to permit the newly applied lubricant free entrance into the rope.

Lubricating

At the time of fabrication, a lubricant is applied to wire rope. However, this lubricant generally does not last throughout the life of the rope, which makes re-lubrication necessary. To lubricate, use a good grade of oil or grease. It should be free of acids and alkalis and should be light enough to penetrate between the wires and strands. Brush the lubricant on, or apply it by passing the rope through a trough or box containing the lubricant. Apply it as uniformly as possible throughout the length of the rope.

Storing

If wire rope is to be stored for any length of time, you should always clean and lubricate it first. If you apply the lubricant properly and store the wire in a place that is protected from the weather and from chemicals and fumes, corrosion will be virtually eliminated. Although the effects of rusting and corrosion of the wires and deterioration of the fiber core are difficult to estimate, it is certain that they will sharply

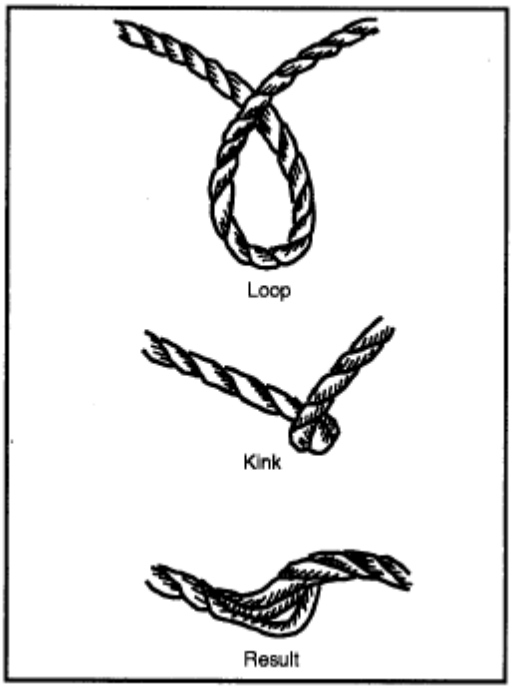
decrease the strength of the rope. Before storing, coil the rope on a spool and tag it properly as to size and length.

Handling of Wire Rope

Handling wire rope may involve kinking, coiling, unreeling, seizing, welding, cutting, or the use of drums and sheaves. When handling wire rope, you should wear work gloves.

Kinking

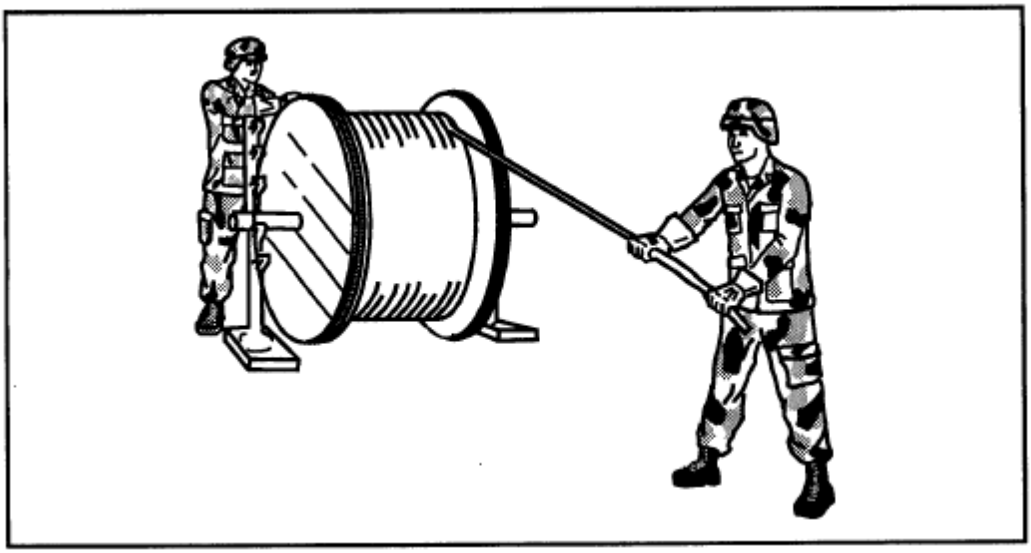
When handling loose wire rope, small loops frequently form in the slack portion. If you apply tension while these loops are in position, they will not straighten out but will form sharp kinks, resulting in unlaying of the rope. You should straighten out all of these loops before applying a load. After a kink has formed in wire rope, it is impossible to remove it. Since the strength of the rope is seriously damaged at the point where a kink occurs, cut out that portion before using the rope again.



Kinking In Wire Rope

Unreeling

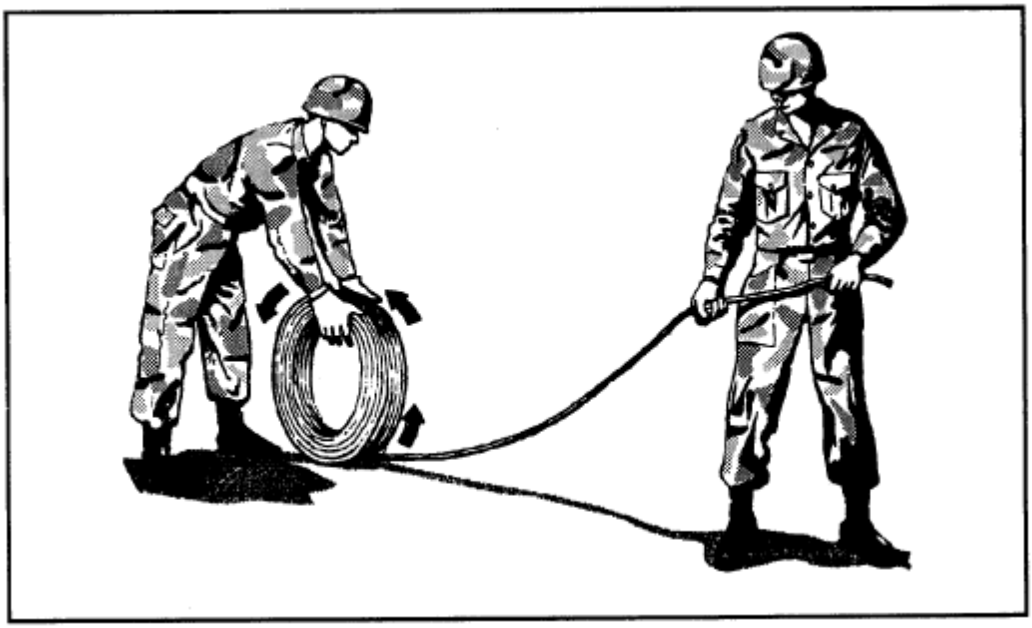
When removing wire rope from a reel or coil, it is imperative that the reel or coil rotate as the rope unwinds. Then pull the rope from the reel by holding the end of the rope and walking away from the reel, which rotates as the rope unwinds. If wire rope is in a small coil, stand the coil on end and roll it along the ground. If loops form in the wire rope, carefully remove them before they form kinks.



Un- reeling Wire Rope

Coiling

Small loops or twists will form if rope is being wound into the coil in a direction that is opposite to the lay. Coil left-lay wire rope in a counterclockwise direction and rightlay wire rope in a clockwise direction.



Un- Coiling Wire Rope

Seizing

Seizing is the most satisfactory method of binding the end of a wire rope, although welding will also hold the ends together satisfactorily.

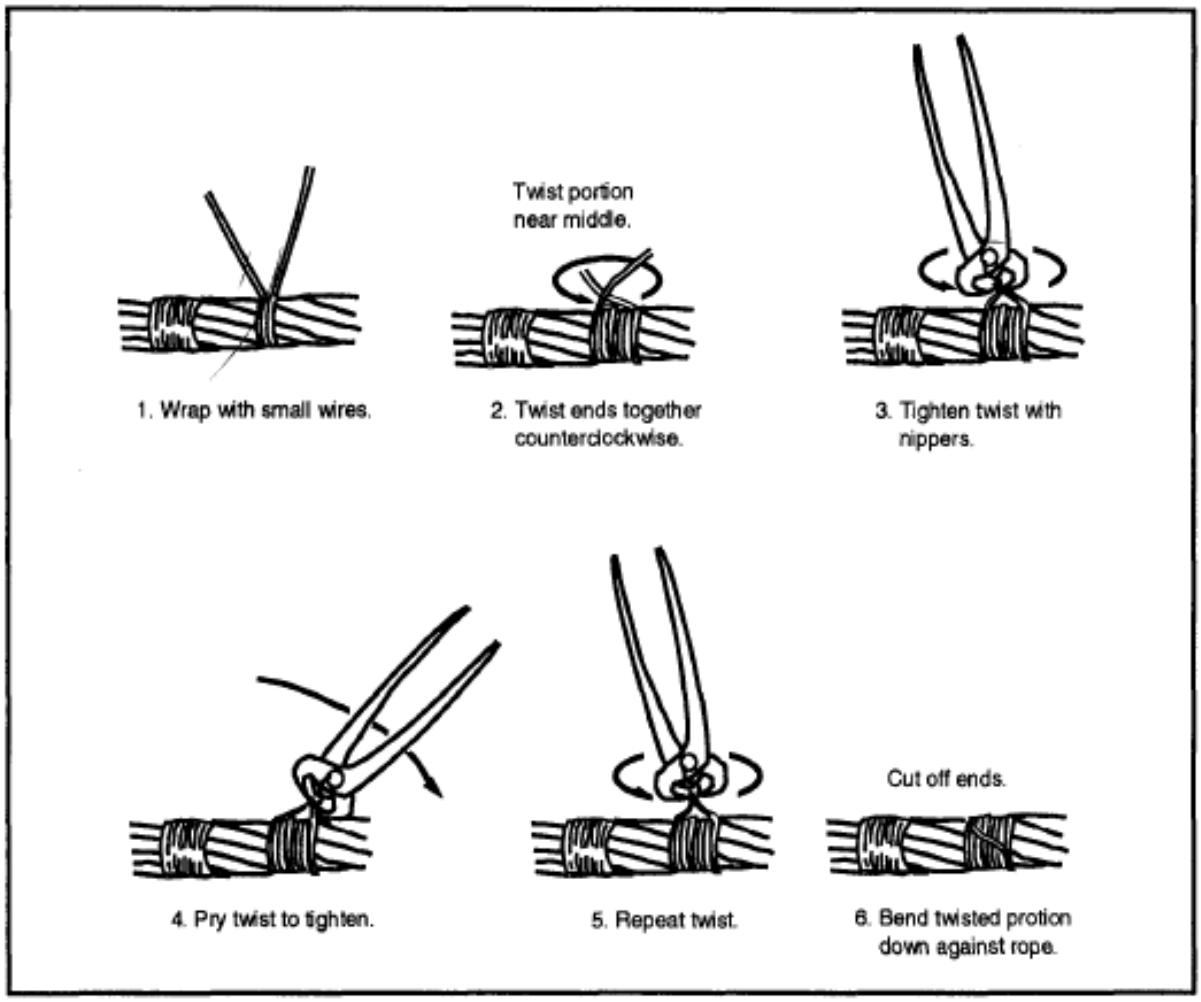
The seizing will last as long as desired, and there is no danger of weakening the wire through the application of heat. There are three convenient rules for determining the number of seizings, lengths, and

space between seizings. In each case when the calculation results in a fraction, use the next larger whole number.

The following calculations are based on a 4-inch diameter wire rope:

- ✓ The number of seizings to be applied equals approximately three times the diameter of the rope (number of seizings = SD).
  Example: 3 x 3/4 (D) = 2 1/4. Use 3 seizings.
- ✓ Each seizing should be 1 to 1 1/2 times as long as the diameter of the rope.
  (length of seizing= 1 1/2D).
- ✓ The seizings should be spaced a distance apart equal to twice the diameter (spacing = 2D).

Example: 2 x 3/4 (D) = 1 1/2. Use 2-inch spaces.



Seizing Wire Rope

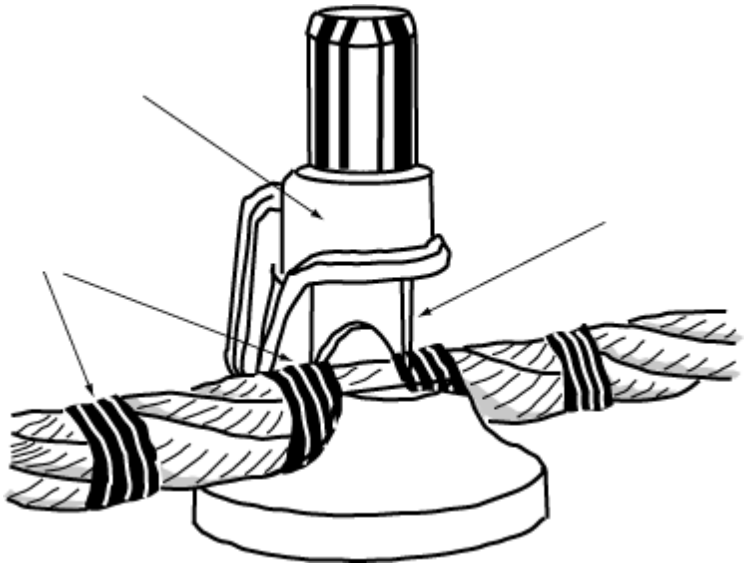
Note: Always change the fraction to the next larger whole number.

Welding

You can bind wire-rope ends together by fusing or welding the wires. This is a satisfactory method if you do it carefully, as it does not increase the size of the rope and requires little time to complete. Before welding rope, cut a short piece of the core out of the end so that a clean weld will result and the core will not be burned deep into the rope. Keep the area heated to a minimum and do not apply more heat than is essential to fuse the metal.

Cutting

You can cut wire rope with a wire-rope cutter, a cold chisel, a hacksaw, bolt clippers, or an oxyacetylene cutting torch. Before cutting wire rope, tightly bind the strands to prevent un-laying. Secure the ends that are to be cut by seizing or welding them. To use the wire-rope cutter, insert the wire rope in the bottom of the cutter with the blade of the cutter coming between the two central seizings. Push the blade down against the wire rope and strike the top of the blade sharply with a sledge hammer several times. Use the bolt clippers on wire rope of fairly small diameter; however, use an oxyacetylene torch on wire rope of any diameter. The hacksaw and cold chisel are slower methods of cutting.



Wire Rope Cutter

Drums and Sheaves

The size and location of the sheaves and drums about which wire rope operates and the speed with which the rope passes over the sheaves have a definite effect on the rope's strength and service life.

Size

Each time wire rope is bent, the individual strands must move with respect to each other in addition to bending. Keep this bending and moving of wires to a minimum to reduce wear. If the sheave or drum diameter is sufficiently large, the loss of strength due to bending wire rope around it will be about 5 or 6 percent. In all cases, keep the speed of the rope over the sheaves or drum as slow as is consistent with efficient work to decrease wear on the rope. It is impossible to give an absolute minimum size for each sheave or drum, since a number of factors enter into this decision. The sheave diameter always should be

as large as possible and, except for very flexible rope, never less than 20 times the wirerope diameter. This figure has been adopted widely.

Rope Diameter (inches)	Minimum Tread Diameter for Given Rope Construction* (inches)			
	6 x 7	6 x 19	6 x 37	8 x 19
1/4	10 1/2	8 1/2		6 1/2
3/8	15 3/4	12 3/4	6 3/4	9 3/4
1/2	21	17	9	13
5/8	26 1/4	21 1/4	11 1/4	16 1/4
3/4	31 1/2	25 1/2	13 1/2	19 1/2
7/8	36 3/4	29 3/4	15 3/4	22 3/4
1	42	34	18	26
1 1/8	47 1/4	38 1/4	20 1/4	29 1/4
1 1/4	52 1/2	42 1/2	22 1/2	32 1/2
1 1/2	63	51	27	39

*Rope construction is strands and wires per strand.

Minimum tread diameter of drums and sheaves

Location

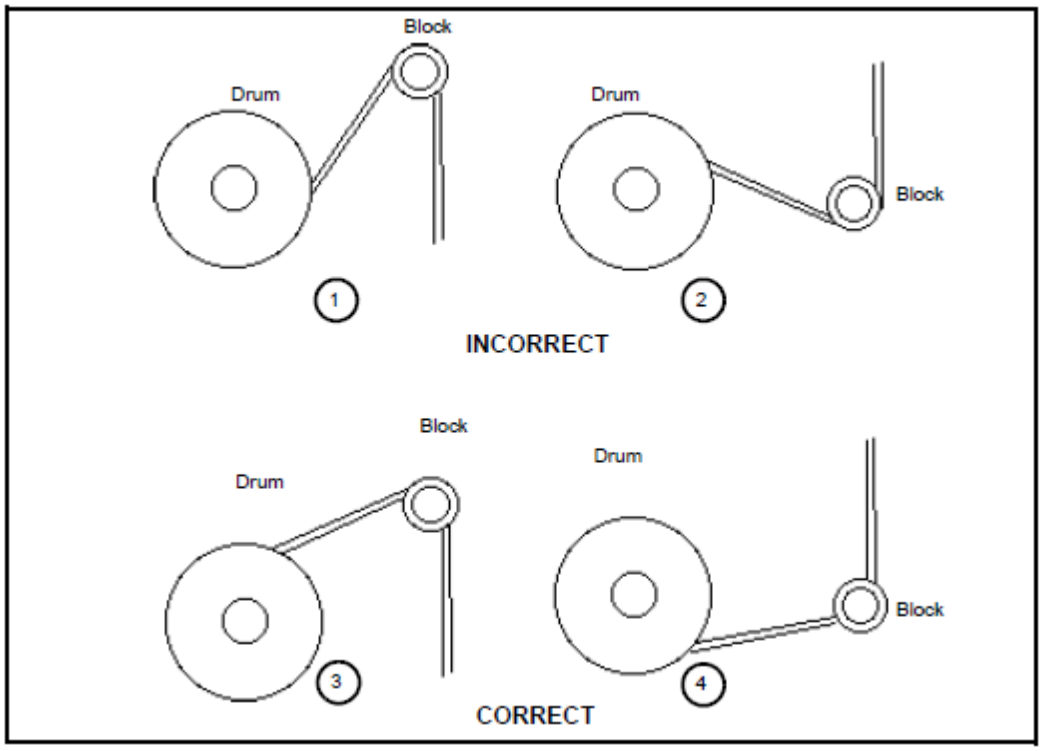
You should reeve the drums, sheaves, and blocks used with wire rope and place them in a manner to avoid reverse bends whenever possible. A reverse bend occurs when rope bends in one direction around one block, drum, or sheave and bends in the opposite direction around the next. This causes the individual wires and strands to do an unnecessary amount of shifting, which increases wear. Where you must use a reverse bend, the block, sheave, or drum causing the reversal should be of larger diameter than ordinarily used.

Space the bend as far apart as possible so there will be more time allowed between the bending motions.

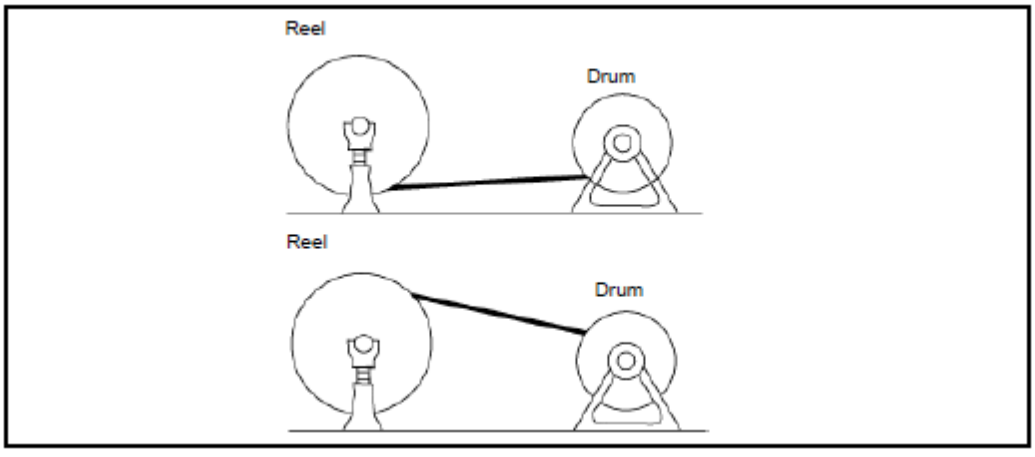
Winding

Do not overlap wire-rope turns when winding them on the drum of a winch; wrap them in smooth layers. Overlapping results in binding, causing snatches on the line when the rope is unwound. To produce smooth layers, start the rope against one flange of the drum and keep tension on the line while winding. Start the rope against the right or left flange as necessary to match the direction of winding, so that when it is rewound on the drum, the rope will curve in the same manner as when it left the reel. A convenient method for determining the proper flange of the drum for starting the rope is known as the hand rule. The extended index finger in this figure points at the on winding rope. The turns of the rope are wound on the drum close together to prevent the possibility of crushing and abrasion of the rope while it is winding and to prevent binding or snatching when it is unwound. If necessary, use a wood stick to force the turns closer together. Striking the wire with a hammer or other metal object damages the individual wires in the

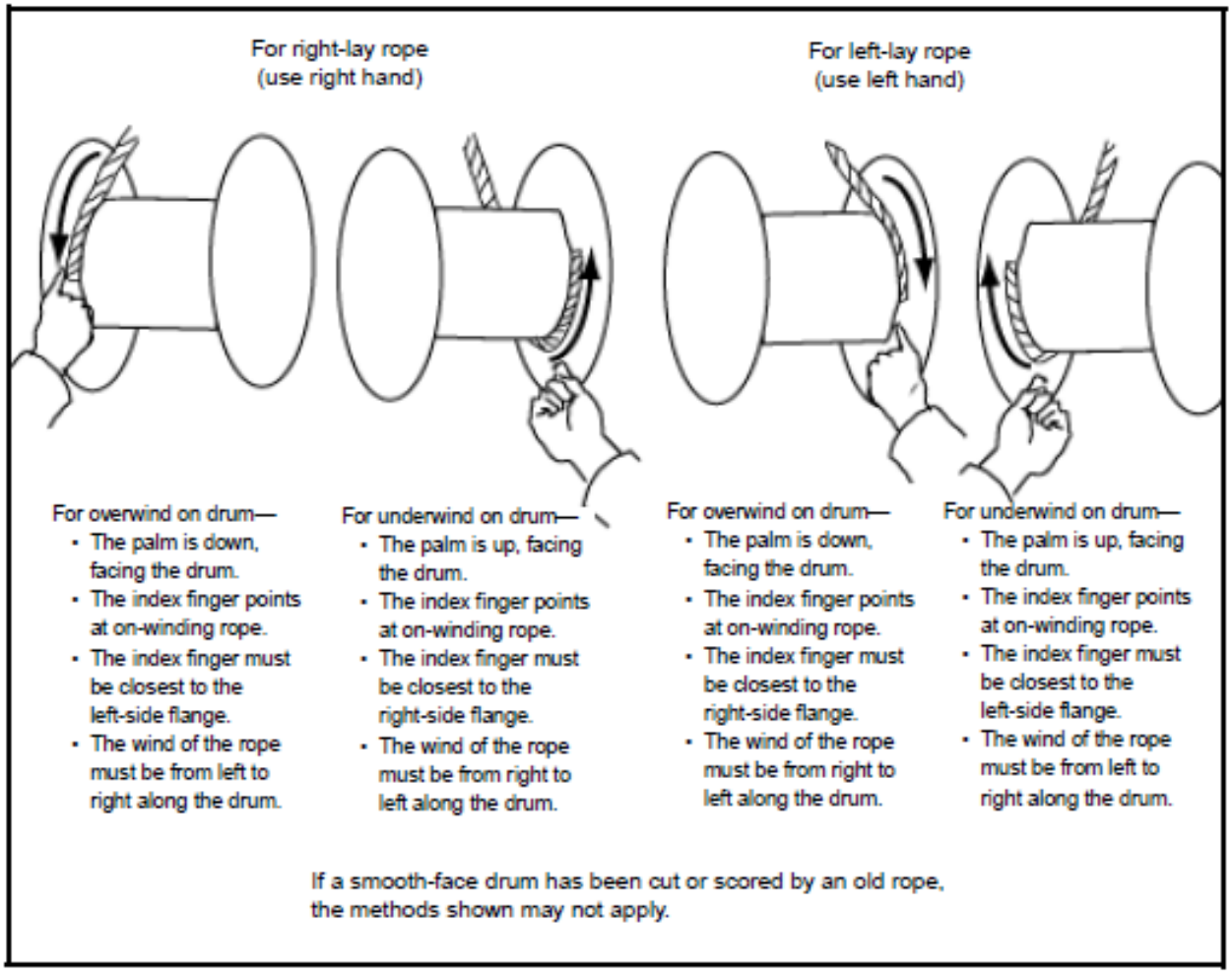
rope. If possible, wind only a single layer of wire rope on the drum. Where it is necessary to wind additional layers, wind them so as to eliminate the binding. Wind the second layer of turns over the first layer by placing the wire in the grooves formed by the first layer; however, cross each turn of the rope in the second layer over two turns of the first layer. Wind the third layer in the grooves of the second layer; however, each turn of the rope will cross over two turns of the second layer.



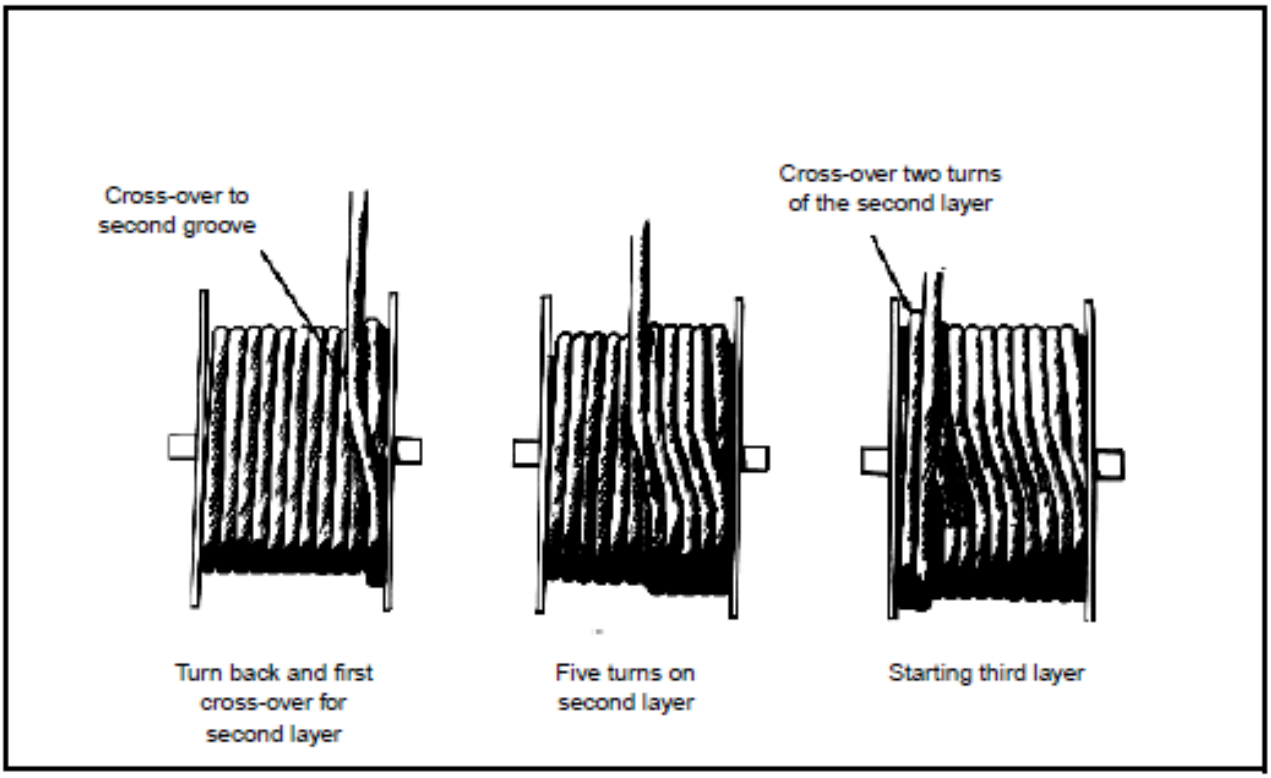
Avoiding reverse bends in wire rope



Spooling wire rope from reel to drum



Determining starting flange of wire rope



Winding wire-rope layers on a drum

Inspection of Wire Rope

Inspect wire rope frequently. Replace frayed, kinked, worn, or corroded rope. The frequency of inspection is determined by the amount of use. A rope that is used 1 or 2 hours a week requires less frequent inspection than one that is used 24 hours a day.

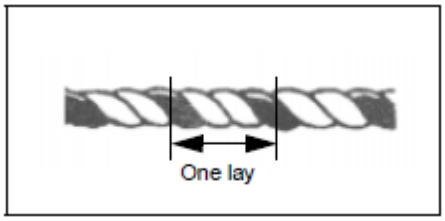
Procedures

Carefully inspect the weak points in rope and the points where the greatest stress occurs. Worn spots will show up as shiny flattened spots on the wires.

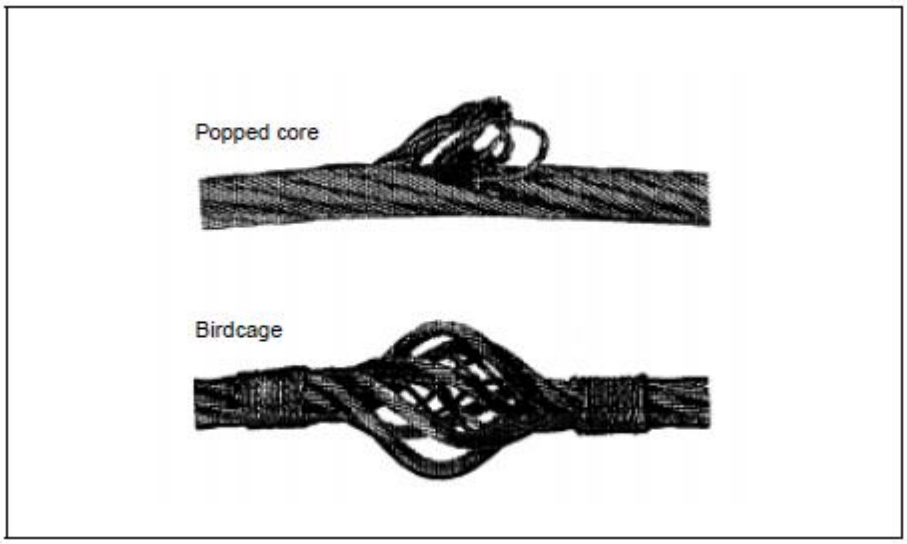
Inspect broken wires to determine whether it is a single broken wire or several wires.

Rope is unsafe if:

- ✓ Individual wires are broken next to one another, causing unequal load distribution at this point.
- ✓ Replace the wire rope when 2.5 percent of the total rope wires are broken in the length of one lay, which is the length along the rope that a strand makes one complete spiral around the rope core.



- ✓ Replace the wire rope when 1.25 percent of the total rope wires are broken in one strand in one lay.
- ✓ Replace wire rope with 200 or more wires (6 x 37 class) when the surface wires show flat wear spots equal in width to 80 percent of the diameter of the wires. On wire rope with larger and fewer total wires (6 x 7, 7 x 7, 7 x 19), replace it when the flat wear spot width is 50 percent of the wire diameter.
- ✓ Replace the wire if it is kinked or if there is evidence of a popped core or broken wire strands protruding from the core strand.
- ✓ Replace the wire rope if there is evidence of an electrical arc strike (or other thermal damage) or crushing damage.
- ✓ Replace the wire rope if there is evidence of "birdcage" damage due to shock unloading.



Unserviceable wire rope

Causes of Failure

Wire rope failure is commonly caused by:

- ✓ Sizing, constructing, or grading it incorrectly.
- ✓ Allowing it to drag over obstacles.
- ✓ Lubricating it improperly.
- ✓ Operating it over drums and sheaves of inadequate size.
- ✓ Over winding or cross winding it on drums.
- ✓ Operating it over drums and sheaves that are out of alignment.
- ✓ Permitting it to jump sheaves.
- ✓ Subjecting it to moisture or acid fumes.
- ✓ Permitting it to untwist.
- ✓ Kinking.

Initial Inspection

Prior to use, all new, altered, modified, or repaired slings shall be inspected by a designated person to verify compliance with the applicable provisions of this procedure.

Frequent Inspection

A visual inspection for damage shall be performed by the user or other designated person each day or shift the sling is used.

Conditions such as those listed below or any other condition that may result in a hazard shall cause the sling to be removed from service. Slings shall not be returned to service until approved by a qualified person.

(a) missing or illegible sling identification

(b) broken wires

(1) for strand-laid and single-part slings, ten randomly distributed broken wires in one rope lay, or five broken wires in one strand in one rope lay

(2) for cable-laid slings, 20 broken wires per lay

(3) for six-part braided slings, 20 broken wires per braid

(4) for eight-part braided slings, 40 broken wires per braid

(c) severe localized abrasion or scraping

(d) kinking, crushing, bird-caging, or any other damage resulting in damage to the rope structure

(e) evidence of heat damage

(f) end attachments that are cracked, deformed, or worn to the extent that the strength of the sling is substantially affected (g) severe corrosion of the rope, end attachments, or Fittings

(h) for hooks, removal criteria as stated in ASME B30.10

(i) for rigging hardware, removal criteria as stated in ASME B30.26

(j) other conditions, including visible damage, that cause doubt as to the continued use of the sling Written records are not required for frequent inspections.

Periodic Inspection

A complete inspection for damage to the sling shall be periodically performed by a designated person. Inspection shall be conducted on the entire length including splices, end attachments, and fittings. The sling shall be examined for conditions such as those listed in para. 9-2.9.4 and a determination made as to whether they constitute a hazard.

Periodic Inspection Frequency. Periodic inspection intervals shall not exceed 1 year. The frequency of periodic inspections should be based on

(1) frequency of sling use

(2) severity of service conditions

(3) nature of lifts being made

(4) experience gained on the service life of slings used in similar circumstances

(c) Guidelines for the time intervals are

(1) normal service — yearly

(2) severe service — monthly to quarterly

(3) special service — as recommended by a qualified person

A written record of the most recent periodic inspection shall be maintained.

Proof Load Test

For single- or multiple-leg slings and endless slings, each leg shall be proof loaded to the following load requirements based on fabrication method. In no case shall the proof load exceed 50% of the component ropes' or structural strands' minimum breaking strength.

(1) Mechanical Splice Slings. The proof load shall be a minimum of 2 times the single-leg vertical hitch rated load.

(2) Swaged Socket and Poured Socket Slings. The proof load shall be a minimum of 2 and a maximum of 2.5 times the single-leg vertical hitch rated load.
NOTE: The proof load should be that specified by the wire rope or fitting manufacturer's recommendation provided that it is within the above-specified proof load range.

(3) Hand-Tucked Slings. If proof tested, the proof load shall be a minimum of 1 and a maximum of 1.25 times the single-leg vertical hitch rated load.

Master links for two-leg bridle slings shall be proof loaded to a minimum of 4 times the single-leg vertical hitch rated load.

Master links for three-leg bridle slings shall be proof loaded to a minimum of 6 times the single-leg vertical hitch rated load.

Master links for four-leg bridle slings shall be proof loaded to a minimum of 8 times the single-leg vertical hitch rated load.

Appendix A
Sample Wire Rope Certificate

宁夏恒力钢丝绳股份有限公司

NING XIA HENG LI STEEL WIRE ROPE CO. LTD.

钢丝绳产品质量证明书

PRODUCT CERTIFICATE OF STEEL WIRE ROPE

产品标准（Product standard）：GB/T20118-2006

质量证明书编号（CERN . No.）：92-3146-51　　产品编号(Product No.)：294558-1-2\59-1-2

订货单位（Customer）：上海中缆实业有限公司	合同号(Contract No)：--
钢丝绳结构(Construction of wire Rope)：6×37+FC	钢丝绳直径(Diameter)：48 mm 捻　法（Type of lay）：交右
钢丝绳强度级(Grade of Strength)：1770 MPa	镀锌层级别(Grade of Galvanization)：镀锌
用途 (Usefulness)：重要	钢丝绳长度(Length)：200×6 m
钢丝绳毛重(Gross Weight)：　kg	钢丝绳净重(Net Weight)：10035 kg
钢丝绳实测破断拉力(Measured breaking force)：　kN	

拆股钢丝试验结果(Test Result of Each Strand)

钢丝破断拉力总和：1589　　规定值(Required)：≥　kN

Aggregate breaking load of individual wires:　　实际值(Actual)：　kN

钢丝公称直径 Nominal dia. of wire (mm)		2.2		2.5					
公称抗拉强度 Tensile strength grade (MPa)		1770		1670					
试验项目 Item of Test		最小值Min	低值报	最小值Min	低值报	最小值Min	低值报	最小值Min	低值报
抗拉强度 Tensile strength (MPa.)		1790		1970					
扭转次数 Number of twists (次/360°)		25		35					
弯曲次数 Number of bending (次/180°)		24		28					
打结率 Knotting rate (%)									
镀锌层试验 Zinc Coating Test	镀锌层重量Weight (g/m^2)								
	芯棒直径 (mm) Core diameter (mm)								

备注(Remarks)：

工厂质检部门印章

Stamp of Q. C. Dept

日期（Date）：2009.08.12

质检部负责人：卢尚礼　　审核员：陈海玲　　质检员：2-07

Q. C. Chief.:　　Auditor:　　Inspector:

宁夏恒力钢丝绳股份有限公司

NING XIA HENG LI STEEL WIRE ROPE CO. LTD.

钢丝绳产品质量证明书

PRODUCT CERTIFICATE OF STEEL WIRE ROPE

产品标准（Product standard）：Q/HLS018-2006

质量证明书编号（CERN .No.）：92-3161　　产品编号(Product No.)：593185

订货单位（Customer）:上海中绳实业有限公司	合同号(Contract No):--
钢丝绳结构(Construction of wire Rope): 6T×36WS+IWR	钢丝绳直径(Diameter): 38 mm
	捻　法（Type of lay）: 交右
钢丝绳强度级(Grade of Strength): 1960MPa	镀锌层级别(Grade of Galvanization): 镀锌
用途 (Usefulness): 重要	钢丝绳长度(Length): 1900m
钢丝绳毛重(Gross Weight): kg	钢丝绳净重(Net Weight): 12915kg
钢丝绳实测破断拉力(Measured breaking force): 1135 kN	

拆股钢丝试验结果(Test Result of Each Strand)

钢丝破断拉力总和:　　规定值(Required): ≥ kN

Aggregate breaking load of individual wires:　　实际值(Actual): kN

钢丝公称直径 Nominal dia. of wire (mm)		1.35		1.9		2.2		2.65	
公称抗拉强度 Tensile strength grade (MPa)		1960		1960		1960		1960	
试验项目 Item of Test		最小值Min	低值报	最小值Min	低值报	最小值Min	低值报	最小值Min	低值报
抗拉强度 Tensile strength (MPa.)		1970		1880		1910			
扭转次数 Number of twists (次/360°)		30		32		25			
弯曲次数 Number of bending (次/180°)		13		13		21			
打结率 Knotting rate (%)									
镀锌层试验 Zinc Coating Test	镀锌层重量Weight (g/m^2)								
	芯棒直径 (mm) Core diameter (mm)								

备注(Remarks):

工厂质检部门印章

Stamp of Q.C. Dept

宁夏恒力钢丝绳股份有限公司 产品质量证明书专用章

日期（Date）: 2009.08.15

黄建

2-07

质检部负责人：卢尚礼　　审核员:　　质检员:

Q.C.Chief.:　　Auditor:　　Inspector:

宁 夏 恒 力 钢 丝 绳 股 份 有 限 公 司

NING XIA HENG LI STEEL WIRE ROPE CO. LTD.

钢 丝 绳 产 品 质 量 证 明 书

PRODUCT CERTIFICATE OF STEEL WIRE ROPE

产品标准（Product standard）：GB/T20067-2006

质量证明书编号（CERN .No.）：105-X1431　　产品编号(Product No.)：5101814

订货单位（Customer）：上海中绳实业有限公司	合同号(Contract No)：--
钢丝绳结构(Construction of wire Rope)：6T×36WS+IWR	钢丝绳直径(Diameter)：76.0 mm
	捻　法（Type of lay）：交右
钢丝绳强度级(Grade of Strength)：1770 MPa	镀锌层级别(Grade of Galvanization)：光面
用途 (Usefulness)：重要	钢丝绳长度(Length)：600 m
钢丝绳毛重(Gross Weight)：　kg	钢丝绳净重(Net Weight)：16073 kg
钢丝绳实测破断拉力(Measured breaking force)：4030 kN	

拆 股 钢 丝 试 验 结 果(Test Result of Each Strand)

钢丝破断拉力总和:　　规定值(Required)：≥　　kN

Aggregate breaking load of individual wires:　　实际值(Actual)：　　kN

钢丝公称直径 Nominal dia. of wire (mm)		3.70		2.65		3.50		4.30	
公称抗拉强度 Tensile strength grade (MPa)		1770		1770		1770		1770	
试验项目 Item of Test		最小值Min	低值根	最小值Min	低值根	最小值Min	低值根	最小值Min	低值根
抗拉强度 Tensile strength (MPa.)		1760		1930		1830			
扭转次数 Number of twists (次/360°)		31		30		15			
弯曲次数 Number of bending (次/180°)		10		16		18			
打结率 Knotting rate (%)									
镀锌层试验 Zinc Coating Test	镀锌层重量Weight (g/m^2)								
	芯棒直径 (mm) Core diameter (mm)								

备注(Remarks)：

船用　　切头时请注意捆绑

工厂质检部门印章

Stamp of Q. C. Dept

日期（Date）：2010.04.28

质检部负责人：卢尚礼　　审核员：卢尚礼　　质检员：5-04

Q. C. Chief.:　　Auditor:　　Inspector:

AMERICAN BUREAU OF SHIPPING
MISCELLANEOUS SURVEY REPORT

Customer Name	**SHANGHAI ZHONGSHENG STEEL WIRE ROPE INDUSTRY (SHANGHAI) CO., LTD.**	Purchase Order No.	
Attending Office	**Yangzhou**	Report Number	**YU1741038**
First Visit Date	**09-Oct-2009**	Last Visit Date	**19-Oct-2009**

Statement of Fact

Survey Location: Yinchuan, P. R. China

The scope of work was as agreed.
The survey of the items identified has been carried out in accordance with the applicable Process Instruction.

1. Particular:

Type: 6 x 37 + FC - 48 - 1770; Coil No.: 294558, 294558-1, 294558-2.
Type: 6 x 37 S + IWR - 64-1770; Coil No.: 593248.
Type: 6T X 36WS + IWR - 38 -1960; Coil No.: 593185.

2. Following inspection were carried out at this time as per manufacturer's requirement:

a. Visual examination (W)
b. Material test of wire (W)

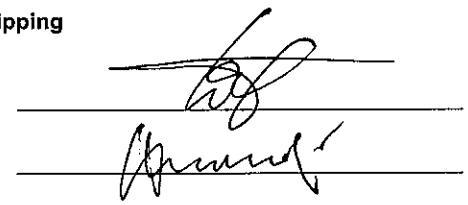
For details of test result, please refer to the manufacturer's test report.

Note: W - witnessed.

Surveyor(s) to The American Bureau of Shipping
Attending Surveyors

Wang Ying

Reviewed By



AMERICAN BUREAU OF SHIPPING
MISCELLANEOUS SURVEY REPORT

Customer Name	**SHANGHAI ZHONGSHENG STEEL WIRE ROPE INDUSTRY (SHANGHAI) CO., LTD.**	Purchase Order No.	
Attending Office	**Yangzhou**	Report Number	**YU1741038**
First Visit Date	**09-Oct-2009**	Last Visit Date	**19-Oct-2009**

Statement of Fact

Survey Location: Yinchuan, P. R. China

The scope of work was as agreed.
The survey of the items identified has been carried out in accordance with the applicable Process Instruction.

1. Particular:

Type: 6 x 37 + FC - 48 - 1770; Coil No.: 294559, 294559-1, 294559-2.
Type: 6 x 37S + IWR - 64 - 1770; Coil No.: 593249.

2. Following inspection were carried out at this time as per manufacturer's requirement:

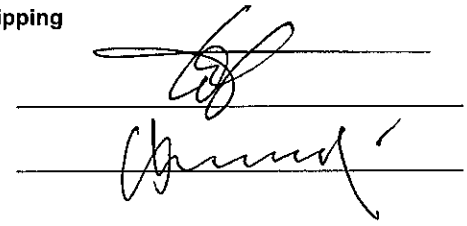
a. Visual examination (W)
b. Material test of wire (W)

Note: W - witnessed.

Surveyor(s) to The American Bureau of Shipping
Attending Surveyors

Wang Ying

Reviewed By



Appendix B
Sample of Wire Rope Manufacturer Instructions

Sling Angle Information

Inspection of Fittings

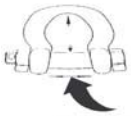
INSPECTION FITTINGS

- WEAR
- DEFORMATION
- CRACKS OR SHARP NICKS
- MODIFICATION
- WIRE ROPE AT TERMINATION

The inspection of fittings:

1. Initial, upon purchase
2. Frequent, prior to each use
3. Periodic, at least annually

INSPECTION OF FITTINGS DEFORMATION



STOP

ANY SIGNIFICANT PERMANENT DEFORMATION, OR CHANGE IN SHAPE, INDICATES IT HAS BEEN OVERLOADED AND MUST BE REMOVED FROM SERVICE

More frequent inspection is required if type of service requires it. Records are not required by federal OSHA unless fittings are part of chain sling.

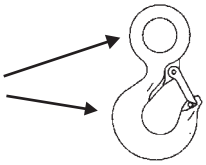
OSHA and ANSI allow 15% increase in throat opening of hooks, however Crosby recommends that hooks be removed from service if any significant deformation exists.

INSPECTION OF FITTINGS WEAR

STOP

NO MORE THAN 10% WEAR OF ANY SECTIONAL DIMENSION, MEASURE BY COMPARING TO A SECTION OF FITTING THAT HAS NO WEAR, OR TO THE CATALOG DIMENSIONS

Wear of hook is limited to 5% in the two critical areas shown.



INSPECTION OF FITTINGS CRACKS AND SHARP NICKS

STOP

ANY CRACK, SHARP NICK OR GOUGE IN THE SURFACE OF ANY FITTING IS CAUSE FOR REMOVAL FROM SERVICE

Cracks can form if a properly made fitting is repeatedly overloaded. A crack can form if non heat treated fittings are used in frequently cycled loads that are within the Working Load Limit.

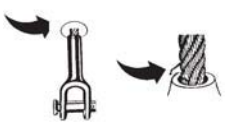
INSPECTION OF FITTINGS MODIFICATION

STOP

ANY MODIFICATION OF ANY FITTING IS CAUSE FOR REMOVAL FROM SERVICE:
WELDING OR HEATING
NO SUBSTITUTION OF PARTS
NO BENDING

Never modify a shackle by substituting the shackle pin. Use only genuine Crosby shackle pins with Crosby Shackles. All alloy shackles must have pins that are marked with HT.

INSPECTION OF WIRE ROPE TERMINATIONS



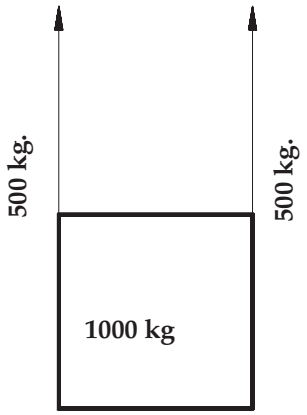
STOP

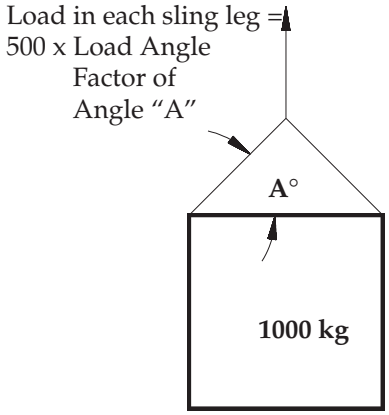
MORE THAN ONE BROKEN WIRE AT ANY TIME (WITHIN ONE WIRE ROPE DIAMETER OF THE FITTING) TERMINATION IS CAUSE FOR REMOVAL FROM SERVICE

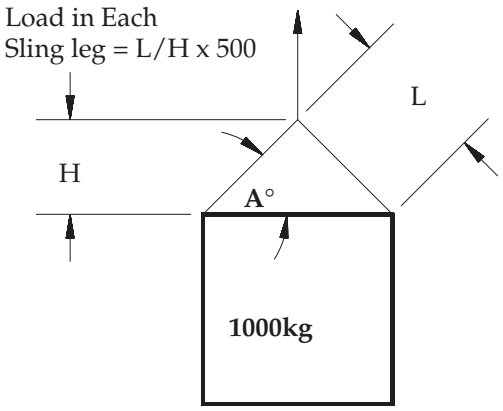
Any modification will mean that the Working Load Limit is no longer valid. The person modifying the fitting is responsible.

Sling Information

SLING ANGLES







Sling Angle Degrees (A°)	Load Angle Factor = L / H
90	1.000
60	1.155
50	1.305
45	1.414
30	2.000
LOAD ON EACH LEG OF SLING = (Load ÷ 2) x LOAD ANGLE FACTOR	

ANSI B30.9 recommends against the use of a horizontal sling angle smaller than 30°.

BASIC SLING OPERATING PRACTICES ANSI B30.9

Whenever any sling is used, the following practices shall be observed.

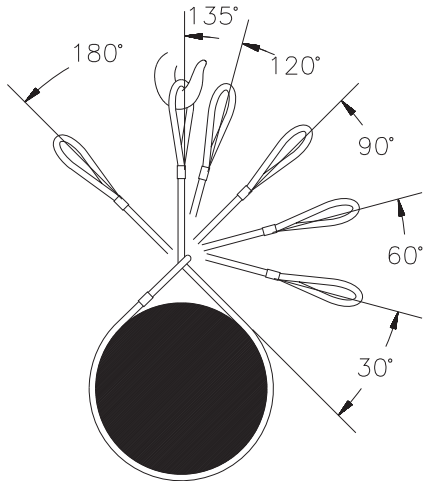
1. Slings that are damaged or defective shall not be used.
2. Slings shall not be shortened with knots or bolts or other makeshift devices.
3. Sling legs shall not be kinked.
4. Slings shall not be loaded in excess of their rated capacities.
5. Slings used in a basket hitch shall have the loads balanced to prevent slippage.
6. Slings shall be securely attached to their load.
7. Slings shall be padded or protected from the sharp edges of their loads.
8. Suspended loads shall be kept clear of all obstruction.
9. All employees shall be kept clear of loads about to be lifted and of suspended loads.
10. Hands or fingers shall not be placed between the sling and its load while the sling is being tightened around the load.
11. Shock loading is prohibited.
12. A sling shall not be pulled from under a load when the load is resting on the sling.

INSPECTION - Each day before being used, the sling and all fastenings and attachments shall be inspected for damage or defects by a competent person designated by the employer. Additional inspections shall be performed during sling use where service conditions warrant. Damaged or defective slings shall be immediately removed from service.

Sling Information

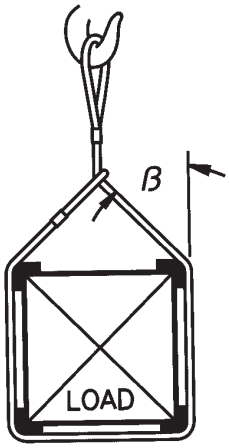
CHOKER HITCHES

CHOKER HITCHES WIRE ROPE SLINGS ANSI B30.9



Angle of Choke	Sling Rated Load Percentage of Single Leg Sling Capacity
120 - 180	75%
90 - 119	65%
60 - 89	55%
30 - 59	40%

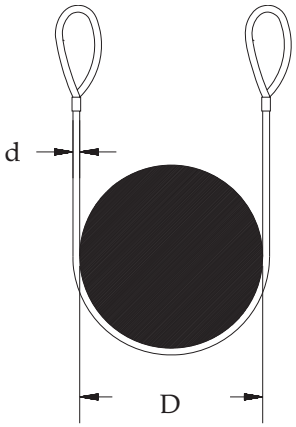
CHOKER HITCHES WIRE ROPE, CHAIN, AND SYNTHETIC SLINGS



A choker hitch has 75% (80% for Webbing Slings) of the capacity of a single leg only if the corners are softened and the horizontal angle is greater than 30 degrees. Use blocks to prevent angles less than 30 degrees.

BASKET HITCHES

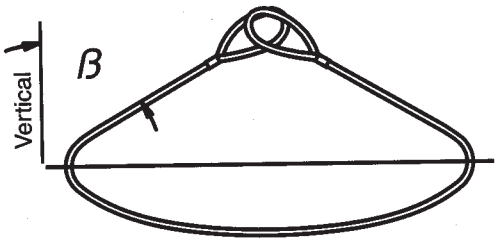
BASKET HITCH WIRE ROPE SLINGS



A basket hitch has twice the capacity of a single leg only if D/d Ratio is 25/1 and it is vertical.

D/d> 25/1 per ANSI B30.9

BASKET HITCHES WIRE ROPE, CHAIN AND SYNTHETICS

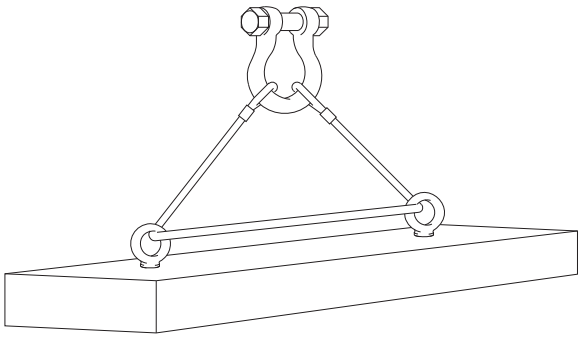


Angle Degrees	Percentage of Single Leg Capacity
90	200%
60	170%
45	140%
30	100%

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

Sling Information

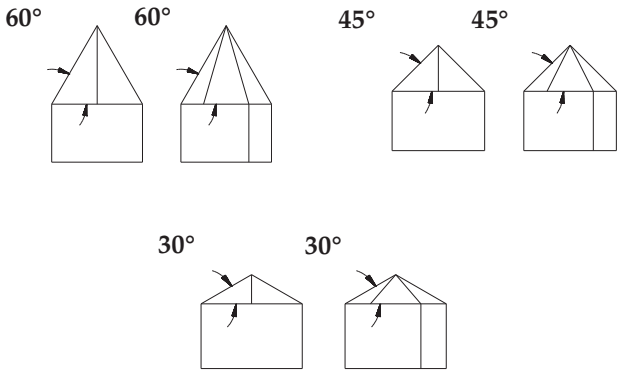
REEVING INCREASES LOADS



Reeving through connections to load increases load on connections fitting by as much as twice.

DO NOT REEVE!

TRIPLE AND QUAD LEG SLINGS

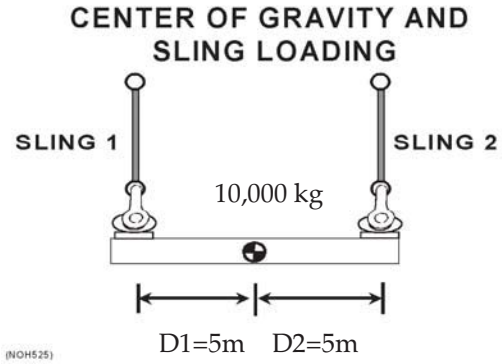


Triple leg slings have 50% more capacity than double leg only if the center of gravity is in center of connection point and the legs are adjusted properly. (equal share of the load)

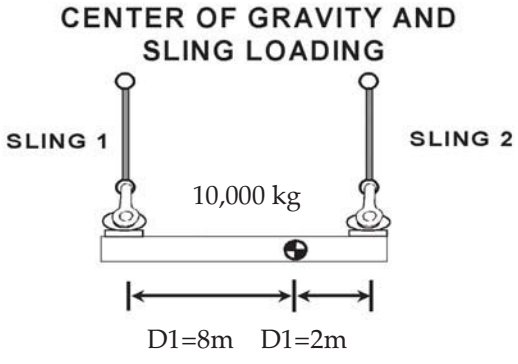
Quad leg slings offer improved stability but do not provide increased lifting capacity.

CENTER OF GRAVITY (COG)

The location of the center of Gravity to the pick points is an important consideration.



When lifting vertically, the load will be shared equally if the center of gravity is placed equally between the pick points. If the weight of load is 10,000 kg., then each sling will have a load of 5,000 kg. and each shackle and eyebolt will also have a load of 5,000 kg.



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

Sling 2 is closest to COG. It will have the greatest share of load.

Sling 2 = 10,000 x 8 / (8+2) = 8,000 kg

Sling 1 = 10,000 x 2 / (8+2) = 2,000 kg

Sling Inspection

INSPECTION AND REPLACEMENT PER ANSI B30.9

INSPECTION

All slings shall be visually inspected by the person handling the sling each day they are used. In addition , recorded periodic inspection must be done annually.

- Distortion of the rope in the sling such as kinking, crushing, unstranding, birdcaging, main strand displacement or core protrusion. Loss of rope diameter in short rope lengths or unevenness of outer strands should provide evidence the sling should be replaced.
- General corrosion.
- Broken or cut strands.
- Number, distribution, and type of visible broken wires.

REPLACEMENT

Condition such as the following should be sufficent reason for consideration of sling replacement.

- For strand laid and single part slings, ten randomly distributed broken wires in one rope lay, or five broken wires in one strand in one rope lay.
- Severe localized abrasion or scraping.
- Kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure.
- Evidence of heat damage.
- End attachments that are cracked, deformed, or worn to the extent that the strength of the sling is substantially affected.
- Hooks should be inspected in accordance with ANSI B30.10
- Severe corrosion of the rope or end attachments.

MULTI - PART REMOVAL CRITERIA FOR CABLE AND BRAIDED SLINGS

Sling Body	Allowable Broken Wire Per Lay or One Braid	Allow Broken Strands per Sling Lay
Less than 8 per Braid	20	1
Cable Laid	20	1
8 Parts and more	40	1