

WIRE ROPE INSTALLATION GUIDE FOR MOBILE CRANES

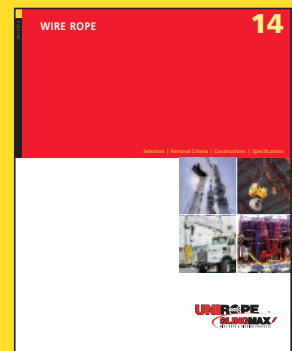




60 years have passed since Unirope® was first incorporated in 1956 as WDI Wire Rope of Canada Limited. From small humble beginnings to today's three modern facilities with over 100,000 sqft we've come a long way since.

Over the past decades Unirope® has become one of the prime wire rope distributors and rigging supply companies in Canada serving the manufacturing-, automotive-, construction-, entertainment-, marine-, steel-, utility-, and power generation industries.

Our testing equipment is certified by Lloyd's Register of Shipping and calibrated to ASTM E99. Where applicable, our ropes meet international performance standards, including CSA, EN, ISO, ASTM, RR-W-410



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Use and Care of Wire Rope

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

What follows is a brief outline of the basic information required to safely use wire rope

1. Wire rope WILL FAIL IF WORN OUT, OVERLOADED, MISUSED, DAMAGED, or IMPROPERLY MAINTAINED.
2. In service, wire rope loses strength and work capability. Abuse and misuse increase the rate of loss.
3. The MINIMUM BREAKING STRENGTH of wire rope applies ONLY to a NEW, UNUSED rope.
4. The Minimum Breaking Strength should be considered the straight line pull with both rope ends fixed to prevent rotation, which will ACTUALLY BREAK a new, UNUSED, rope. The Minimum Breaking Strength of a rope should NEVER BE USED AS ITS WORKING LOAD.
5. To determine the working load of a wire rope, the MINIMUM or NOMINAL Breaking Strength MUST BE REDUCED by a DESIGN FACTOR (formerly called a Safety Factor). The Design Factor will vary depending upon the type of machine and installation, and the work performed. YOU must determine the applicable Design Factor for your use.
8. NEVER 'SHOCK LOAD' a wire rope. A sudden application of force or load can cause both visible external damage (e.g. birdcaging) and internal damage. There is no practical way to estimate the force applied by shock loading a rope. The sudden release of a load can also damage a wire rope.
9. Lubricant is applied to the wires and strands of a wire rope when manufactured. This lubricant is depleted when the rope is in service and should be replaced periodically.
10. Regular, periodic INSPECTIONS of the wire rope, and keeping of PERMANENT RECORDS SIGNED BY A QUALIFIED PERSON, are required by OSHA and other regulatory bodies for almost every rope installation. The purpose of inspection is to determine whether or not a wire rope may continue to be safely used on that application. Inspection criteria, including number and location of broken wires, wear and elongation, have been established by DIN, ISO, CEN, OSHA, ANSI, ASME and other organizations.

IF IN DOUBT, REPLACE THE ROPE.

- For example, a Design Factor of "5" means that the Minimum- or Nominal Breaking Strength of the wire rope must be DIVIDED BY FIVE to determine the maximum load that can be applied to the rope system.
- Design Factors have been established by DIN, ISO, CEN, OSHA, ANSI, ASME and similar government and industrial organizations.
- No wire rope should ever be installed or used without full knowledge and consideration of the Design Factor for the application.
6. WIRE ROPE WEAR OUT. The strength of a wire rope slightly increases after the break in period, but will decrease over time. When approaching the finite fatigue life span the breaking strength will sharply decrease. Never evaluate the remaining fatigue life of a wire rope by testing a portion of a rope to destruction only. An indepth rope inspection must be part of such evaluations.
 7. NEVER overload a wire rope. This means NEVER use the rope where the load applied is greater than the working load determined by dividing the Minimum Breaking Strength of the rope by the appropriate Design Factor.
 11. When a wire rope has been removed from service because it is no longer suitable, IT MUST NOT BE RE-USED ON ANOTHER APPLICATION.
 12. Every wire rope user should be aware of the fact that each type of fitting attached to a wire rope has a specific efficiency rating which can reduce the working load of a rope assembly or rope system, and this must be given due consideration in determining the capacity of a wire rope system.
 13. Some conditions that can lead to problems in a wire rope system include:
 - Sheaves that are too small, worn or corrugated can cause damage to wire rope.
 - Broken wires mean a loss of strength.
 - Kinks permanently damage a wire rope.
 - Environmental factors such as corrosive conditions and heat can damage a wire rope.
 - Lack of lubrication can significantly shorten the useful service life of a wire rope
 - Contact with electrical wire and the resulting arcing will damage a wire rope

Installation of Wire Rope

Foreword

In order to fully achieve the service life potential of Python™ and standard wire rope for demanding crane jobs these step by step instructions should be followed. They are intended to prevent rope damage caused by kinks, untwisting, and loose strands, during handling and installation.

We realize that the 'real world' is not perfect. This applies also to wire rope installation. It is impossible to

cover ALL imaginable installation situations, location difficulties, and crane set ups. You will also find that these instructions are not very different from the installation procedure of 6-strand or 19x7 ropes. Many experienced Riggers may find some of the following "old hat". If you notice any omissions or have ideas that we can incorporate into this brochure we will be most appreciative.

For a complete version of our Inspection-, Handling-, Installation-, and Instruction Guide please e-mail us at info@unirope.com

Usually, you do not need to re-cut a wire rope. However, you may encounter situations where it becomes necessary to shorten the rope.

In cutting any wire rope special care **MUST** be taken in seizing the rope end.

Two methods are suggested:

- 1) Seizing the rope end with soft iron wire.
- 2) Seizing the rope end with hose clamps.

If you have to field cut a rope

After cutting the rope it is good practice to braze or weld the rope ends to ensure that they don't unravel. Leave the seizing on the rope for added holding strength. Be careful not to damage the seizing while brazing.

Cutting a rope with a torch may result in both uneven ends and damage to the seizing causing the strands to open up.

Rope diameter up to 14 mm (9/16") may be cut with a FELCO C16 hand cutter.



After attaching 3 hose clamps on either side of the cut mark, blade cut the rope.



Do not use a grinding wheel but a steel cutting blade; e.g. Elastic # 80EHT230-2.



After blade cutting mount upright in a vice



Carefully melt and fuse together all individual wires.



Properly fused wire rope end. If not damaged during the fusing procedure clamps shall be left attached to the rope.



If hose clamps got damaged or are too bulky for the installation you need to replace all 3 of them with a wire seizing.



In comparison, these are factory fused and tapered ends done with a specialized machine.

Unreeling of Wire Rope

When removing the rope from the shipping reel or coil, the reel or coil **MUST** rotate as the rope unwinds. Any attempt to unwind a rope from stationary reel or coil **WILL** result in a kinked rope that is ruined beyond repair.

The following illustrations demonstrate the right and wrong way of unreeling a rope.

Special care must be taken **not** to drag the rope over obstacles, over a deflection shaft, or around corners.

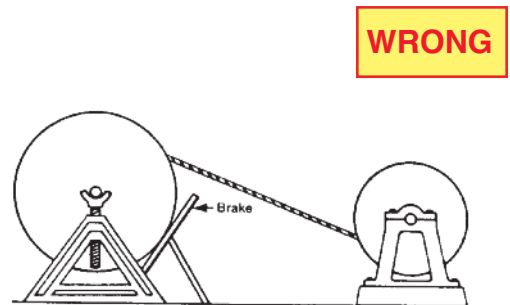
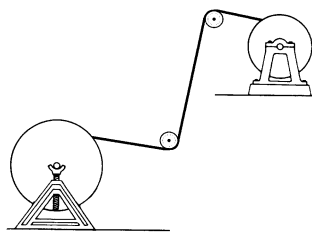
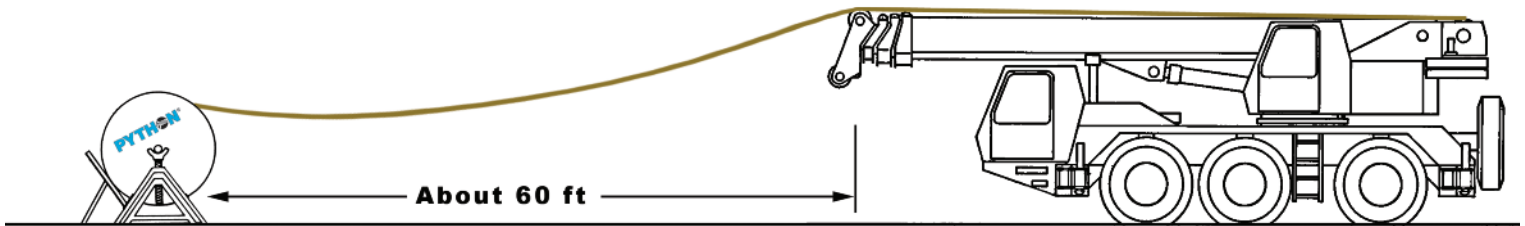
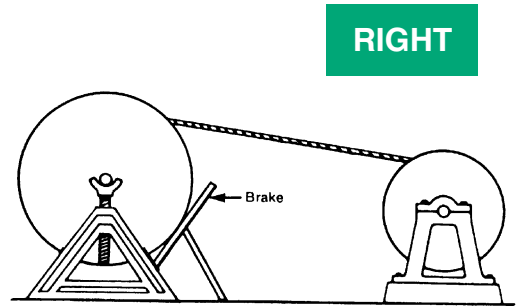
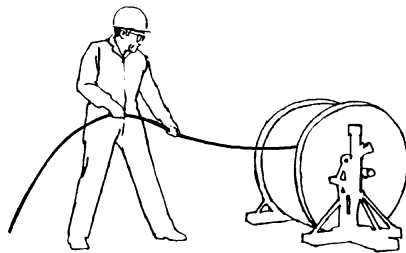
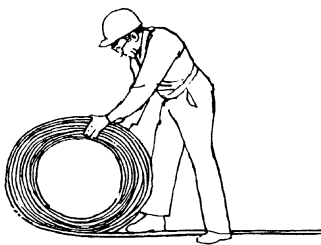
Avoid large fleet angles between the shipping reel and the first sheave. The rope may roll in the sheave causing the rope to unlay. This is particularly important for all DoPar-, langs lay, and non-rotating rope constructions.

Avoid reeving the rope through small deflection sheaves and avoid changing the plane from vertical to horizontal direction.

If you have to unspool large and heavy wire rope, use a brake to keep a slight tension on the rope. **NEVER** let the rope go slack and form loops.

All of these precautions apply to Python® as well as to standard 6-strand-, 19x7, 19x19, and 34x7 wire ropes.

If in doubt, contact your nearest Unirote® representative.



Measuring the rope diameter

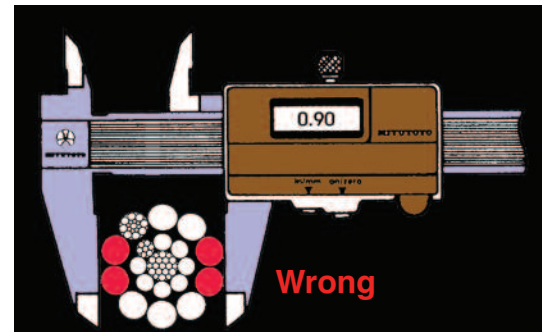
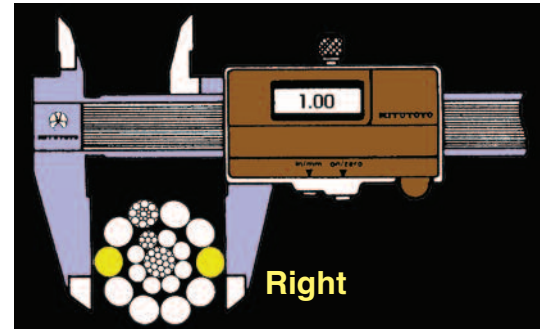
Before you start anything, make sure the diameter of the new rope you are about to install is the correct one for your crane.

Remember that most wire ropes measure slightly over their nominal diameter. Wire rope is allowed to measure up to 5% over it's nominal diameter however, some drum systems (e.g. Lebus) require a tighter tolerance (see below).

Keep a record of the new rope diameter for future references. You will be asked to determine how much the rope diameter has decreased in service and you MUST know the ACTUAL diameter of the wire rope after the break in period.

When measuring the rope, don't measure the layer on the reel. Pull a couple of feet off the reel and measure the rope when straight. It is advisable to take 4 measurements of the rope round it's axis and average the results.

If the rope is used on multiple layer drums with a 'Lebus' or 'parallel' lagging system the rope diameter should have an oversize tolerance of between 2% and 3%.



Use of Cable Grips

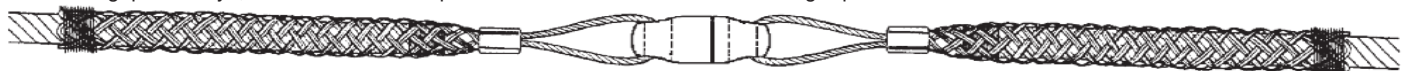
The most common method to install a wire rope. The type of cable grip depends on the rope type and construction.

Non-rotating rope should be installed with a swivel between old and new ropes. The old rope may have developed torque during it's working life and we must ensure that this torque is not transferred to the new rope.



When using cable grips, the end of the grips have to be tightly seized on to the rope body to prevent accidental slip-out of the rope. Alternately, you may wrap the grip end with a strong reinforced industrial strength adhesive tape.

Two cable grips with eye, connected to two ropes with a swivel. Use with non-rotating rope.



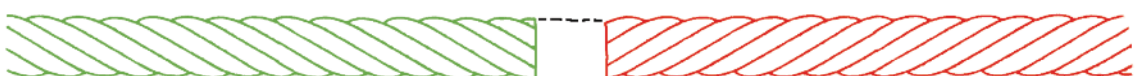
Two cable grips with eye, connected to two ropes with a suitable length of fiber rope or a rope sling.



Open-end cable grip connected to two ropes. Most common for light ropes.



NEVER attach a RIGHT hand lay rope to a LEFT hand lay rope



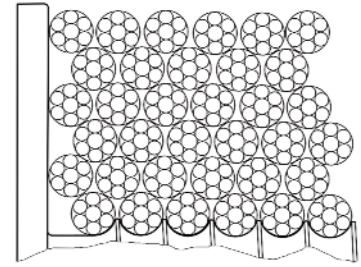
Winding the Rope onto the Drum

Today, nearly all mobile cranes spool the rope in multiple layers onto a grooved drum. After installation it is very important to apply a sufficient pre-tension (5-10% of the rope's WLL is a good measure). If wound with no tension at all, the rope is subjected to premature crushing and flattening caused by the 'under load' top layers.

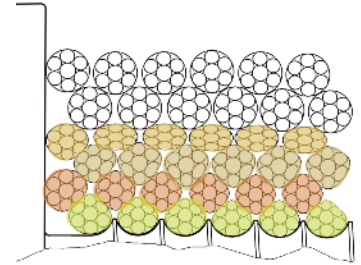
If the first layer, or layers, are only used from time to time, they will lose their tension on the drum and start to flatten out due to the high pressures of the loaded layers. Repeat this pre-tensioning procedure regularly.

Whatever you do, **DO NOT** run the rope through a 'tightening' device (see picture), e.g. two wooden blocks clamped together. **YOU WILL DESTROY THE ROPE !**

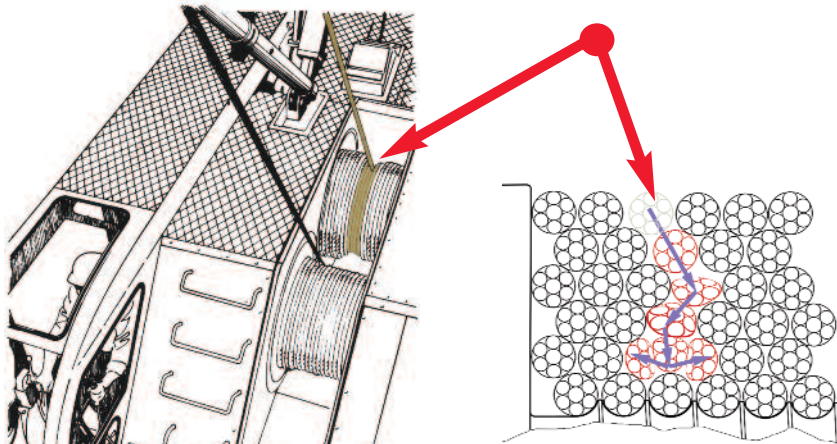
Note: If your crane does have a 'smooth-' or 'flat' faced drum please ask for our detailed instructions.



Rope is installed with proper pre-tension onto the drum. All layers are 'hard' wound and retain their round shape.



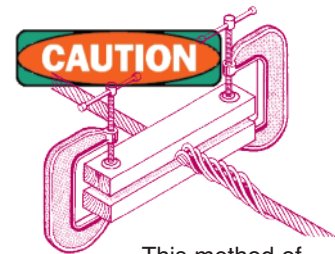
The first 4 layers have lost their tension and begin to deform and get crushed by the 'hard' wound top layers. Regular pre-tensioning of ALL layers will minimize the crushing effect.



The rope has 'pulled-in' between the lower wraps. Most often this happens when a 'slack' line was spooled and the next 'heavy' lift was spooled on top of such 'slack' wraps.

The lower layers have collapsed, got pushed sideways allowing the upper wraps to fill this gap ... the rope has 'pulled-in'.

Proper rope pre-tensioning between light- and heavy lifts will minimize such spooling problems.



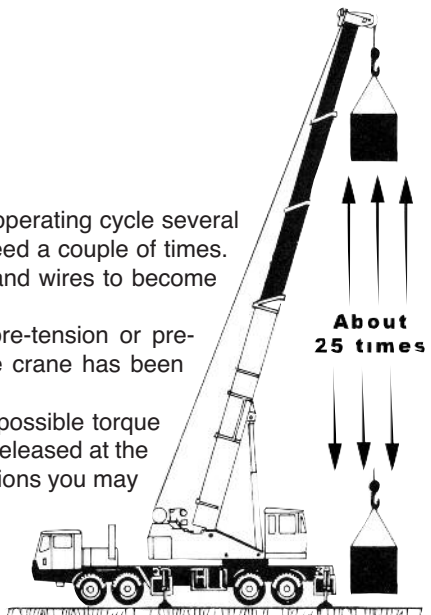
This method of tightening the rope on to the drum **WILL** destroy the rope.

Break-in Period Tensioning Rope Windings

After installing the rope and with the boom fully extended run the rope through its operating cycle several times under light load and at reduced speed. Repeat this with increasing load and speed a couple of times. This allows the rope to adjust itself to the working conditions and enable all strands and wires to become seated.

Make sure you unspool the entire rope length down to the 3 safety wraps to pre-tension or pre-tensioning the rope to 5-10% of the rope's WLL. This may also be required after the crane has been working using only a portion of the rope length.

Ideally, you should disconnect the rope end after the break-in-period to allow any possible torque and twists which may have developed during installation and the break-in-period to be released at the end connection. When using non-rotating Python® Compac 35, Lift-, or Hoist constructions you may want to install a swivel between the rope end connection and the crane.



There are several reasons why a sheave block starts to rotate around itself.

- a: Odd-part reeving is much less stable than even part reeving; e.g. a 3-part line reeve is less stable than a 4-part line reeve.
- b: During rope installation torque or twist was introduced into the rope.
- c: For the lifting height the chosen rope type is not rotation resistant enough.
- d: Sheaves which are too tight and/or fleet angles are too large.

Block Rotation



Relieving the rope twist when using non-rotating Python® wire rope:

Method A)

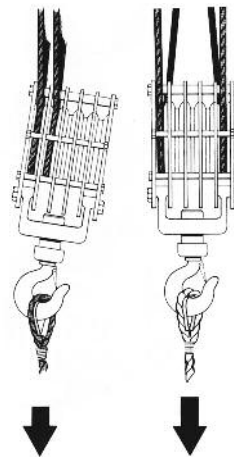
Disconnect the rope end and rotate the rope end in the OPPOSITE direction of the block twist. If the block twisted 1/2 revolution (as in the illustration) rotate the rope end 180°. If the block twisted 3 full revolutions rotate the rope end 3 times around itself. Re-attach the rope end and run the rope (with no load attached) through the entire reeving to distribute the counter-turns.

Method B)

If you use Python® Compac 35, Lift-, or Hoist constructions you can install a swivel between the rope end fitting and the crane boom. A swivel will aid in relieving any possible twist. Once the twist is taken out of the rope you may lock the swivel, remove it entirely, or leave it permanently installed.

Block Tilting

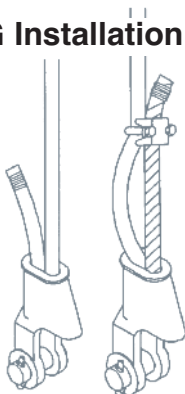
Block tilting results in increased rope fleet angle causing rope rotation and thus block twisting; aside from severe sheave wear. Multipart lines should be reeved symmetrically to avoid tilting.



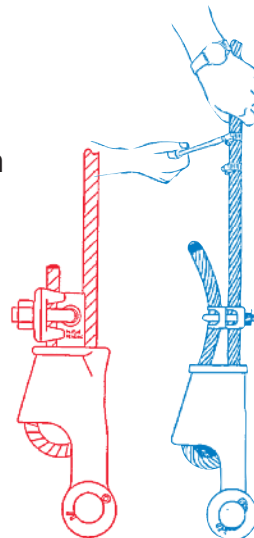
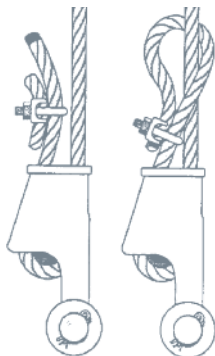
Wedge Socket Installation

Make sure the LOAD end of the rope is installed in line with the pin; that is the STRAIGHT portion of the socket bowl. The 'Terminator' style wedge socket (red) is a preferred method.

WRONG Installation



RIGHT Installation



Non-Rotating Ropes

Attach hose clamp to all rotation-resistant and non-rotating wire rope to prevent any slack caused by the socket installation of outer- or inner strands from travelling along the entire rope length