

USE AND CARE OF WIRE

Wire Ropes are mainly used in three ways:

- (a) Standing Ropes
- (b) Running Ropes
- (c) Slings

Although wire ropes will withstand a great deal of abuse, and often have to, a little care by the user will be amply repaid in longer rope life and reduced risk of accident.

Standing Ropes

The chief hazard with standing ropes (Guys, Stays, Standing Rigging, etc.) is corrosion and fatigue due to vibration. For this reason the coarsest possible constructions are used employing large wire sizes, e.g.

- 7 x 7 (6/1)
- 7 x 19 (12/6/1)
- 7 x 37 (18/12/6/1)

The choice of construction depends on the rope size and is dictated by the practical problems of manufacture and handling.

The most important place to inspect on a standing rope is the lowest point next to the end fitting. This is where moisture collects and where stresses due to vibration or shock loading are most likely to cause fatigue failure of the wires particularly when corrosion is also taking place.

Running Ropes

There are great advantages to be gained by the use of adequate pulley and drum tread diameters. Increased rope performance can be achieved if the recommended minimum ratios of *Pulley diameter/Rope diameter* of 19 to 24 (depending upon construction) can be increased. Equally important is the cross-sectional groove diameter which should be at least 5% greater than the nominal rope diameter. The fact that the groove diameter is slightly greater than the rope diameter allows the rope to take up its natural shape which is slightly elliptical as it passes round the pulley under load. If the groove diameter is inadequate the rope will be 'pinched' in the groove and early failure due to abrasion or fatigue can be anticipated.

After very long periods of service a worn rope which has 'pulled down' in diameter will wear its own groove in a pulley and can form diagonal grooves in the pulley tread corresponding to the rope lay.

If a pulley (or drum) becomes worn in this manner it is essential to re-machine the grooves before fitting a new rope, otherwise early failure will inevitably occur.

The easiest way to check the groove diameter is to make a round gauge equal to the nominal rope diameter plus 5%. The gauge should touch the bottom of the groove. If any 'daylight' is visible the groove should be re-machined.

When machining a pulley groove care should be taken that the bottom of the groove is a circular one over an angle of at least 120°. The depth of the groove should be at least 1.5 times the nominal rope diameter. The angle of flare between the sides of the groove should be 52°. The finish should be smooth and sharp corners should be removed.

Helical grooves in drums should be the same diameter as pulley grooves but the depth should be not less than 1/3 of the nominal rope diameter. The clearance between neighbouring turns of rope should be not less than:

- 1.6mm (1/16") for ropes up to 13mm (1/2") diameter
- 2.4mm (3/32") for ropes over 13mm (1/2") up to 28mm (1.1/8") diameter
- 3.2mm (1/8") for ropes over 28mm (1.1/8") up to 38mm (1.1/2") diameter

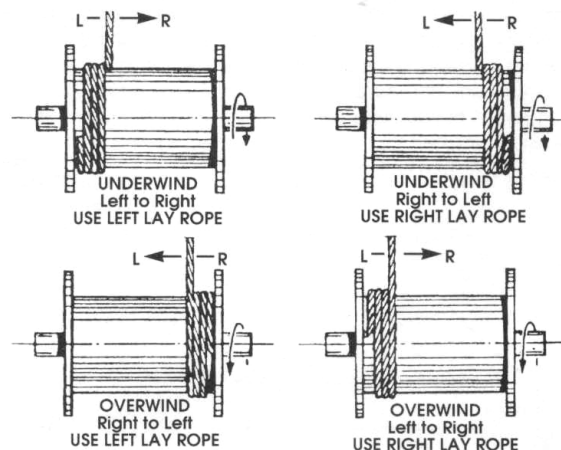
Where multi-layer winding on a drum is unavoidable Lebus Grooving should be considered. This type of grooving, although expensive to install, does overcome many of the problems associated with multi-layer winding.

Correct Spooling of Rope on Drum

(One layer winding)

To determine the correct direction of rope lay for spooling or winding on flat or smooth faced drums, the following diagrams and details will be helpful.

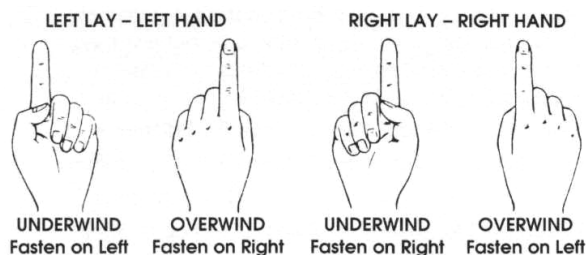
The lay of wire rope (right or left) must be related to its application to the drum, and direction of winding. When wound on a drum, the tendency of a rope to twist when released from tension will always be in the direction that would untwist the rope at its free end.



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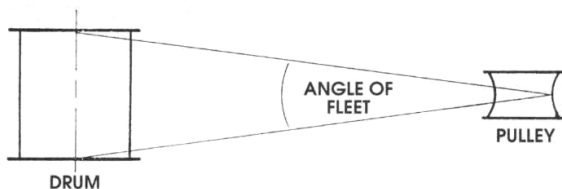
When a rope of proper direction is spooled the several coils on the drum will hug together and maintain an even layer when the load is slackened off. With rope of improper lay the coils will spread apart at each removal of the load. With the resumption of winding the rope may criss-cross and overlap the drum, resulting in the flattening and crushing of the rope.

Easy way to remember how to wind wire rope on to a drum



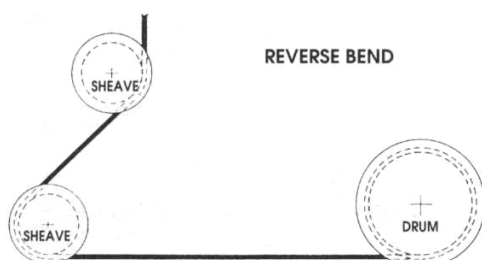
Angle of Fleet

It is recommended that for grooved drums the maximum angle of fleet should not exceed $2\frac{1}{2}^{\circ}$ and for plain drums should not exceed $1\frac{1}{2}^{\circ}$.



Reverse Bends

The most practical system of rope reeving is to employ the least number of changes in direction as possible and without reverse bends; Reverse bends quickly wear out a rope and should be avoided wherever possible; if this cannot be avoided the sheaves should be as large as possible; one third to one half larger than the others is suggested. In addition they should be as widely spaced as possible. Sheaves should also be larger where many changes in rope direction are required.



Storage

Until required, steel wire ropes should be stored in a clean, dry place, preferably under cover, free from damp and rain and away from boilers or escaping steam. Ropes, except when on reels, should be raised from the ground on planks, and coils should be coated with protective grease and covered with sacking. Periodical inspection and renewal of anti-corrosive grease is desirable.

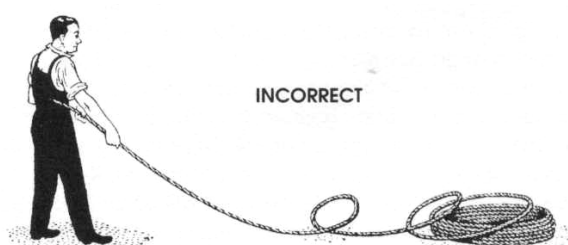
Handling and Uncoiling

Steel wire ropes are usually supplied in coils or on reels. Correct handling and uncoiling, particularly of Lang's lay rope, is of the utmost importance if damage by kinking and untwisting is to be avoided.

For unwinding small coils it is advisable to select a dry clean floor free from abrasive dust and near to the place of installation. The coil should then be stood on edge, the bands cut, and the rope carefully rolled out until it is completely uncoiled. Kinks will inevitably result if small coils are laid flat on the ground before drawing out or if turns of rope are thrown off the coil lying on the ground.

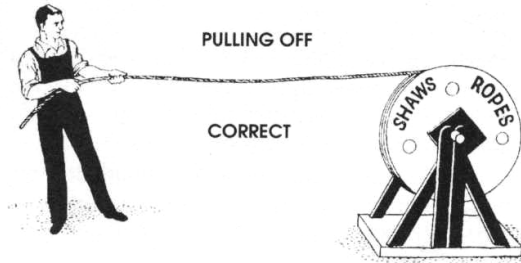


Correct and incorrect method of uncoiling small coils.

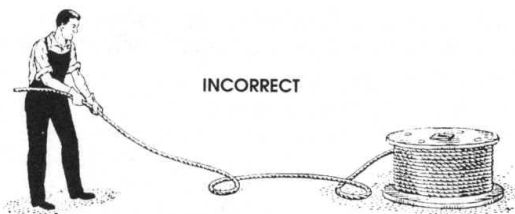


Wire rope on reels should be mounted on a spindle, preferably with horizontal axis, and the rope wound off by revolving the reel under control.

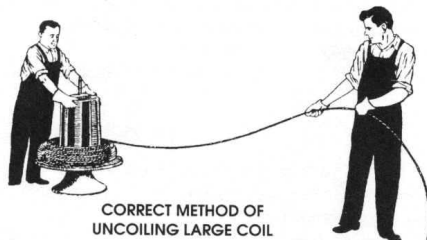
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Correct and incorrect method of uncoiling rope on reels

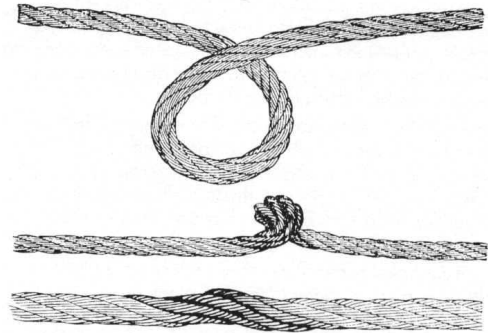


A large coil should be placed flat on its side on a revolving turntable having a brake or other means of control. Suitable battens should be lashed on top of the coil before the bands which hold the coil in shape are cut. This will prevent the rope from springing off before the turntable is revolved.



Kinks

Possibly the most common form of damage to a wire rope due to improper handling is the formation of a kink. A kink starts with the formation of a loop as illustrated and although it can be formed in a rope in service, it is usually encountered during the handling of a rope prior to its operation.



A loop which has not been drawn tight enough can easily be removed by turning the rope in the correct direction to restore the lay. If the loop is pulled up tightly, the rope is irreparably damaged; a severe distortion results, and at the particular spot the individual wires are never again in their proper relative positions.

Normal service can never be depended upon after a rope has been kinked. Abrasion and fatigue usually develop rapidly, and owing to distortion, undetected damage can sometimes lead to dangerous situations.

Lubrication

Correct lubrication of wire ropes is essential if the ropes are to give satisfactory service. Good lubrication not only prolongs the life of the rope but helps to reduce friction and preserves the internal parts.

All ropes are lubricated internally and nearly all externally during manufacture but care should be taken to see that an approved neutral lubrication is externally applied at frequent intervals, during use and whilst not in use if practicable.

Thinner types of lubricant have the best lubricant qualities but if the rope is constantly exposed to the elements or to water, the heavy, thicker lubricants are more suitable. To particularise, it may be said that for conditions which cause corrosion, such as dredging and wet mine shafts, a heavy lubricant gives the best protection. For cranes, derricks, conveyors etc., which have only the elements to contend with, medium lubricants are suggested.

The ropes on installations which operate indoors such as lifts and shop cranes, are not so subject to corrosion and thinner lubricants can be applied.

Wire ropes should be clean and dry before lubricants are applied (paraffin is not recommended as a means of cleaning Ropes). Heavy and medium types of lubricant must be heated before application to ensure maximum penetration.

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Wear, fatigue and necessary inspection

It is obvious that the strength of a wire rope is continually being reduced during service owing to the action of abrasion, bending, corrosion and other factors. Inspection is necessary at periodic intervals and the observer must keep in mind the fact that the safety of the rope depends upon its strength as it nears the time for removal.

Rope installations vary so much that it is not the intention here to advise the inspector on the best method of ascertaining the remaining strength of any rope, but rather to assist him by providing information which can be added to ultimate break tests on worn ropes and other details in order to build up definite data for each particular installation.

The most practical method is to observe any marked reduction in the diameter of the rope, indications of excessive abrasion on the outside wires, and broken outside wires. Usually reduction in diameter is due to external wear or corrosion, but occasionally, due to lack of lubrication, the inside wires and core may be damaged, and when such internal deterioration exists the rope must be considered to be in a serious and dangerous condition. It follows that any marked reduction in rope diameter must be fully investigated and its cause definitely determined.

When corrosion is present, the remaining strength of a rope cannot be calculated with safety. This being the case it is essential that corrosion must at all times be controlled by correct and sufficient lubrication.

It is usually the number of broken wires developing in a wire rope which causes its removal from service. By examining the most worn rope lay for abrasion and broken wires, sufficient information should be available to calculate the effective remaining area.

It is recommended that this publication be read in conjunction with British Standard 12385 Part 3 Steel wire ropes—Safety—Information for use and maintenance and ISO 4309—Cranes—Wire ropes—Care and maintenance, Inspection and discard.

HEAD OFFICE:

BRUNTON SHAW UK
SANDY LANE
WORKSOP
NOTTS
S80 3ES

Tel: 01909 537600
Fax: 01909 500199
E-Mail: info@brunton-shaw.co.uk
Web: <http://www.brunton-shaw.co.uk>