

WIRE ROPE

OVERVIEW

Strength of wire ropes vary, depending on the material from which the individual strands are made and the method used in forming the cable, ranging between 30 and 100 tons per square inch. Primarily there are 3 classes of wire rope:

- (1) **Iron** – Iron wire is soft with low tensile strength of 30 to 40 tons per square inch. Commonly used for drum type elevator cables and to some extent for derrick guys; being replaced by low-carbon steel wire in these uses.
- (2) **Cast Steel** – May have a tensile strength up to 90 tons per square inch and because of its greater strength is generally used for hoisting purposes. To check quickly whether a piece of wire is iron or cast steel, bend it. Iron will bend easily and take a long time to regain its original shape, while cast steel will be harder to bend and will snap back to its original shape very quickly.
- (3) **Plow Steel** - Plow steel wire rope is made from high grade, open hearth furnace steel and has an average tensile strength of 110 tons per square inch. This is the best and safest wire rope for cranes, derricks, dredges and slings or straps for heavy loads.

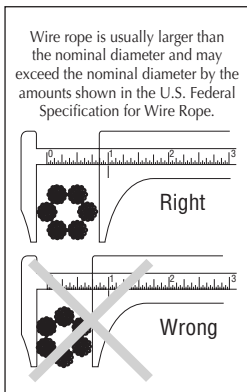
LUBRICATION — WIRE ROPE

All wire rope, whether used indoors or out, should be considered as a group of moving wires constantly rubbing against one another. The resulting friction causes incessant wear on the moving parts of the wire rope or cable and will shorten its life very rapidly unless lubricants are used to overcome the friction. Lubrication also prevents rusting.

Lubricating intervals will depend on the types and amount of work encountered. Under average conditions, if worked steadily on equipment, wire rope or cable will require lubrication once every 3 weeks. Where heavy abrasive dusts exist, more frequent lubrication is in order. Rusty ropes may break without warning.

SHEAVES

The life of wire rope or cable is directly affected by the condition and size of the sheaves over which it is used. Sheaves should be at least 16 x the diameter of the rope or cable that is used over them. In passing over a sheave, the inside portion of the cable, which is against the sheave, is shortened and compression is developed in that section of the cable. The outside portion (away from the sheave) is lengthened or stretched, causing tension in that section. These compressive and tensional stresses combine to create bending



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stresses which increase rapidly as the diameter of the sheaves decrease. As these bending stresses cause much undue wear and directly shorten the safe working life of the rope or cable, the ratio mention between sheaves and rope should be maintained.

New wire rope may be damaged and not work properly in sheaves that have become worn or in which the grooves have become irregular in shape. When sheaves are worn or damaged, it is more economical to renew the sheaves rather than to allow excessive wear on the cable.

One cause of very severe wear in wire rope or cables is reverse bending, which will shorten the life of the rope by approximately 1/2. Reverse bending refers to the bending of a cable or rope over sheaves, first in one direction then in another.

Another cause of severe rope wear is twisting of the fall rope. When the fall rope is twisted and a hoist is made, the wear produced is equal to more than that resulting from weeks of normal use. The person in charge of lifting operations should guard against twisting of the fall rope and should not allow a lift to be made if the fall rope is twisted.

No. of Crosby or Safety Clips & Dist. Between Clips Needed for Safety		
Rope Dia. Inches	No. of Clips	Dist. Between Clips, Inches
1/4 - 3/8	3	2 1/4
7/16 - 5/8	3	3 3/4
3/4 - 1 1/8	4	6 3/4
1 1/4 - 1 1/2	5	9
1 5/8 - 1 3/4	6	10 1/2
2 and over	7	6 x diam. of cable

HANDLING CABLE OR WIRE ROPE

Cable or wire rope must not be coiled or uncoiled like manila rope. Cable or wire rope must be taken off the reel in a straight line, avoiding kinking. The reel may be mounted on a heavy pipe or roller to facilitate unwinding. If space is limited, the cable as it comes off the reel may be layed out in a figure 8, after which it can be reeved into the line for which it is intended.

CLAMP FASTENINGS

When it is necessary to make a short bend. as in attaching wire rope or when it is to be looped. thimbles should always be used.

In clamping a strap or an eye, the loose or “dead” end is clamped against the main part of the rope with the damp spaced apart a distance equal to 6 x diameter of the rope. Clamp fastenings seldom develop more than 4/5 of rope strength at best.

The point of greatest fatigue and/or wear in a rope usually develops at or near the end where it is clamped around the boom or where attached to the becket on the block. Clamps should be inspected at least once weekly and tightened if they show signs of loosening. All clamped or spliced fastenings, especially those on cranes or derricks, should be shifted and changed at least once every six months.

U BOLTS OF ALL CLAMPS MUST BE ON THE DEAD END OF THE ROPE.

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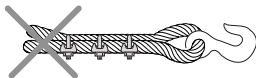


CORRECT - U-Bolts on short end of rope. (No distortion on live end of rope.)



CORRECT

INCORRECT - Thimble should be used to increase strength of eye and reduce wear on rope.



INCORRECT - U-Bolts on live end of rope. (Causes mashed spots on live end of rope.)



INCORRECT - Staggered clips. (Causes a mashed spot in live end of rope due to incorrect position of center clip.)



INCORRECT - Wire rope knot with clip efficiency 50% or less



SAFE LOAD (IN POUNDS) ON IMPROVED PLOW STEEL WIRE ROPE
(6 Strands, 19 or 37 Wires per Strand, Hempcore)

Dia. In.	Circum. In.	Single Vertical Wire rope	TWO PART SLING			Breaking Strength	
			60°	45°	30°	Wt./Ft. Lbs. (2000 lbs)	Tons
1/4	3/4	1,100	1,900	1,550	1,100	0.10	2.74
3/8	1 1/8	2,500	4,230	3,460	2,450	0.23	6.1
1/2	1 1/2	4,300	7,450	6,080	4,300	0.40	10.7
5/8	2	6,600	11,600	9,430	6,670	0.63	16.7
3/4	2 1/4	9,400	16,500	13,450	9,520	0.90	23.8
7/8	2 3/4	12,800	22,300	18,200	12,800	1.23	32.2
1	3	16,000	29,000	23,690	16,790	1.60	41.8
1 1/8	3 1/2	21,000	36,450	29,780	21,040	2.03	52.6
1 1/4	4	26,000	44,700	36,570	25,870	2.50	64.6
1 3/8	4 1/4	31,000	53,800	43,900	31,050	3.03	77.7
1 1/2	4 3/4	37,000	63,700	52,000	36,800	3.60	92.0
1 5/8	5	43,000	74,400	60,700	42,900	4.23	107.0
1 3/4	5 1/2	49,600	86,000	70,260	49,700	4.90	124.0
2	6 1/4	64,000	110,700	90,400	64,000	6.40	160.0
2 1/8	6 5/8	63,000	125,200	102,200	72,200	7.22	181.0
2 1/4	7 1/8	81,000	140,300	114,600	79,000	8.10	202.0
2 1/2	7 7/8	98,000	170,000	139,100	98,400	10.00	246.0
2 3/4	8 5/8	117,600	203,500	166,700	117,700	12.10	294.0