IMPORTANT WARNINGS

READ ALL WARNINGS BEFORE USING THIS PUBLICATION
Failure to follow warnings and instructions may result in serious injury or death.

Working Load Limit

This is the term used throughout the catalog. There are, however, other terms used in the industry which are interchangeable with the term Working Load Limit. These are: WLL, SWL, Safe Working Load, Rated Load Value, Resulting Safe Working Load, and Rated Capacity.

Never exceed the Working Load Limit.

The Working Load Limit is the maximum load which should ever be applied to a product, even when the product is new and when the load is uniformly applied - straight line pull only. **Avoid side loading.** All catalog ratings are based upon usual environmental conditions, and consideration must be given to unusual conditions such as extreme high or low temperatures, chemical solutions or vapors, prolonged immersion in salt water, etc. Such conditions or high-risk applications may necessitate reducing the Working Load Limit.

Working Load Limit will not apply if product has been welded or otherwise modified.

Matching of Components

Components must match. Make certain that components such as hooks, links or shackles, etc. used with wire rope (or chain or cordage) are of suitable material size and strength to provide adequate safety protection. Attachments must be properly installed and must have a Working Load Limit at least equal to the product with which they are used. Remember: Any chain is only as strong as its weakest link.

Raised Loads

Keep out from under a raised load.

Take notice of the recommendation from the Safety Council Accident Prevention Manual concerning all lifting operations:

"All employees working at cranes or hoists or assisting in hooking or arranging a load should be instructed to **keep out from under the load**. From a safety standpoint, one factor is paramount:
Conduct all lifting operations in such a manner, that if there were an equipment failure, no personnel would be injured. This means **keep out from under a raised load and keep out of the line of force of any load."**

Do not operate a load over people. Do not ride on loads.

Shock Loads

Avoid impacting, jerking or swinging of load as the Working Load Limit could be exceeded and the Working Load Limit will not apply. A shock load is generally significantly greater than the static load. **Avoid shock loads.**

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Regular Inspections

Inspect products regularly for visible damage, cracks, wear, elongation, rust, etc. **Protect all products from corrosion.** The need for periodic inspections cannot be overemphasized. **No product can keep operating at its rated capacity indefinitely.** Periodic inspections help determine when to replace a product and reduce rigging hazards. **Keep inspection records** to help pinpoint problems and to ensure periodic inspection intervals.

Due to the diversity of the products involved and uses to which they can be put, it would be counterproductive to make blanket recommendations for inspection procedures and frequency. Best results will be achieved when qualified personnel base their decisions on information from rigging and engineering manuals and on experience from actual use in the field. **Refer to sources listed in T.O.C. > ADDITIONAL REFERENCE MATERIAL > TECHNICAL SAFETY AND INFORMATION SOURCES for technical literature.**

Frequency of inspection will depend on environmental conditions, application, storage of product prior to use, frequency of use, etc. **When in doubt, inspect products prior to each use.** Carefully check each item for wear, deformation, cracks or elongation - a sure sign of imminent failure. Immediately withdraw such items from service.

Rust damage is another potential hazard. When in doubt about the extent of corrosion or other damage, withdraw the items from service.

Destroy, rather than discard, items that have been judged defective. They might be used again by someone not aware of the hazard involved.

Additional warnings and information on wire rope, chain, cordage, blocks and tools can be found in the Table of Contents by clicking on the warning symbol icon (⚠). These should be read and understood thoroughly before using a particular item.

DEFINITIONS

Information contained in this catalog is subject to change; all weights and dimensions are approximate. Ratings are stated in short tons (2,000lbs.) or pounds. All dimensions are in inches; all weights are in pounds, unless stated otherwise.

Working Load Limit (WLL)

The Working Load Limit is the maximum load which should ever be applied to the product, even when the product is new and when the load is uniformly applied - straight line pull only. **Avoid side loading.** All catalog ratings are based upon usual environmental conditions and consideration must be given to unusual conditions such as extreme high or low temperatures, chemical solutions or vapors, prolonged immersion in salt water, etc. **Never** exceed the Working Load Limit.

Proof Test Load (Proof Load)

The term "Proof Test" designates a quality control test applied to the product for the sole purpose of detecting defects in material or manufacture. The Proof Test Load (usually twice the Working Load Limit) is the load which the product withstood without deformation when new and under laboratory test conditions. A constantly increasing force is applied in direct line to the product at a uniform rate of speed on a standard pull testing machine. The Proof Test Load does not mean the Working Load Limit should ever be exceeded.

Breaking Strength/Ultimate Strength

Do not use breaking strength as a criterion for service or design purposes. Refer to the Working Load Limit instead.

Breaking Strength is the average force at which the product, in the condition it would leave the factory, has been found by representative testing to break, when a constantly increasing force is applied in direct line to the product at a uniform rate of speed on a standard pull testing machine. Proof testing to twice the Working Load Limit does not apply to hand-spliced slings.
Remember: Breaking Strengths, when published, were obtained under controlled laboratory conditions.
Listing of the Breaking Strength does not mean the Working Load Limit should ever be exceeded.

Design Factor (sometimes referred to as safety factor)

An industry term usually computed by dividing the catalog Breaking Strength by the catalog Working Load Limit and generally expressed as a ratio. For example: 5 to 1.

Shock Load

A load resulting from rapid change of movement, such as impacting, jerking or swinging of a static load. Sudden release of tension is another form of shock loading. Shock loads are generally significantly greater than static loads. Any shock loading must be considered when selecting the item for use in a system.
Avoid shock loads as they may exceed the Working Load Limit.

IMPORTANT WARNINGS

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WIRE ROPE IS A MACHINE. Understand and respect it.

Like any machine, it needs proper care and maintenance for optimal safety and long service life. For a better understanding of wire rope we highly recommend the Wire Rope Users Manual by the Wire Rope Technical Board. Wire Rope Technical Board 801 North Fairfax Street, Suite 211, Alexandria VA 22314-1757.
Phone: (703) 299-8550 Fax:(703) 299-9253.

Refer to T.O.C. > GENERAL WARNINGS.

These warnings also apply to wire rope. Only **additional** warnings and information are listed below.

Rated Capacity.

Rated capacity is the load which a new wire rope may handle under given operating conditions and at assumed design factor. A design factor of 5 is chosen most frequently for wire rope. (Operating loads not to exceed 20% of catalog Breaking Strength.) Operating loads may have to be reduced when life, limb or valuable property are at risk or other than new rope is used. A design factor of 10 is usually chosen when wire rope is used to carry personnel. (Operating loads not to exceed 10% of catalog Breaking Strength.)
Responsibility for choosing a design factor rests with the user.

Attachments must have at least the same Working Load Limit as the wire rope used.

Clips, sockets, thimbles, sleeves, hooks, links, shackles, sheaves, blocks, etc. must match in size, material and strength to provide adequate safety protection.
Proper installation is crucial for maximum efficiency and safety.

Keep out from under a raised load.

Do not operate load over people. Do not ride on load. Conduct all lifting operations in such a manner that if equipment were to fail or break, no personnel would be injured. This means: **KEEP OUT FROM UNDER A RAISED LOAD, DO NOT OPERATE LOADS OVER PEOPLE AND KEEP OUT OF THE LINE OF FORCE OF ANY LOAD.**

Avoid shock loads.

Avoid impacting, jerking or swinging of load. Working Load limit will not apply in these circumstances because a shock load is generally significantly greater than the static load.

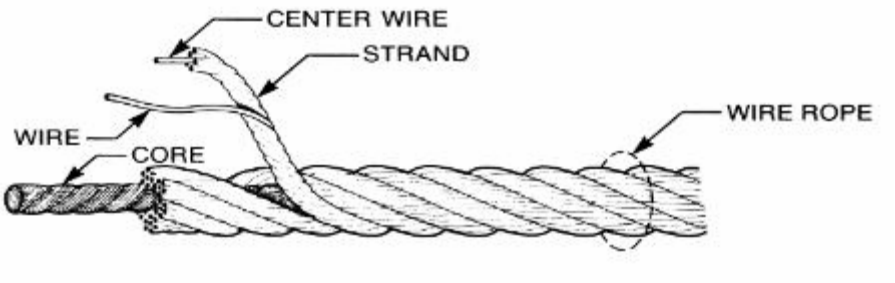
Inspect wire rope regularly.

Use inspection instructions as guidelines only. Additional technical information on wire rope inspection can be obtained from the sources listed in **T.O.C. > ADDITIONAL REFERENCE MATERIAL > TECHNICAL SAFETY AND INFORMATION SOURCES** . Two of the most important prerequisites for inspecting wire rope are technical knowledge and **experience**.
Check the general condition of the wire rope. Also, look for localized damage and wear, especially at wire rope attachments. Inspect all parts that come in contact with the wire rope. Poor performance of wire rope can often be traced back to worn or wrong-sized sheaves, drums, rollers, etc. Look for kinks, broken wires, abrasions, lack of lubrication, rust damage, crushing, reduction of diameter, stretch or other obvious damage. If any of these conditions exists or if there is **any other apparent damage to the wire rope**, retire the wire rope according to the instructions below.
When in doubt about the extent of the damage, retire the wire rope in question immediately. Without laboratory analysis, it is **impossible** to determine the strength of damaged or used wire. Thus, you will not be able to tell whether wire rope with any amount of damage is safe to use. Retire the wire rope that is damaged. For specific inspection procedures check various OSHA and ANSI publications.

Destroy, rather than discard, wire rope to be retired.

Wire rope that is not destroyed might be used again by someone not aware of the hazard associated with that use. Destroying wire rope is best done by cutting it up into short pieces.

GENERAL INFORMATION ON WIRE ROPE



The three basic components of a typical wire rope. (Fiber core is shown.)
COMPONENTS: Wire rope consists of three basic components.
1. Wires.
2. Strands, formed by wires, laid helically around a core.
3. Core, or center.

MATERIAL: Steel grades in wide use today are IPS (improved plow steel), EIPS (extra improved plow steel), sometimes also referred to as XIPS, XIP, or EIP, as well as EEIPS (extra, extra improved plow steel).

CORE: Its function is to provide proper support for the strands under normal conditions. Three types of core (or center) are commonly used.
1. Fiber Core (F.C.), usually polypropylene (P.C.), sometimes hemp (H.C.) and sisal.
2. Independent Wire Rope Core (IWRC)
3. Wire Strand Core (WSC)
IWRC and WSC are sometimes referred to as steel wire core or steel center.

CONSTRUCTION: Expressed in numbers of strands x number of wires. 6 x 25 indicates that the wire rope consists of 6 strands, which in turn have 25 individual wires. Constructions are grouped into classes:
6 x 7 Class: Containing 6 strands that are made up of 3 through 14 wires, of which no more than 9 are outside wires.

6 x 19 Class: Containing 6 strands that are made up of 15 through 26 wires, of which no more than 12 are outside wires.

6 x 36 Class: Containing 6 strands that are made up of 27 through 49 wires, of which no more than 18 are outside wires.

8 x 19 Class: Containing 8 strands that are made up of 15 through 26 wires, of which no more than 12 are outside wires.

19 x 7 Class: Containing 19 strands, each of which is made up of 7 wires.

8 x 19 and 19 x 7 class wire ropes have rotation-resistant properties, excluding elevator ropes.

The constructions listed above are just some of the more popular constructions.

Other common constructions: 7 x 7, 7 x 19: Galvanized cable. Sometimes referred to as "aircraft cable" but **not** intended for aircraft use. 1 x 7, 1 x 19: Strand 7 x 7 x 7, 7 x 7 x 19: Cable Laid

Many others exist, some for highly specialized applications only.
Note that any class denotes the **nominal** number of wires in each strand. The **actual** number of wires may be different. For example 6 x 36 class: **strands** most commonly consist of 36 wires, or 31, or 41.

GENERAL INFORMATION ON WIRE ROPE

STRAND PATTERNS: They refer to different types of arrangements of wires and their diameters within a strand. Common strand patterns are Filler Wire, Seale, Warrington and combinations thereof.

LAY: indicates how the wires have been laid to form strands and how the strands have been laid around the core. A right regular lay rope (RRL; the most common) has its strands laid right on the rope - similar to threading a right-hand threaded bolt. Regular means that the direction of the wire lay in the strand is opposite to the direction of the strand lay in the rope. (The wires in regular lay rope appear to be in line with the axis of the rope).

CAUTION: When combining separate ropes in a single line application always use ropes of the same lay pattern. Different lays can increase rotation at connection points decreasing rope efficiency.


Right Regular Lay (RRL)


Right Lang Lay (RLL)


Left Regular Lay (LRL)


Left Lang Lay (LLL)

PREFORMING: A manufacturing process wherein the strands and their wires are permanently formed - during fabrication - to the helical shape that they will ultimately assume in the finished wire rope. Proper preforming prevents the strands and wires from unlaying during normal use. The vast majority of wire rope sold today is preformed.

FINISH: Wire rope is either sold as "bright" (or "black") - meaning uncoated, or galvanized for better corrosion resistance. "Drawn Galvanized" wire has the same strength as bright wire, but wire, "galvanized at finished size" is usually 10% lower in strength. Plastic coated wire rope is also available, usually galvanized or stainless steel cable. The most common plastic coatings are vinyl or nylon in either clear or white, although other materials and colors are available. These coatings do not add strength to the wire rope itself.

LUBRICATION: During fabrication, wire ropes receive lubrication. The kind and amount depends on the rope's size, type and use, if known. This in-process treatment will provide the finished wire rope with ample protection for a reasonable time if it is stored under proper conditions. But, when the wire rope is put into service, the initial lubrication will normally be less than needed for the full useful life of the wire rope. Because of this, periodic applications of a suitable wire rope lubricant are necessary.

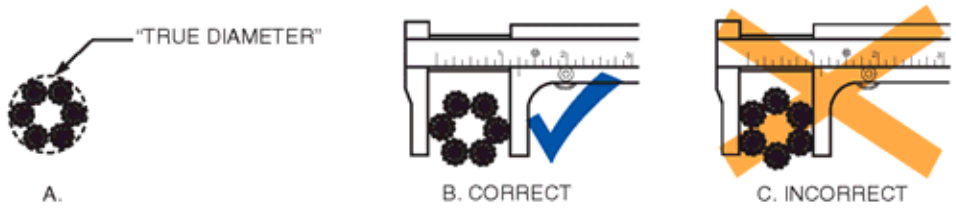
ORDERING WIRE ROPE: Construction, lay, core, finish and other factors mentioned above impart greatly differing characteristics to different wire ropes. They must be understood and considered when selecting wire rope. There is no perfect wire rope for all applications; usually some less desirable properties are traded off for other, more desirable ones. Refer to the Wire Rope Users Manual by the Wire Rope Technical Board for a better understanding of wire rope properties and consult professional help when in doubt.

Lacking a complete description of the wire rope desired, a supplier can make several assumptions:

1. If direction and type of lay are omitted from the rope description, it is assumed to be right regular lay (RRL).
2. If finish is omitted, this will be presumed to mean ungalvanized, "bright" finish.
3. If no mention is made with reference to preforming, preformed wire rope will be supplied.
4. If a supplier receives an order for 6 x 19 wire rope he may assume this to be a class reference and is, therefore, legally justified in furnishing any construction within this category.

PROPER HANDLING OF WIRE ROPE

MEASURING OF WIRE ROPE



How to measure (or caliper) a wire rope correctly. Since the "true" diameter (A) lies within the circumscribed circle, always measure the larger dimension (B). Actual diameter can be 5% larger than nominal wire rope diameter.

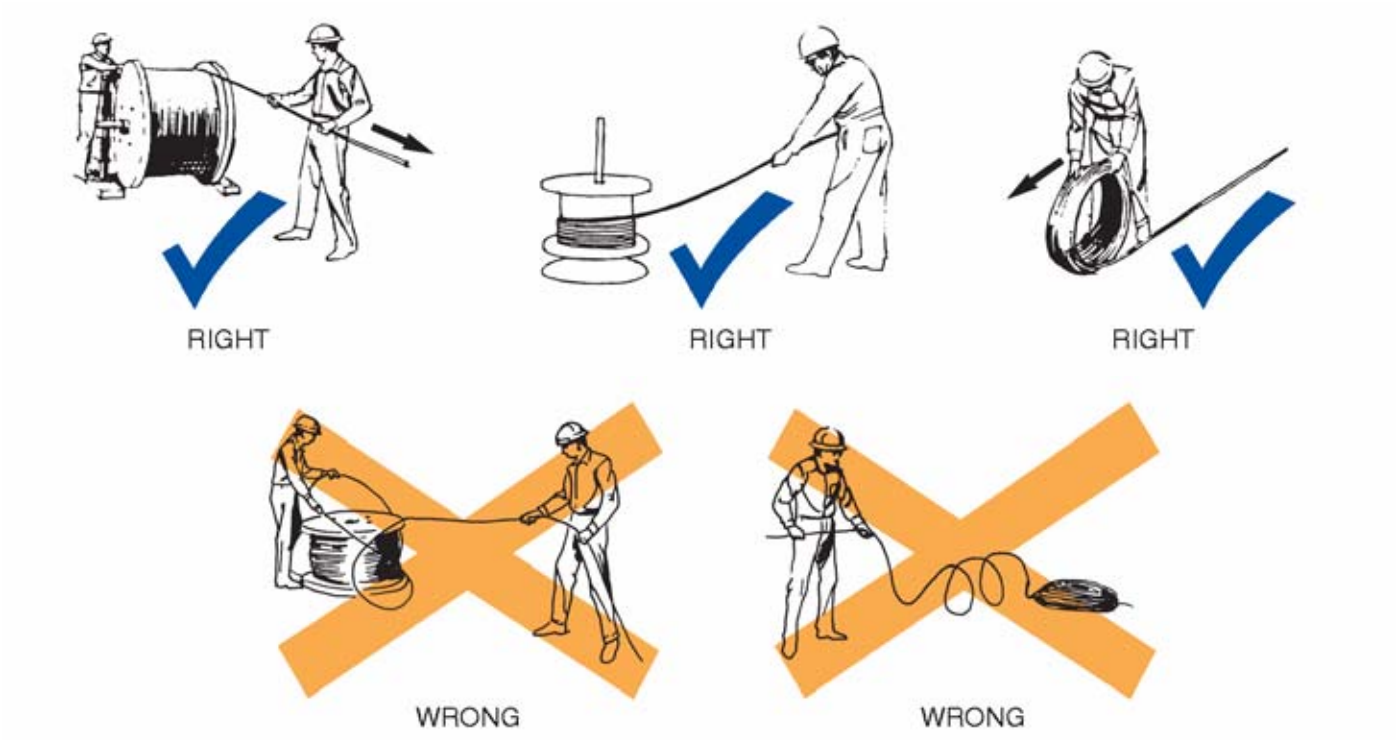
RECEIVING AND STORING WIRE ROPE

Make certain that the wire rope received is the one that was ordered. Check for obvious damage to wire rope and reel. Store wire rope away from heat, moisture and other corrosive agents. This means storing under a weatherproof cover, off the ground, preferably in a dry, cool, well ventilated warehouse. If wire rope has to be kept outdoors, cover it with a coating of protective wire rope lubricant and cover both wire rope and reel with waterproof material. Keep it well off the ground. Careful inspection after extended storage is of utmost importance.

UNREELING OR UNCOILING WIRE ROPE

Great care must be taken when removing wire rope from reels or coils. Looping the rope over the flange of the reel or pulling the rope off a coil while it is lying on the ground will create loops in the line. If these loops are pulled tight, kinks will result, thereby permanently damaging the wire rope. Check illustrations below showing correct and incorrect ways of unreeling and uncoiling wire rope.

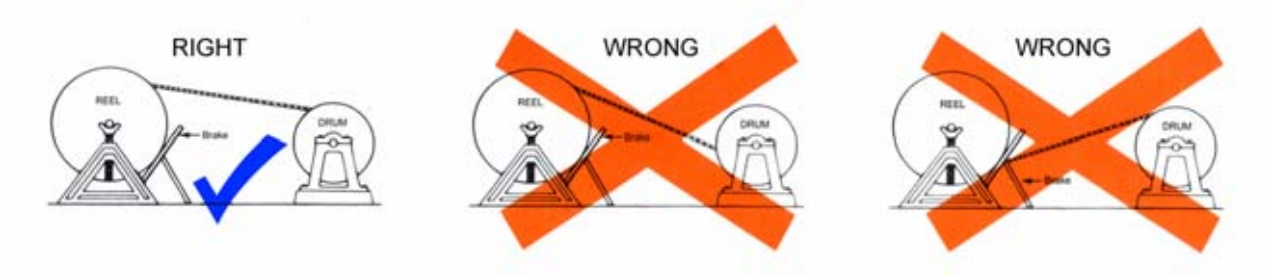
Whenever handling wire rope, take care not to drop reels or coils. This can damage wire rope and collapse the reel, making removal of the wire rope extremely difficult if not impossible.



PROPER HANDLING OF WIRE ROPE

REREELING WIRE ROPE

When reeling wire rope from one reel to another it is preferable for the wire rope to travel from top to top, as illustrated. Spooling from bottom to bottom is also acceptable, provided the surface over which the wire rope will travel is clean, smooth and dry, so as not to allow foreign particles to become embedded in the wire rope. Spooling from top to bottom or from bottom to top can put a reverse bend into wire rope and must be avoided. When stringing up on machinery wire rope should be removed from the reel in the same direction as placed on the drum.



CUTTING & SEIZING WIRE ROPE

There are numerous ways to cut wire rope - use only appropriate tools specifically designed to cut wire rope. Safety goggles and work gloves must **always** be worn. Observe other precautions peculiar to the tools used. Wire rope should be properly seized on both sides of the cut with wire or strand. Seizing wire diameter and the number and length of the seizings will depend on the diameter of the wire rope, and whether or not it is preformed.

BREAKING IN NEW WIRE ROPE

Since wire rope is a machine with many moving parts, it requires careful installation and breaking in procedures for maximum safety and long service life. After proper installation, allow the wire rope to run through a cycle of operation at a very low speed. Keep a close watch on the wire rope, its attachments and any working parts such as sheaves, drums, rollers, etc. to make certain that the wire rope runs freely. If no problems appear at this stage, run the wire rope through several cycles of operation under light load at reduced speed. This procedure allows the component parts of the new rope to make a gradual adjustment to the actual operating conditions.

WIRE ROPE EFFICIENCY

Wire rope will develop 100% efficiency, that is, break at or above minimum acceptance strength (not less than 2 1/2% below nominal breaking strength) under controlled laboratory conditions. Once fittings such as sleeves, clips, sockets, etc. are attached and/or the wire rope passes over a curved surface such as sheaves, pins, etc. its **strength is decreased.** In the case of wire rope passing over a curved surface this decrease in strength depends on the severity of the bend. In the case of wire rope fittings, the decrease in wire rope strength will depend on the type of fittings used. The wire rope efficiency usually ranges from 70% - 100%. For more detailed information consult the strength efficiency of wire rope table in **T.O.C. > BLOCKS** ⚠. Note, that hand spliced wire rope, while not using any fittings, has less efficiency than properly flemished and swaged wire rope. There are other factors, depending on the application of wire rope, that can cause a decrease in nominal wire rope strength. They must be considered when choosing a design factor. Refer to the Wire Rope Users Manual and/or other qualified sources for details.

ELASTIC PROPERTIES OF WIRE ROPE

Wire rope is an elastic member; it stretches or elongates under load. This elongation can be permanent or recoverable. The extent of elongation will depend on the wire rope used and the design factor chosen. While it may be acceptable for many wire rope uses to neglect its elastic properties, they are of critical importance for some uses. When in doubt about the importance of wire rope elongation consult professional help. Pre-stretching wire rope will only remove some of the constructional stretch and will not totally eliminate elongation under load.

WINDING WIRE ROPE ON DRUMS

Installation of wire rope on a plain or grooved drum requires a great deal of care. Make certain the wire rope is properly attached to the drum. Keep adequate tension on the wire rope as it is wound onto the drum. Guide each wrap as close to the preceding wrap as possible, or follow the groove in case of a grooved drum. No blanket recommendations can be given concerning direction of winding, desirable drum diameter, fleet angle, etc. Consult the Wire Rope Users Manual for this and other important technical information.

WIRE ROPE SLINGS

Refer to ASME standard B30.9 and OSHA standard 1910.184 for design factors and other important information. Other standards and information may apply.

REEL CHART

Listed below are some of the most commonly used reels in our inventory and the approximate lengths of wire rope that will fit on the reels.

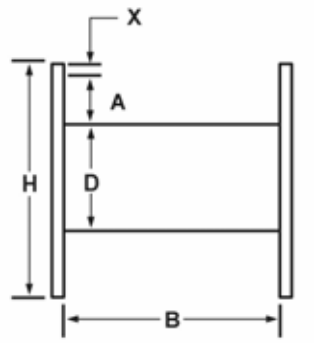
H B D	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 3/8"
12" x 6" x 5"	500'	300'	200'	125'								
18" x 8" x 8"	1800'	1200'	800'	600'	300'							
24" x 16" x 12"	6400'	3900'	2,600'	2,000'	1,200'	800'						
26" x 16" x 12"	8300'	5100'	3,400'	2,600'	1,550'	1,000'	625'	450'				
28" x 16" x 12"	10,300	6,400'	4,300'	3,300'	1,900'	1,200'	800'	570'	450'			
32" x 16" x 14"		7.800'	5,200'	3,700'	2,350'	1,550'	1,100'	800'	600'	475'		
36" x 24" x 16"		13,900	9,400'	6,700'	4,200'	2,750'	1,950'	1,400'	1,100'	850'	625'	
40" x 22" x 18"			13,00'	9,300'	5,800'	3,800'	2,700'	1,950'	1,500'	1,200'	900'	725'
42" x 22" x 18"		19,300		10,000	6,250'	4,100'	2,900'	2,100'	1,600'	1,300'	1,000'	850'

REEL CAPACITY

Due to tolerances on diameters and variety of constructions of wire rope, it is difficult to calculate the maximum length of wire rope that can be spooled on a reel or drum. The formula below may be used to calculate reel capacities with at least one wire rope diameter below the flange diameter, for clearance ("X"). Calculated reel capacities are based on uniform rope winding on the reel.

$$L = (A + D) \times A \times B \times K$$

L = length of wire rope in feet
A = depth of rope space on reel in inches
B = width of drum between flanges in inches
D = barrel diameter in inches
K = constant for given wire rope diameter (per table below)
H = diameter in reel flange in inches
X = clearance



Diameter (inches)	K
1/16	49.8
3/32	23.4
1/8	13.6
5/32	8.72
3/16	6.14
7/32	4.59
1/4	3.29
5/16	2.21
3/8	1.58
7/16	1.19

Diameter (inches)	K
1/2	.925
9/16	.741
5/8	.607
11/16	.506
3/4	.428
13/16	.354
7/8	.308
1	.239
1.1/8	.191
1.1/4	.152

Diameter (inches)	K
1.3/8	.127
1.1/2	.107
1.5/8	.0886
1.3/4	.077
1.7/8	.0675
2	.0597
2.1/8	.0532
2.1/4	.0476
2.3/8	.0419
2.1/2	.038