Pinnacle Wire Ropes

ACCESS TO LONG-TERM PERFORMANCE & SERVICE

Alps Wire Rope Corporation

"THE PINNACLE OF QUALITY"

GENERAL CATALOG

This publication is made available to assist our customers in the distribution of our products.

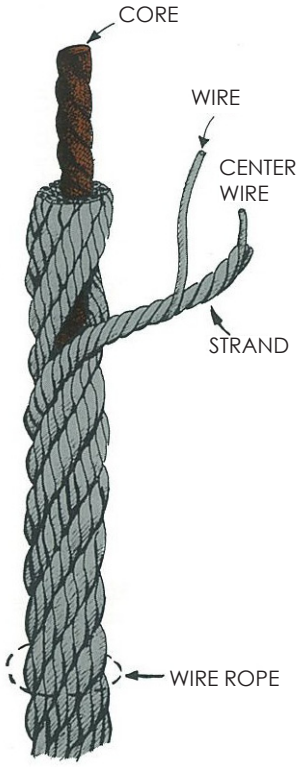
The data presented has been prepared in accordance with recognized engineering principles and provides general information.

Material suitability for specific applications should be in accordance with the recommendations of the original equipment manufacturer and competent authorities.

CONTENTS

INTRODUCTION

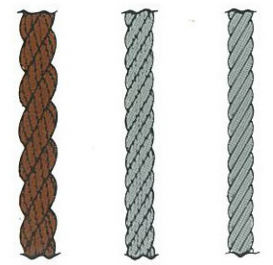
Wire Rope is a complex piece of machinery, in many cases containing hundreds of moving parts. Proper application, maintenance, storage and handling must be adhered to at all times so that it may be used to its maximum potential, both in safety and performance.



WIRE ROPE COMPONENTS
Wire rope consists of three basic components:
1) Individual wires
2) Multi-wire strands
3) A Core

WIRES
The individual wires that form strands are most commonly available in high-carbon steel, generally supplied in an uncoated, or "bright" finish. Zinc coated, or "Galvanized" rope is available in some sizes and carries a nominal strength of 10% below that of a bright rope. On special request, wire rope can be drawn-galvanized, offering the same nominal strength as a bright rope.

STRANDS
Wires are laid geometrically to form strands, each composed of two or more wires. Breaking these strand configurations into several classifications (P.4) is the basis for identifying wire rope.
These classifications may or may not be an actual construction. For example, a request for a "6x19", without further mention to a specific strand construction would be considered a request for a 6x25 Filler Wire, the most popular construction in the 6x19 classification.



CORES
The core is the supporting member of the rope, made of either synthetic or sisal fibers, or steel. A fiber core rope offers flexibility; a steel center rope yields a higher strength along with the ability to resist crushing.
Steel cores are required when the environment exceeds 180°(F).
NOTE: When fiber core is specified, the core material (synthetic or sisal) could vary. The most popular fiber core is manufactured in polypropylene.

SECTION 1

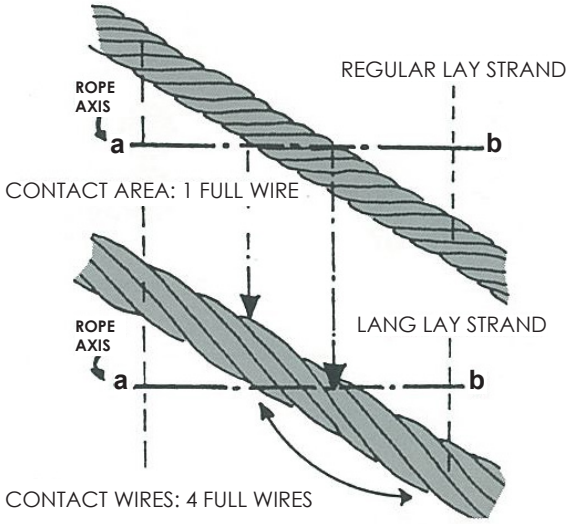
TYPICAL WIRE ROPE LAYS

REGULAR LAY ROPE
Regular lay rope is the most standard, and accepted for a wide range of applications. The direction of the individual wires is opposite to the direction of the strands. Because of this, the rope is less likely to untwist, and therefore is easier to handle than lang lay rope. This rope is also less subject to crushing.

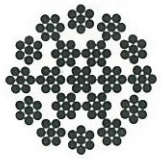
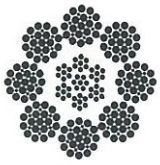
RIGHT LAY ROPE
A right lay rope is one in which the path of the strands in the rope is from left to right in a direction away from the observer. A right lay rope may either be regular lay or lang lay.

LEFT LAY ROPE
A left lay rope is one in which the path of the strands in the rope is from right to left in a direction away from the observer. A left lay rope may be either regular lay or lang lay.

LANG LAY ROPE
Lang lay wire ropes have the individual wires matching the same lay direction as the strands. Considered a special construction for specific applications it provides improved bending fatigue and greater wear-resistance. It's uses are limited to applications (such as drag lines) where both ends are permanently fixed. Lang lay ropes will untwist if one end is free to rotate.



The above is a comparison of wear characteristics between regular lay and lang lay ropes. The greater metal area along the rope's axis (a-b) promotes more wear-resistance than a regular lay rope. The longer exposed length of outer wires in a lang lay rope offers an easier bend, resulting in greater fatigue resistance (page 9).

GENERAL CLASSIFICATION	CROSS-SECTION	ACTUAL CONSTRUCTIONS
6 X 19	 6 x 25 Filler Wire*  6 x 21 Filler Wire  6 x 19 Seale*  6 x 26 Warrington Seale	6 strands containing 15 through 26 wires, with a maximum of 12 outside wires. **Construction Count (Inside to Outside)** 6 x 25 (FW): 1 - 6 - (6) - 12 6 x 21 (FW): 1 - 5 - (5) - 10 6 x 19 (S): 1 - 9 - 9 6 x 26 (WS): 1 - 5 - (5+5)-10 *Also available in Fiber Core
6 X 37	 6 x 36 Warrington Seale*  6 x 41 Warrington Seale  6 x 31 Warrington Seale	6 strands containing 27 through 49 wires, with a maximum of 18 outside wires. **Construction Count (Inside to Outside)** 6 x 36 (WS): 1 - 7 - (7+7) - 14 6 x 41 (WS): 1 - 8 - (8+8) - 16 6 x 31 (WS): 1 - 6 - (6+6) - 12 *Also available in Fiber Core
19 X 7 Rotation-Resistant	 19 x 7	19 strands containing 7 wires each. The 7 x 7 core is left lang lay, the 12 outer strands are right regular lay. These directional changes result in a rotation-resistant characteristic.
8 x 19 Rotation-Resistant	 8 x 25 Filler Wire	8 strands containing 15 through 26 wires each. Using a 7 x 7 wire core in left lang lay, coupled with 8 outer strands of right regular lay again promote rotation- resistant properties.

General-Purpose Wire Rope

DIA. INCHES	6 x 19 • 6 x 37 CLASS Fibre Core - I.P.S.		6 x 19 • 6 x 37 CLASS Independent Wire Rope Core-E.I.P.S.		
	Weight Lbs./Ft	Nominal Strength Tons-BRT.	Weight Lbs./Ft	Nominal Strength-Tons	
				BRT.	GALV.
3/16	.059	1.55	—	—	—
1/4	.105	2.74	.116	3.40	3.06
5/16	.164	4.26	.18	5.27	4.74
3/8	.236	6.10	.26	7.55	6.80
7/16	.32	8.27	.35	10.2	9.18
1/2	.42	10.7	.46	13.3	12.00
9/16	.53	13.5	.59	16.8	—
5/8	.66	16.7	.72	20.6	18.50
3/4	.95	23.8	1.04	29.4	26.50
7/8	1.29	32.2	1.42	39.8	35.80
1	1.68	41.8	1.85	51.7	46.50
1 1/8	2.13	52.6	2.34	65.0	—
1 1/4	2.63	64.6	2.89	79.9	—
1 3/8	—	—	3.50	96.0	—
1 1/2	3.78	92.0	4.16	114.0	—

Rotation Resistant Wire Rope

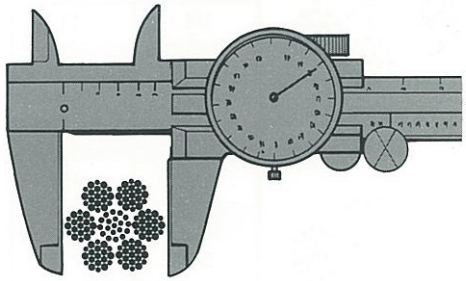
DIA. INCHES	19 x 7 E.I.P.S.		8 x 25 I.W.R.C. • E.I.P.S.	
	Weight Lbs./Ft	Nominal Strength-Tons	Weight Lbs./Ft	Nominal Strength-Tons
3/16	.064	1.57	—	—
1/4	.113	2.77	—	—
5/16	.177	4.30	—	—
3/8	.252	6.15	—	—
7/16	.346	8.33	—	—
1/2	.431	10.8	.47	11.6
9/16	.577	13.6	.60	14.7
5/8	.714	16.8	.73	18.1
3/4	1.02	24.0	1.06	25.9
7/8	1.39	32.5	1.44	35.0
1	1.82	42.2	1.88	45.5
1 1/8	2.30	53.1	—	—

Diameter Tolerance

Nominal Diameter	Tolerance In. (-0)	Maximum Dia.-In.
3/64"	+.008	.055
1/16"	+.010	.073
3/32"	+.012	.106
1/8"	+.014	.139
5/32"	+.016	.172
3/16"	+.018	.206
7/32"	+.018	.237
1/4"	+.015	.265
5/16"	+.015	.328
3/8"	+.019	.394
7/16"	+.021	.459
1/2"	+.025	.525
9/16"	+.028	.591
5/8"	+.031	.656
3/4"	+.038	.788
7/8"	+.044	.919
1"	+.050	1.050
1 1/8"	+.056	1.181
1 1/4"	+.063	1.313
1 3/8"	+.069	1.444
1 1/2"	+.075	1.575

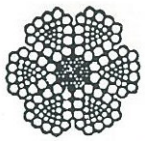
Above tolerances refer to: Aircraft Cable, 3/64" thru 7/32" Wire Rope, 1/4" thru 1 1/2".

HOW TO MEASURE WIRE ROPE



The true diameter of wire rope is measured at it's largest point.

WARNING: The nominal strengths listed throughout this publication are the results of testing under ideal conditions: straight pull, no bending, ambient temperatures, with loading applied at a gradual speed. In most applications, the applied load should not exceed 20% of the nominal strengths.


6 x 30G Flattened Strand IWRC

6 x 30 Style G • IWRC Flattened Strand • E.I.P.S.

Diameter Inches	Weight Lbs./Ft.	Nominal Strength/Tons
5/8	.73	21.7
3/4	1.06	31.0
7/8	1.46	41.9


6 x 7 FC

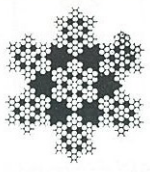
Sandlines 6 x 7 Class Bright • FC

Diameter Inches	Weight Lbs./Ft.	Nominal Strength/Tons
5/16	.15	4.10
3/8	.21	5.86
7/16	.29	7.93
1/2	.38	10.3
9/16	.48	13.0

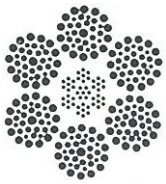
Galvanized Cable-Laid Sling Ropes

Diameter Inches	Construction	Weight Lbs/Ft.	Nominal Strength/Tons
1/4	7 x 7 x 7	.094	2.38
3/8	7 x 7 x 7	.21	5.7
1/2	7 x 7 x 7	.37	9.75
5/8	7 x 7 x 7	.58	14.6
3/4	7 x 7 x 19	.88	21.4
7/8	7 x 7 x 19	1.19	28.4
1	7 x 7 x 19	1.56	36.2
1 1/8	7 x 7 x 19	1.72	47.4
1 1/4	7 x 7 x 19	2.18	65.05
1 1/2	7 x 7 x 19	2.96	88.75


7 x 7 x S (19)


7 x 7 x 7


6 x 25 FILLER WIRE IWRC


6 X 36 WARRINGTON-SEALE IWRC

Type 304 Stainless Steel Wire Rope • IWRC

Diameter Inches	Weight Lbs./Ft.	Nominal Strength-Lbs.	
		6 x19 Class	6 x 37 Class
1/4	.110	—	5,400
5/16	.180	—	8,300
3/8	.240	—	11,700
7/16	.330	—	15,800
1/2	.458	22,800	20,400
9/16	.590	28,500	25,600
5/8	.715	35,000	31,400
3/4	1.05	49,600	—
1	1.87	85,400	—

Other sizes and constructions available upon request. Some items available in Type 316 Stainless Steel.

6 x 15 Lashing Rope • Contains 7 Fibre Cores

Diameter Inches	Weight Lbs./Ft.	Nominal Strength/Tons
3/8	.15	3.50
1/2	.26	6.00
5/8	.45	9.55

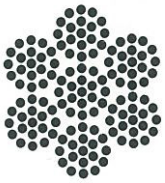
Caution: Not designed for overhead lifting.


6 x 15 FC

AIRCRAFT CABLE & STRANDS

Galvanized Aircraft Cable • Type 304 Stainless-Steel Aircraft Cable

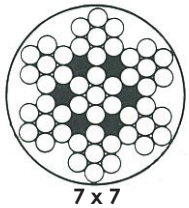

7 x 7

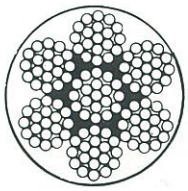

7 x 19

Dia. Inches	7 x 7			7 x 19		
	Weight Lbs./M Ft.	Nominal Strength-Lbs.		Weight Lbs./M Ft.	Nominal Strength-Lbs.	
		GAC	SSAC		GAC	SSAC
1/16	7.5	480	480	—	—	—
3/32	16	920	920	17	1,000	920
1/8	28	1,700	1,700	29	2,000	1,760
5/32	43	2,600	2,400	45	2,800	2,400
3/16	62	3,700	3,700	65	4,200	3,700
7/32	—	—	—	86	5,600	—
1/4	—	—	—	110	7,000	6,400
5/16	—	—	—	173	9,800	9,000
3/8	—	—	—	243	14,400	12,000

Some items also available in Type 316 Stainless Steel

Vinyl Coated G.A.C. (P.V.C.)


7 x 7


7 x 19

Cable Dia. - O.D.	Construction	Weight Lbs./M Ft.	Nominal Strength/Lbs.
1/16 - 1/8	7 x 7	11.8	480
3/32 - 3/16	7 x 7	25.8	920
1/8 - 3/16	7 x 7	35.2	1,700
1/8 - 3/16	7 x 19	36.2	2,000
3/16 - 1/4	7 x 19	77.5	4,200
7/32 - 9/32	7 x 19	103	5,600
1/4 - 5/16	7 x 19	123	7,000

Standard coating is clear P.V.C. Also available upon request: Nylon coating, colored P.V.C. and Nylon, coated Stainless Steel, other sizes and constructions.

Note: If the full strength of the bare cable is required, plastic must be stripped from cable, with the fittings attached in direct contact with the cable.

Single - Wire Strands • E.H.S. Galvanized • Type 304 Stainless Steel


1 x 7


1 x 19

Dia. Inches	Construction	Weight Lbs./M Ft.	Nominal Strength ~ Lbs.	
			E.H.S. GALV.	Stainless Steel
1/16	1 x 19	8.5	500	500
3/32	1 x 19	20	1,200	1,200
1/8	1 x 19	35	2,100	2,100
5/32	1 x 19	55	—	3,300
3/16	1 x 19	77	—	4,700
3/16	1 x 7	73	3,990	—
1/4	1 x 7	117	6,650	—
5/16	1 x 7	205	11,200	—
3/8	1 x 7	273	15,400	18,000
1/2	1 x 7	517	26,900	—

WIRE ROPE SELECTION

SELECTION FACTORS: STRENGTH • ABRASION • CRUSHING • FATIGUE

Choosing the rope best suited for a specific application requires attention to all four factors shown above. While it is impossible to possess the ultimate physical properties for every factor, establishing an order of priorities is essential in choosing the wire rope best suited to an application.

1. SUFFICIENT STRENGTH

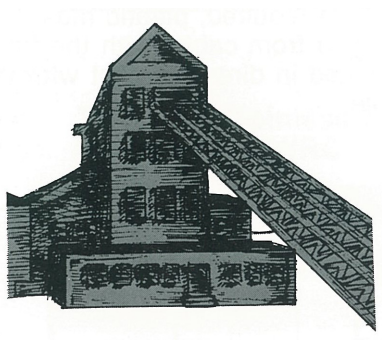
First and foremost, wire rope must have sufficient strength to handle the ultimate applied load. The following factors must be considered when calculating applied load potential:

- Dead Weight • abrupt starts • sudden stops
- Shock Loads • high speeds • friction
- Loss of Efficiency when rope is bent over sheaves
- Location of sheaves and drums
- Environmental conditions - heat, humidity, etc.
- Special considerations - danger to human life; value of load

The true total load includes all of the above. The sum of these factors is then multiplied by a "Design Factor", defined as the ratio of the nominal strength of a wire rope to the total load it is expected to carry. For an average application, a common design factor is 5:1, or if there is danger to life, this factor could be as high as 10:1. For proper design selection, consulting industry standards and OSHA requirements is recommended.

RESERVE STRENGTH

The reserve strength of a wire rope is the strength exclusive of the outside wires, which are the first to wear out under abrasion. As the number of layers of wires per strand increases, the reserve strength increases. Well lubricated ropes in service have the following reserve strengths (approximately) in terms of strengths of new ropes:



Wire Rope Construction	Reserve Strength
6 x 7	18%
6 x 19 (S)	32%
6 x 21 (FW)	36%
6 x 25 (FW)	43%
6 x 31 (WS)	43%
6 x 36 (WS)	49%
6 x41 (WS)	54%

2. ABRASION RESISTANCE

Whether a rope is dragged against gravel or dirt, or passed over sheaves, it is subject to abrasive wear. Internal wear can also occur, depending upon application and construction. When choosing a rope to resist abrasion, a good rule-of-thumb is to keep in mind that larger outside wires and lang lay ropes are generally more abrasion-resistant than regular lay ropes.

3. RESISTANCE TO CRUSHING

Or in simpler terms, abuse. Wire rope crushing can occur from a number of abuses: undersized grooves on drums and sheaves; excessive pressure over drums and sheaves; and overwinding on drums, or irregular winding. Steel center ropes have a better tendency to resist crushing than fiber core ropes as does regular lay versus lang lay.

4. RESISTANCE TO FATIGUE

Operating ropes experiencing shortened rope service life is frequently due to a condition known as early fatigue. To picture this action, a clothes hanger, when bent repeatedly back and forth at the same point, will eventually break. All wire ropes running over sheaves and drums are subjected to bending stresses, and the rope wires will eventually fatigue. The tighter (and faster) the bend, the quicker the eventual fatigue. As the number of wires per strand in a rope increases, the ability to resist fatigue increases as well. The diameter of the sheave or drum in relationship to the diameter of rope is a critical factor in establishing the ropes' ability to resist fatigue.

Following the ratios shown below is important, particularly in applications where bending fatigue is the major consideration

Suggested Sheave & Drum Ratios

Wire Rope Construction	Minimum D/d Ratio
6 x 7	42 : 1
6 x 19 (S)	34 : 1
6 x 21 (FW)	30 : 1
6 x 25 (FW)	26 : 1
6 x 26 (WS)	30 : 1
6 x 31 (WS)	26 : 1
6 x 36 (WS)	23 : 1
6 x 41 (WS)	21 : 1
6 x 30 (G) FSR	30 : 1
19 x 7	34 : 1
8 x 25 (FW)	21 : 1

D = Diameter of Drum d = Diameter of Rope

To determine the recommended diameter of sheaves or drums, the diameter of the rope should be multiplied by the D/d ratio as listed above.

For example; a 1/2" 19 x 7 (.5 x 34) should have a minimum 17 inch diameter drum or sheave.

If a change in construction is being considered as a means for delaying wire fatigue influenced by bending stresses, the table below may me useful. For example; a change from a 6 x 25 (FW) with a factor of 1.00 to a 6 x 36 (WS) with a factor of 1.16 would mean the service life could be expected to increase by 16%.

Rope Construction	Factor
6 x 7	.61
19 x 7	.67
6 x 19 (S)	.81
6 x 21 (FW)	.89
6 x 26 (WS)	.89
6 x 30 (G) FSR	.90
6 x 25 (FW)	1.00
6 x 31 (WS)	1.00
6 x 36 (WS)	1.16

Caution: These Figures apply only to bending stresses. Other factors which may contribute to rope deterioration have not been considered, such as abrasive wear.

In summary, fatigue resistance is dependent upon:

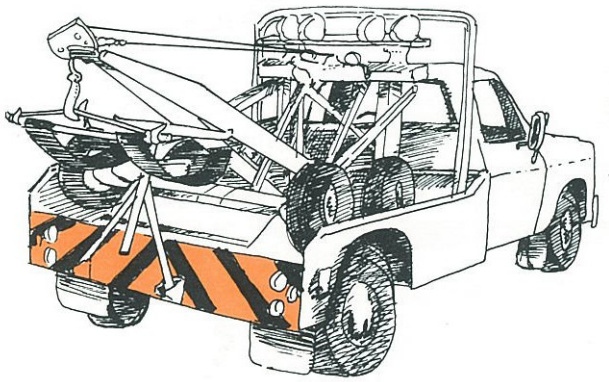
- The size of the individual wire
- The size of the sheave or drum
- The construction of the rope
- The speed of operation

An example of wire fatigue:

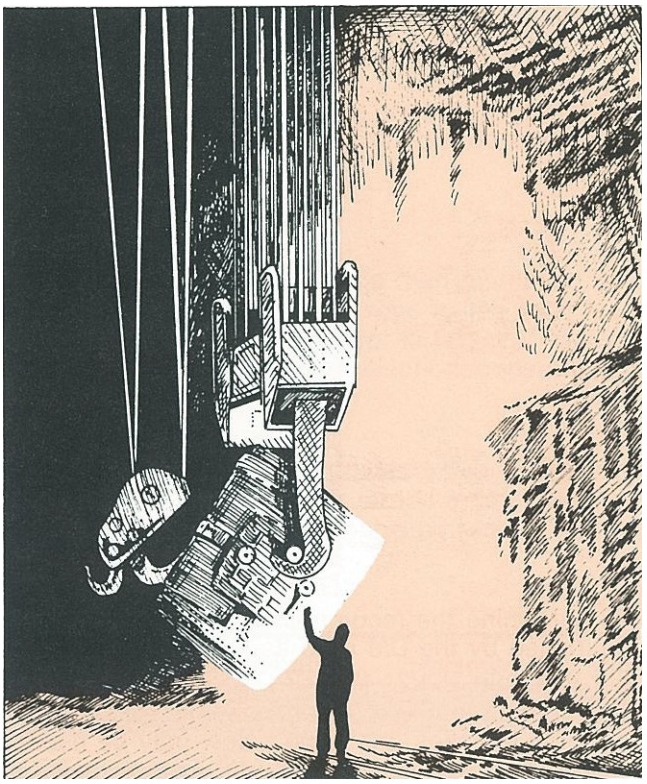
This rope was subjected to tight bending over small sheaves resulting in early fatigue.

GENERAL APPLICATIONS

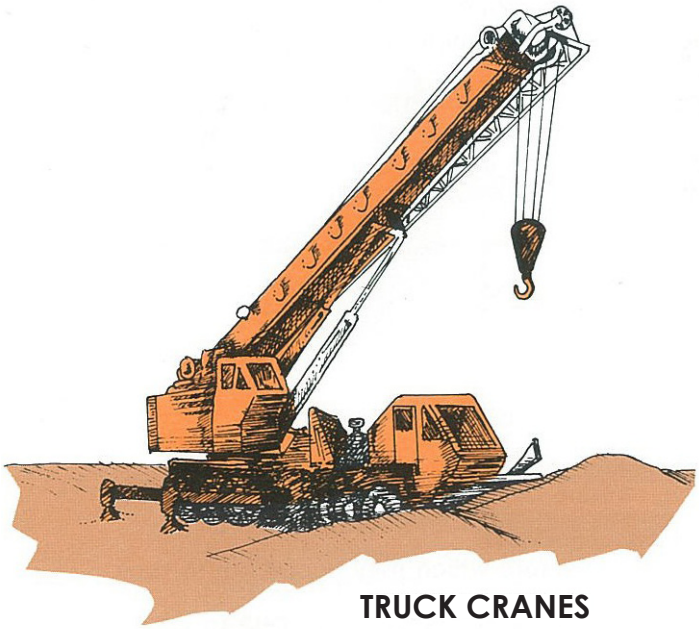
These pages depict some of the most common uses for wire rope. In most applications, a standard 6 x 19 or 6 x 37 - class rope is used, either in Fiber Core or I.W.R.C. Consulting the Original Equipment Manufacturer and O.S.H.A. Standards is recommended to ensure proper selection.



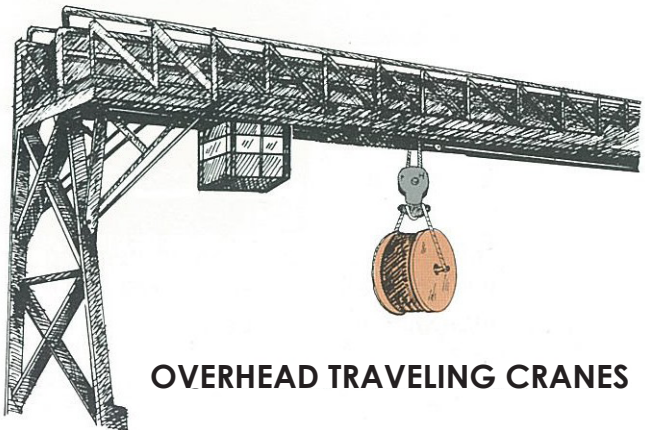
WRECKERS



OVERHEAD CRANE WITH LADLE



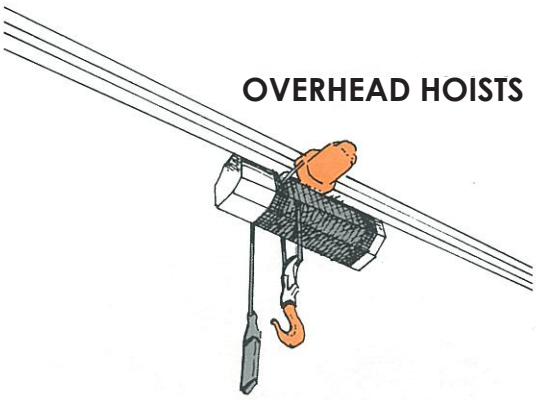
TRUCK CRANES

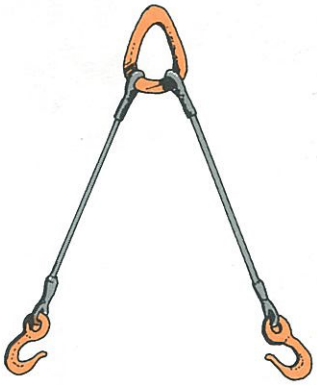


OVERHEAD TRAVELING CRANES

POWER WINCHES

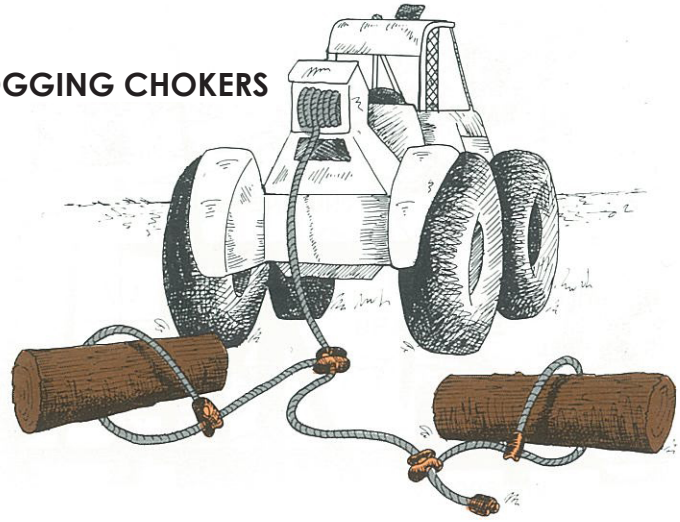
OVERHEAD HOISTS

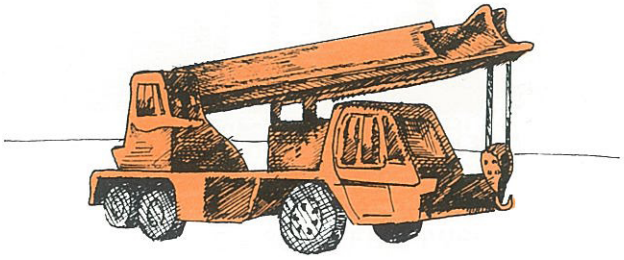




WIRE ROPE SLINGS

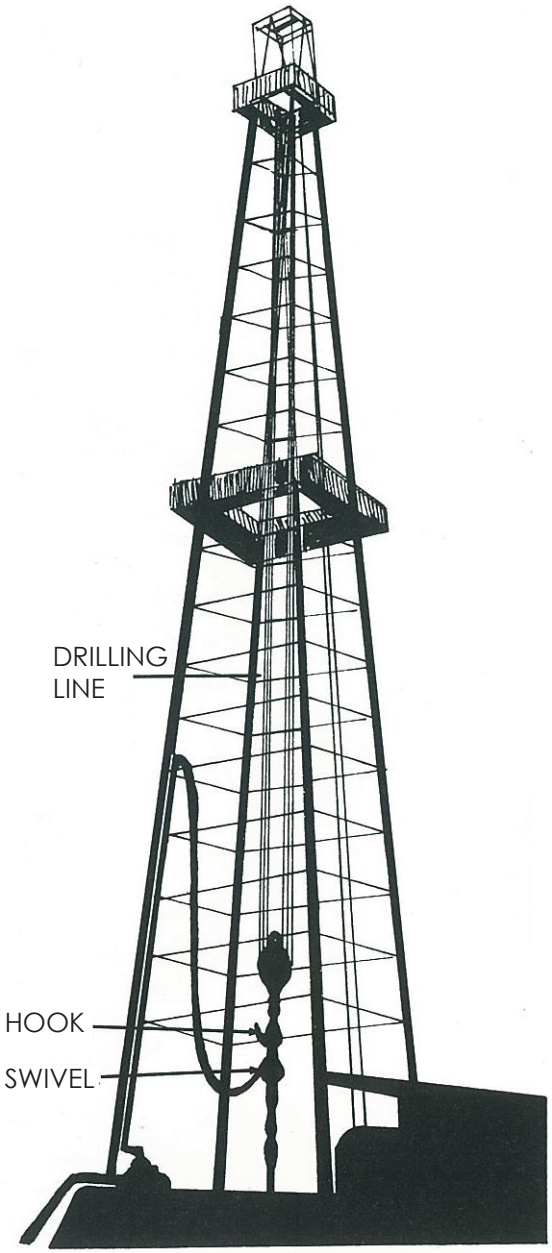
LOGGING CHOKERS





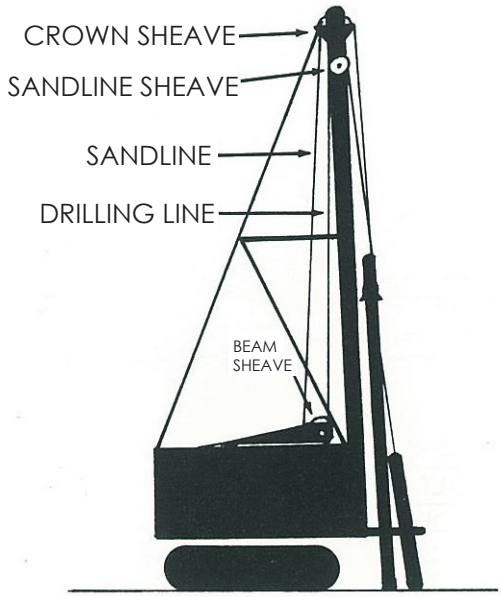
MOBILE CRANES

ROTARY DRILL RIG



Drill Line: 6 x 19 (S) IWRC, RRL
or 6 x 26 (WS), IWRC, RRL, EIPS

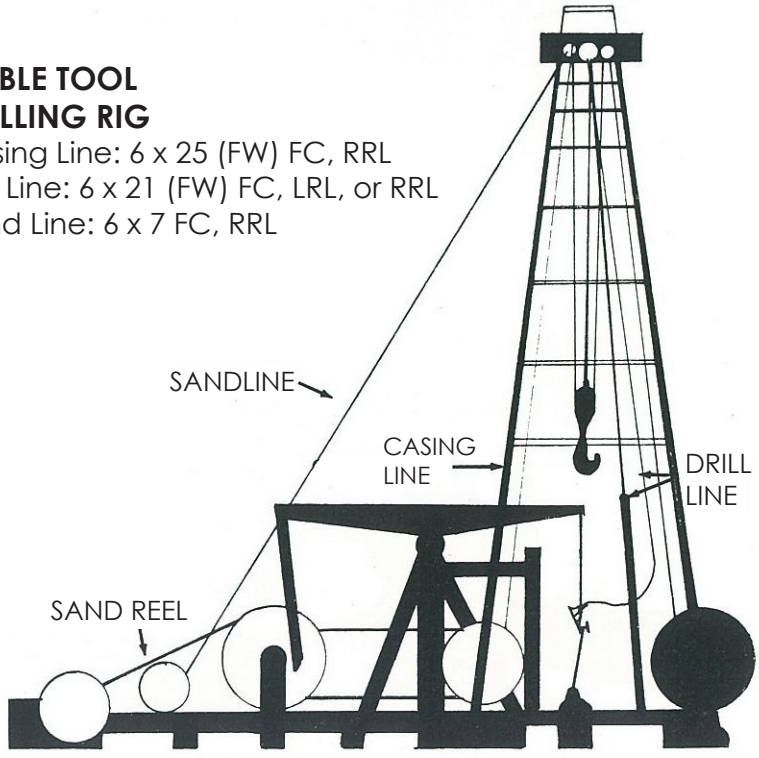
SPUDDER

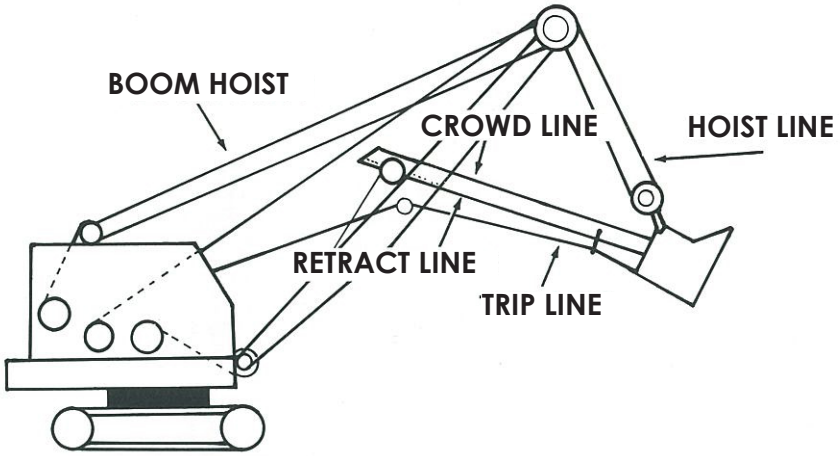


Sand Line: 6 x 7 FC, RRL
Drilling Line: 6 x 21 (FW) FC, LRL or RRL

CABLE TOOL DRILLING RIG

Casing Line: 6 x 25 (FW) FC, RRL
Drill Line: 6 x 21 (FW) FC, LRL, or RRL
Sand Line: 6 x 7 FC, RRL





SHOVEL/FACE SHOVEL
HOIST, CROWD & RETRACT
7/8" & smaller: 6 x 25 (FW) or
6 x 36 (WS), RLL; IWRC
1" & larger: 6 x 41 (FW),
RLL; IWRC

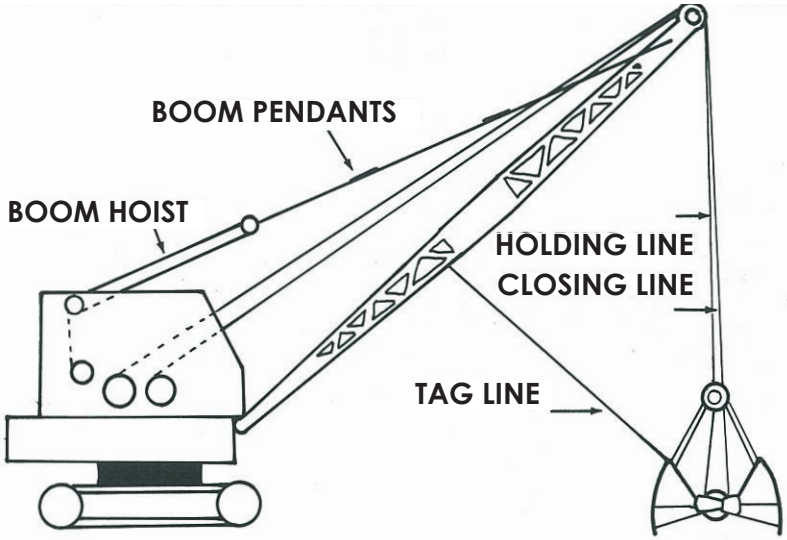
TRIP LINE
6 x 25 (FW) or 6 x 36 (WS),
RRL; IWRC

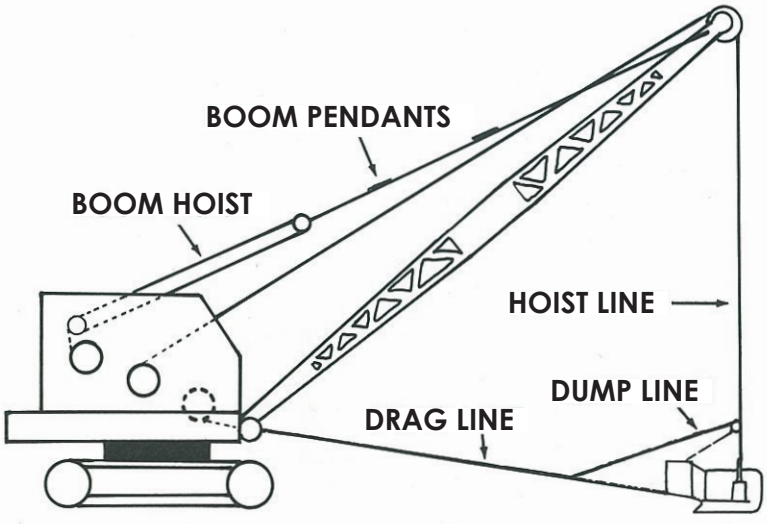
BOOM HOIST
6 x 25 (FW), RRL, or
6 x 30 (G) FSR, RLL; IWRC

CRANE/CLAMSHELL
CLOSING & HOLDING
6 x 25 (FW) or 6 x 36 (WS),
RRL or RLL, IWRC or FC, or
6 x 30 (G) FSR, RLL; IWRC

BOOM HOIST
6 x 25 (FW), RRL, or
6 x 30 (G) FSR, RLL; IWRC

TAG LINE
6 x 25 (FW) or 6 x 36 (WS),
RRL; IWRC





DRAGLINE EXCAVATOR
DRAGLINE
1/2" - 1-3/8": 6 x 21 (FW) or
6 x 30 (G) FSR, RLL; IWRC
1-1/2" - 2-1/2": 6 x 21 (FW), or
6 x 26 (WS) or 6 x 30 (G) FSR, RLL; IWRC

HOIST LINE
7/8" & smaller: 6 x 25 (FW) or
6 x 36 (WS), RRL or RLL; IWRC
1" & larger: 6 x 41 (WS), RLL; IWRC

BOOM HOIST
6 x 25 (FW), RRL, or
6 x 30 (G) FSR; IWRC

DUMP LINE
6 x 25 (FW), RRL or RLL; IWRC

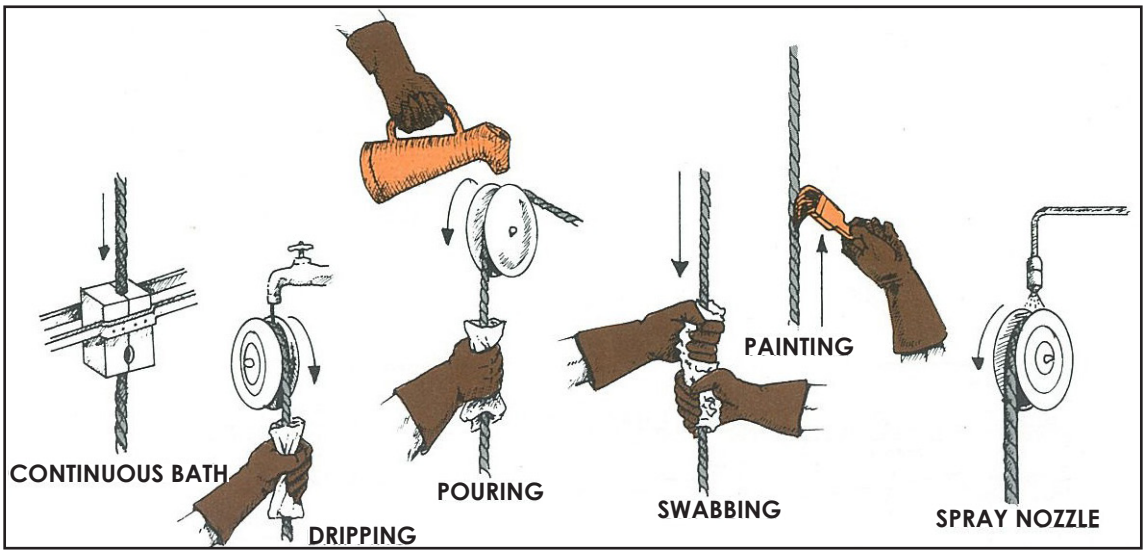
NOTE: Actual constructions may vary depending on equipment and application.

BASIC MAINTENANCE TIPS

HANDLING
Upon receiving a shipment of wire rope, close attention to the packaging is the first important measuer in proper and appropriate care. If, for instance, the reel has broken or split flanges, or loose inner staves, it is a good assumption that there could be damage to the rope as well. Always check for distortions in the outer wraps of the reel, or any conditions resulting from fork-lift abuse.
The reel should be handled from the bottom flange; lifting it from the upper flange could cause it to separate from the drum portion of the reel, and could result in total loss. Avoid letting fork-lift blades to come in contact with the rope.

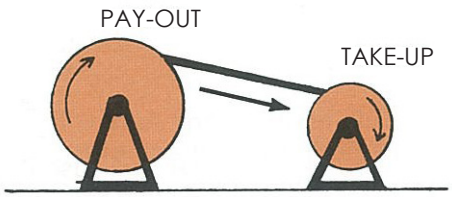
STORAGE
Prior to use, wire rope should be kept away from moisture, regardless of its packaging. Keeping the rope from coming in direct contact with the floor and avoiding dust and chemically-laden atmospheres are also advised. Low, ambient temperatures are necessary in keeping the lubrication from thinning out.

LUBRICATION
Like any machinery with moving parts, operating ropes require a sufficient amount of lubrication.
All ropes, during manufacture, receive a specified amount of lubrication, with a base (in most cases) of either Silicone, Petroleum, or Asphalt. This lubrication provides ample protection for a reasonable time when stored under proper conditions.
However, the lubrication applied during manufacturing does not usually last through the service life of the rope. Periodic application is therefore required. Field lubrication should possess the following qualities:
A) A viscosity capable of reaching the inner wires.
B) Sufficient adhesion to remain on the rope.
C) A resistance to oxidation.
D) A high film strength.



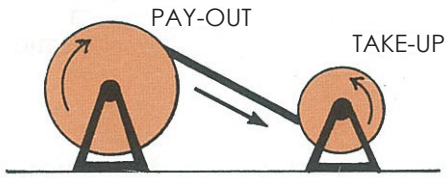
The illustrations above are proper methods of appling lubrication to a rope in service. The arrows indicate the direction of the ropes' movement.

Correct Re-Spooling



OVER-WIND TO OVER-WIND

Improper Re-Spooling



OVER-WIND TO UNDER-WIND OR
VICE-VERSA CAUSES TWISTING.

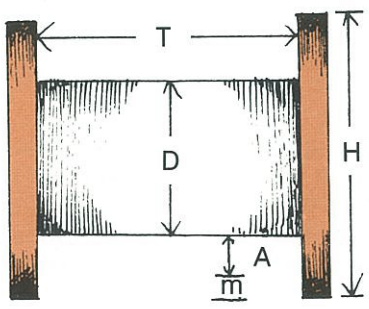
UNREELING AND UNCOILING

Unwinding wire rope from it's original reel to another reel, coil, or drum requires careful attention. As shown in the illustration to the left, it is advised that the rope travel from the top of the pay-out to the top of the take-up. Doing the opposite will cause reverse bending, as evidence by the fact that the spools are traveling in opposite directions. In most cases, this reverse bending will cause the rope to become livelier and harder to handle, inevitably resulting in twists and kinks. When unwinding a coiled rope, simply free the outside end and roll the coil along the ground.

When re-spooling rope to other reels or drums, it is common practice to wind in uniform layers, with each layer set into the grooves formed between 2 wraps of the previous layer. Bearing this uniformity in mind, the formula below is a reliable method for figuring spool capacity for a given rope diameter. It takes into consideration a normal oversize in diameter, but can vary depending upon construction and actual dimensions of the reel or drum. A clearance ("m") is important in avoiding damage to the wire rope.

FORMULA FOR SPOOLING CAPACITY

Let F = Factor for wire rope size (shown below)
H = Diameter of flange in inches
D = Diameter of drum in inches
A = Depth of space on flange in inches
T = Width (or "traverse") between flanges in inches
m = Margin for Rope Clearance



The formula is
F x A x T x (D + A) = maximum capacity. (Feet)
Table of Size Factors (.2618 ÷ diameter^2):

Rope Diameter	Factor	Rope Diameter	Factor
1/4"	4.19	3/4"	.465
5/16"	2.68	7/8"	.342
3/8"	1.86	1"	.262
7/16"	1.37	1-1/8"	.207
1/2"	1.05	1-1/4"	.168
9/16"	.827	1-1/2"	.116
5/8"	.670		

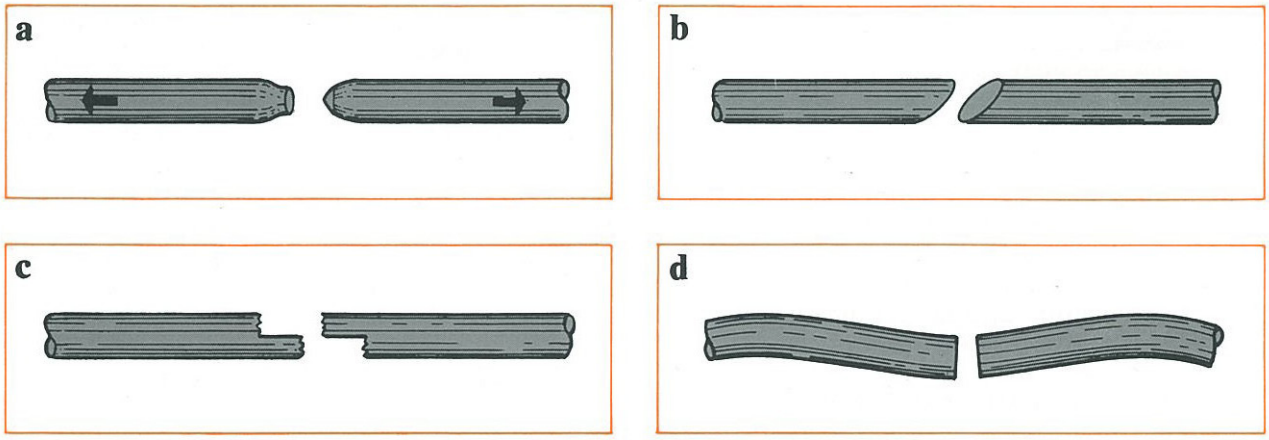
WIRE ROPE INSPECTION

So that optimum safety and performance is achieved, it is important to:
- Consult industry standards and OSHA requirements
- Inspect rope and equipment for any flaws prior to installation
- Periodically inspect rope and equipment during use.

Wire rope may fail if it is damaged, abused, overused, or improperly maintained. Any rope with changes from its original appearance must be considered for replacement. Finding any of the following conditions is most likely a cause for replacement:

A) Reduction in rope diameter
B) Distortion of rope lay
C) Excessive external wear
D) Internal nicking
E) Peening
F) Scrubbing
G) Corrosion
H) Broken Wires

COMMON WIRE BREAKS



A wire broken under a tensile load that exceeds its strength is recognized by the “cup and cone” configuration at the fracture point (a). The *necking down* of the wire at this point shows that failure occurred while the wire retained its ductility. Shear-tensile fracture (b) occurs in wire subjected to a combination of transverse and axial loads. Fatigue breaks are usually characterized by squared-off ends perpendicular to the wire either straight across or Z-shaped (c & d).

SHEAVE GROOVES & ALLIGNMENT

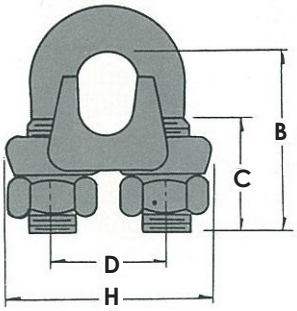
Matching groove diameter with rope diameter is critical to optimum service life. An old, worn rope that has been pulled down in diameter will cause the sheave or roller to wear down as well. When a new rope is installed, it is being forced to operate in this undersize groove. This will pinch the rope and inevitably result in:
- A decrease of strand & wire clearance
- Increased abrasion
- Increased bending stress
- Internal nicking

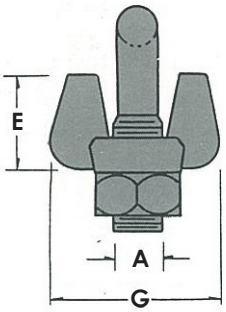
Sheaves that are running out of allignment with the axis of the rope, along with sheaves running on worn bushings, will cause the rope to chafe against the flange. This will create premature failure of both the rope and the sheave.

DIAGNOSTIC GUIDE TO COMMON WIRE ROPE DEGRADATION

MODE	SYMPTOMS	POSSIBLE CAUSES
Fatigue	Wire break is transverse—either straight across or Z shape. Broken ends will appear grainy.	Check for rope bent around too small a radius; vibration or whipping; wobbly sheaves; rollers too small; reverse bends, bent shafts; tight grooves; corrosion; small drums & sheaves; incorrect rope construction; improper installation; poor end terminations. (In the absence of other modes of degradation, all rope will eventually fail in fatigue.)
Tension	Wire break reveals a mixture of cup and cone fracture and shear breaks.	Check for overloads; sticky, grabby clutches; jerky conditions; loose bearing on drum; fast starts, fast stops; broken sheave flange; wrong rope size & grade; poor end terminations. Check for too great a strain on rope after factors of degradation have weakened it.
Abrasion	Wire break mainly displays outer wires worn smooth to knife edge thinness. Wire broken by abrasion in combination with another factor will show a combination break.	Check for change in rope or sheave size; change in load; overburden change; frozen or stuck sheaves; soft rollers, sheaves or drums; excessive fleet angle; misalignment of sheaves; kinks; improperly attached fittings; grit & sand; objects imbedded in rope; improper grooving.
Abrasion plus Fatigue	Reduced cross-section is broken off square thereby producing a chisel shape.	A long term condition normal to the operating process.
Abrasion plus Tension	Reduced cross-section is necked down as in a cup and cone configuration. Tensile break produces a chisel shape.	A long term condition normal to the operating process.
Cut or Gouged or Rough Wire	Wire ends are pinched down, mashed and/or cut in a rough diagonal shear-like manner.	Check on all the above conditions for mechanical abuse, or either abnomal or accidental forces during installation.
Torsion or Twisting	Wire ends show evidence of twist and/or cork-screw effect.	Check on all the above conditions for mechanical abuse, or either abnomal or accidental forces during installation.
Mashing	Wires are flattened and spread at broken ends.	Check on all the above conditions for mechanical abuse, or either abnomal or accidental forces during installation. (This is a common occurrence on the drum.)
Corrosion	Wire surfaces are pitted with break showing evidence either of fatigue tension or abrasion.	Indicates improper lubrication or storage, or a corrosive environment.

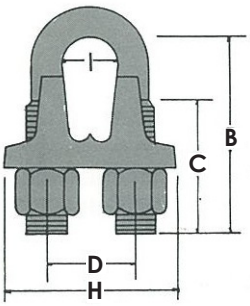
WIRE ROPE CLIPS

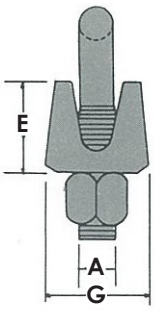




Drop-Forged Wire Rope Clips
Hot Dipped Galvanized
Federal Specification FF-C-450D Type I, Class 1

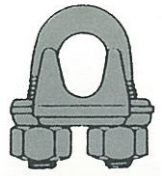
Clip & Rope Size	DIMENSIONS IN INCHES							Wt. Per 100 Pcs. Lbs.	No. of Clips Required	Amt. of Rope to Turn Back In.	Torque in Lb/Ft
	A	B	C	D	E	G	H				
1/4	5/16	1 1/32	1/2	3/4	21/32	1 3/16	1 7/16	18	2	4 3/4	15
5/16	3/8	1 3/8	3/4	7/8	23/32	1 5/16	1 11/16	30	2	5 1/4	30
3/8	7/16	1 1/2	3/4	1	29/32	1 5/8	1 15/16	42	2	6 1/2	45
1/2	1/2	1 7/8	1	1 3/16	1 1/8	1 29/32	2 9/32	75	3	11 1/2	65
5/8	9/16	2 3/8	1 1/4	1 5/16	1 11/32	2 1/18	2 1/2	100	3	12	95
3/4	5/8	2 3/4	1 7/16	1 1/2	1 13/32	2 1/4	2 27/32	150	4	18	130
7/8	3/4	3 1/8	1 5/8	1 3/4	1 19/32	2 7/16	3 5/32	240	4	19	225
1	3/4	3 1/2	1 13/16	1 7/8	1 25/32	2 5/8	3 15/32	250	5	26	225
1 1/8	3/4	3 7/8	2	2	1 29/32	2 13/16	3 19/32	310	6	34	225





Malleable Wire Rope Clips
Electro Galvanized
Federal Specification FF-C-450D Type I, Class 2

Clip & Rope Size	DIMENSIONS IN INCHES							Wt. Per 100 Pcs. Lbs.	No. of Clips Required	Amt. of Rope to Turn Back In.	Torque in Lb/Ft
	A	B	C	D	E	G	H				
1/16	3/16	13/16	1/2	15/32	15/32	1/2	15/16	3	3	3 1/4	4.5
1/8	3/16	13/16	1/2	15/32	1/2	19/32	15/16	4	3	3 1/4	4.5
3/16	1/4	31/32	5/8	19/32	17/32	5/8	1 3/32	6 1/2	3	3 3/4	7.5
1/4	5/16	1 3/16	3/4	3/4	21/32	23/32	1 1/4	13	3	4 3/4	15
5/16	5/16	1 5/16	27/32	13/16	23/32	3/4	1 7/16	15	3	5 1/4	30
3/8	3/8	1 5/8	1	15/16	27/32	7/8	1 19/32	21	3	6 1/2	45
1/2	7/16	2	1 3/16	1 1/16	1	1 1/8	1 27/32	37	4	11 1/2	65
5/8	1/2	2 1/4	1 3/8	1 1/4	1 3/16	1 11/32	2 1/8	59	4	12	95
3/4	9/16	2 9/16	1 9/16	1 3/8	1 7/16	1 5/8	2 13/32	84	5	18	130
7/8	5/8	3 1/16	1 13/16	1 5/8	1 3/4	1 7/8	2 7/8	125	5	19	225
1	5/8	3 7/16	2	1 7/8	2 1/16	2	3	166	6	26	225
1 1/8	3/4	4 1/8	2 3/4	2 1/16	2 3/16	2 1/8	3 7/16	243	7	34	225



Type 316 Stainless Steel Wire Rope Clips Drop-Forged

Metric Size	Fits Cable Size	No. of Clips Required	Weight in Lbs. Each
2mm	1/16"	2	.024
2mm	3/32"	2	.024
3mm	1/8"	2	.035
5mm	3/16"	2	.06
6mm	1/4"	2	.18
8mm	5/16"	2	.31
10mm	3/8"	2	.31
12mm	1/2"	3	.63
16mm	5/8"	3	1.0
19mm	3/4"	4	1.5
26mm	1"	5	2.7

Refer to Galvanized Charts for Turn-Back & Torque Requirements.

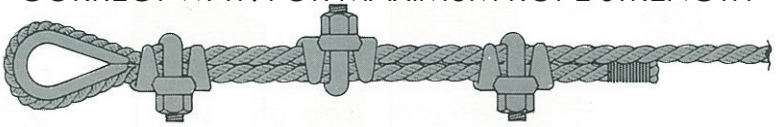
Oval & Stop Sleeves Aluminum and Zinc-Plated Copper

Cable Dia.	Weight per hundred pieces (Approximate)			
	Aluminum Ovals	Copper Ovals	Aluminum Stops	Copper Stops
1/16	.10	.275	.06	.19
3/32	.32	.664	.23	.78
1/8	.80	1.72	.21	.70
5/32	.80	2.79	.37	1.18
3/16	1.52	5.45	.35	1.06
1/4	2.52	7.54	2.10	6.20
5/16	4.35	11.86	—	5.20
3/8	5.82	17.60	—	4.40
1/2	19.0	39.6	—	—

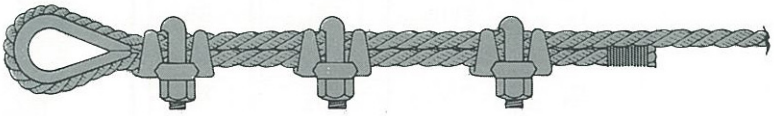
Some items also available in Stainless Steel.

APPLYING U-BOLT CLIPS

CORRECT WAY: FOR MAXIMUM ROPE STRENGTH

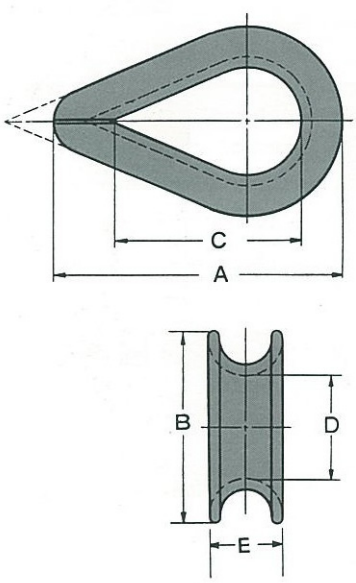


WRONG WAY: CLIPS STAGGERED



WRONG WAY: CLIPS REVERSED

1) Turn back the specified amount of rope from the thimble. Apply the first clip one base width from the dead end of the rope. Tighten to specified torque.
2) Apply the next clip as near the loop as possible. Turn on nuts firm but do not tighten.
3) Space additional clips (if required) evenly between the first two. Turn on nuts firm but do not tighten.
4) Take up rope slack and tighten all nuts to specified torque.
5) Apply initial load and re-tighten to specified torque.



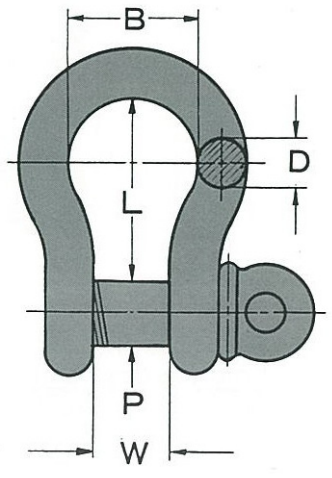
Galvanized Heavy-Duty Thimbles
Fed. Spec. FF-T-276B, Type III

For Rope Dia.	Weight Lbs. Each	Max Pin Dia.	Dimensions (Inches)				
			Overall Length A	Overall Width B	Inside Length C	Inside Width D	Thickness E
1/4"	.075	13/16"	2 3/16	1 1/2	1 5/8	7/8	13/32
5/16"	.14	15/16"	2 1/2	1 13/16	1 7/8	1 1/16	1/2
3/8"	.25	1 1/16"	2 7/8	2 1/8	2 1/8	1 1/8	21/32
1/2"-9/16"	.51	1 7/16"	3 5/8	2 9/16	2 3/4	1 1/2	27/32
5/8"	.75	1 5/8"	4 1/4	3	3 1/4	1 3/4	1
3/4"	1.47	1 7/8"	5	3 1/2	3 3/4	2	1 1/4
7/8"	1.85	2 1/8"	5 1/2	4	4 1/4	2 1/4	1 3/8
1"	3.00	2 3/8"	6 1/8	4 3/8	4 1/2	2 1/2	1 9/16
1 1/8"-1 1/4"	3.80	2 3/4"	7	5 5/8	5 1/8	2 7/8	1 7/8
1 3/8"-1 1/2"	11.00	3 1/4"	9 1/16	7 1/8	6 1/2	3 1/2	2 5/8

Some items also available in Light-Duty.

Galvanized Screw-Pin Anchor Shackles
Forged Carbon Steel • Alloy Pins
Fed. Spec. RR-C-271B, Type IV - Class 1

Nominal Shackle Size (D)	Working Load Limit Tons	Weight Each Lbs.	Dimensions (Inches)			
			Inside Length (L)	Inside Width (W)	Inside Bow (B)	Pin Dia. (P)
1/4"	1/2	.13	1 1/8	1/2	25/32	5/16
5/16"	3/4	.21	1 7/32	17/32	27/32	3/8
3/8"	1	.33	1 7/16	21/32	1 1/32	7/16
1/2"	2	.76	1 7/8	13/16	1 5/16	5/8
5/8"	3 1/4	1.44	2 3/8	1 1/16	1 11/16	3/4
3/4"	4 3/4	2.32	2 13/16	1 1/4	2	7/8
7/8"	6 1/2	3.50	3 7/16	1 7/16	2 1/4	1
1"	8 1/2	5.19	3 3/4	1 11/16	2 11/16	1 1/8
1 1/8"	9 1/2	6.97	4 1/4	1 13/16	2 29/32	1 1/4
1 1/4"	12	9.50	4 11/16	2 1/32	3 1/8	1 3/8
1 1/2"	17	16.5	5 3/4	2 3/8	3 7/8	1 5/8

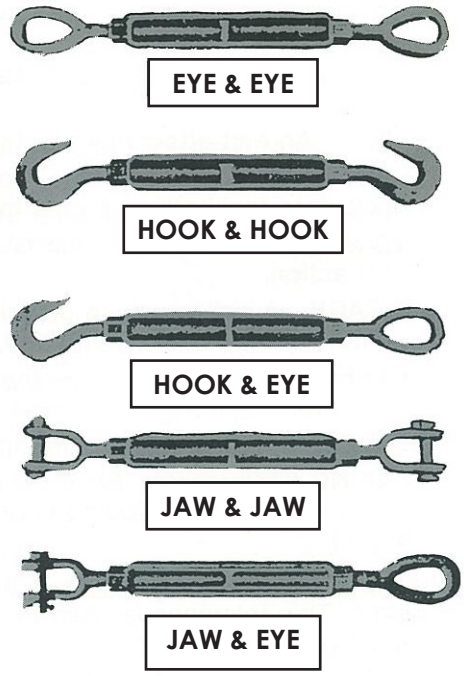


Above working load limit is based on a design factor of 6:1.
Shackles stamped with nominal stock size and working load limit.
Some items also available in Stainless Steel.

Galvanized Drop-Forged Turnbuckles • Fed. Spec. FF-T-791B

Size (Diameter X Take-Up)	Average Approx. Weight Each (Lbs.)	Working Load Limit Lbs.: H/H H/E	Working Load Limit Lbs.: E/E J/E J/J	Average Over-All Length: Ends In Closed Position
1/4" x 4"	.33	400	500	8 1/4"
3/8" x 6"	.84	1,000	1,200	11 7/8"
1/2" x 6"	1.60	1,500	2,200	13 5/16"
1/2" x 12"	2.19	1,500	2,200	19 5/16"
5/8" x 12"	3.50	2,250	3,500	21 1/2"
3/4" x 12"	5.87	3,000	5,200	23"
3/4" x 18"	7.33	3,000	5,200	29"
1" x 12"	12.04	5,000	10,000	26 5/8"
1 1/4" x 12"	21.27	5,000	15,200	29 7/8"
1 1/2" x 12"	31.20	7,500	21,400	32 3/8"

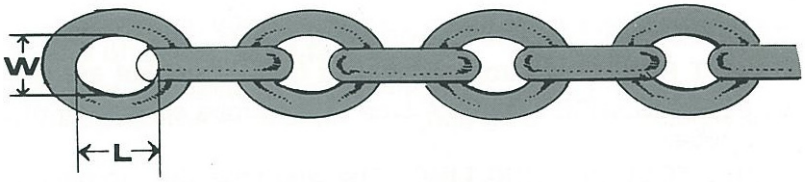
Above Working Load Limit is based on a design factor of 5:1 Some items also available in Stainless Steel.



Type 304 Stainless Steel Thimbles Standard-Duty

For Rope Dia.	Maximum Pin Dia.	Pounds Per C Pcs.
1/8"	5/8"	3.3
3/16"	5/8"	3.3
1/4"	5/8"	3.3
5/16"	3/4"	4.0
3/8"	7/8"	7.5
1/2"	1 1/16"	13.8
5/8"	1 1/4"	36.0
3/4"	1 1/2"	120
1"	2 3/8"	220

Some items also available in Type 316.



Type 304 Stainless Steel Chain

Trade Size	Actual Stock Dia.	Inside Length (L)	Inside Width (W)	Weight Lbs. Per CFT	Feet Per Drum	WLL Lbs.
1/8"	.158"	.89"	.29"	22	400	410
3/16"	.217"	.95"	.41"	42	400	930
1/4"	.280"	1.00"	.50"	74	200	1,500
5/16"	.335"	1.10"	.50"	105	200	2,300
3/8"	.394"	1.23"	.63"	150	100	3,300
1/2"	.512"	1.50"	.81"	255	100	5,500

Above Working Load Limit (WLL) is based on a design factor of 5:1
Some items also available in Type 316.

GLOSSARY

ABRASION Frictional surface wear on the wires of a wire rope.
AGGREGATE STRENGTH The strength derived by totalling the individual breaking strengths of the elements of the strand or rope. This strength does not give recognition to the reduction in strength resulting from the angularity of the elements in the rope, or other factors that may affect efficiency.
BECKET An end attachment to facilitate wire rope installation.
BECKET LOOP A loop of small rope or strand fastened to the end of a larger wire rope. Its function is to facilitate wire rope installation.
BENDING STRESS Stress that is imposed on the wires of a strand or rope by a bending or curving action.
BIRDCAGE A colloquialism descriptive of the appearance of a wire rope forced into compression. The outer strands form a *cage* and, at times, displace the core.
BOOM HOIST LINE Wire rope that operates the boom hoist system of derricks, cranes, draglines, shovels, etc.
BOOM PENDANT A non-operating rope or strand with end terminations to support the boom.
BREAKING STRENGTH *Breaking Strength* is the ultimate load at which a tensile failure occurs in the sample of wire rope being tested. (Note: The term *breaking strength* is synonymous with actual strength.)

Minimum Acceptance Strength is that strength which is $2\frac{1}{2}\%$ lower than the catalog or nominal strength. This tolerance is used to offset variables that occur during sample preparation and actual physical test of a wire rope.

Nominal Strength is the published (catalog) strength calculated by a standard procedure that is accepted by the wire rope industry. The wire rope manufacturer designs wire rope to this strength, and the user should consider this strength when making design calculations.

BRIDLE SLING A multi-leg wire rope SLING.
BRIGHT ROPE Wire rope fabricated from wires that are not coated.
CABLE-LAID WIRE ROPE A type of wire rope consisting of several wire ropes laid into a single wire rope.
CABLE TOOL DRILLING LINE The wire rope used to operate the cutting tools in the *cable tool* drilling method (i.e., rope drilling).
CASING LINE Wire rope used to install oil well casings.
CHOKER ROPE A short wire rope sling that forms a slip noose around an object that is to be moved or lifted.
CLASSIFICATION Group, or family designation based on wire rope constructions with common strengths and weights listed under the broad designation.
COIL Circular bundle or package of wire rope that is not affixed to a reel.
COME ALONG Device for making a temporary grip on a wire rope.
CONICAL DRUM Grooved hoisting drum with a varying diameter. See DRUM.
CONSTRUCTION Geometric design description of the wire rope's cross section. This includes the number of STRANDS, the number of WIRES per strand and the pattern of wire arrangement in each STRAND.

SECTION 5

CONTINUOUS BEND Reeving of the wire rope over sheaves and drums so that it bends in one direction, as opposed to REVERSE BEND.
CORD Term applied to a small diameter specialty wire rope or strand.
CORING LINE Wire rope used to operate the coring tool that is used to take core samples during oil well drilling.
CORROSION-RESISTING STEEL Chrome-nickel steel alloys designed for increased resistance to corrosion.
CORRUGATED Term used to describe the grooves of a SHEAVE or DRUM after these have been worn down to a point where they show an impression of a wire rope.
COVER WIRES Outer layer of wires.
CROWD ROPE A wire rope used to drive or force a power shovel bucket into the material that is to be handled.
DEFLECTION A) The sag of a rope in a span. Usually measured at mid-span as the depth from the chord joining the tops of the two supports. B) Any deviation from a straight line.
DESIGN FACTOR In a wire rope, it is the ratio of the nominal strength to the total working load.
DOG-LEG Permanent bend or kink in a wire rope, caused by improper use or handling.
DRAGLINE A) Wire rope used for pulling excavating or drag buckets, and B) name applied to a specific type of excavator.
EFFICIENCY Ratio of a wire rope's actual breaking strength and the aggregate strength of all individual wires tested separately—usually expressed as a percentage.
ELASTIC LIMIT Stress limit above which permanent deformation will take place within the material.
ENDLESS ROPE Rope with ends spliced together to form a single continuous loop.
EQUALIZING SHEAVE The sheave at the center of a rope system over which no rope movement occurs other than equalizing movement. It is frequently overlooked during crane inspections, with disastrous consequences. It can be a source of sever degradation.
EXTRA FLEXIBLE WIRE ROPE An ambiguous and archaic term sometimes applied to describe wire ropes in the 8 x 19 class and 6 x 37 class. The term is so indefinite as to be meaningless and is in disfavor today.
EXTRA HIGH-STRENGTH STRAND A grade of galvanized strand (EHS).
FACTOR OF SAFETY In the wire rope industry, this term was originally used to express the ratio of nominal strength to the total working load. The term is no longer used since it implies a permanent existence for this ratio when, in actuality, the rope strength begins to reduce the moment it is placed in service. See DESIGN FACTOR.
FATIGUE As applied to wire rope, the term usually refers to the process of progressive fracture resulting from the bending of individual wires. These fractures may and usually do occur at bending stresses well below the ultimate strength of the material; it is not an abnormality although it may be accelerated due to conditions in the rope such as rust, lack of lubrication, or improper selection of construction.
FERRULE A metallic button, usually cylindrical in shape, normally fastened to a wire rope by swaging but sometimes by spelter socketing.
FIBER CENTER Cord or rope of vegetable or synthetic fiber used as the axial member of a strand.

FILLER WIRE Small spacer wires within a strand which help position and support other wires. Also the name for the type of strand pattern utilizing filler wires.
FLATTENED STRAND ROPE Wire rope that is made either of oval or triangular shaped strands in order to form a flattened rope surface.
FLEET ANGLE That angle between the rope's position at the extreme end wrap on a drum, and a line drawn perpendicular to the axis of the drum through the center of the nearest fixed sheave. See DRUM and SHEAVE.
GRADE Wire rope or strand classification by strength and/or type of material, i.e., Improved Plow Steel, Type 304 Stainless, Phosphor Bronze, etc. It does not imply a strength of the basic wire used to meet the rope's nominal strength.
GRAIN SHOVEL ROPE 6 x 19 Marline clad rope used for handling grain in scoops.
GROOVED DRUM Drum with a grooved surface that accommodates the rope and guides it for proper winding.
GUY LINE Strand or rope, usually galvanized, for stabilizing or maintaining a structure in fixed position.
HAULAGE ROPE Wire Rope used for pulling movable devices such as cars that roll on a track.
HOLDING LINE Wire Rope on a clamshell or orange peel bucket that suspends the bucket while the closing line is released to dump its load.
IDLER Sheave or roller used to guide or support a rope. See SHEAVE.
INCLINE ROPE Rope used in the operation of cars on an inclined haulage.
KINK A unique deformation of a wire rope caused by a loop of rope being pulled down tight. It represents irreparable damage to and indeterminate loss of strength in the rope.
LEAD LINE That part of a rope tackle leading from the first, or fast, sheave to the drum. See DRUM and SHEAVE.
LOCKED COIL STRAND Smooth-surfaced strand ordinarily constructed of shaped outer wires arranged in concentric layers around a center of round wires.
MARLINE-CLAD ROPE Rope with individual strands spirally wrapped with Marline.
MARTENSITE A brittle micro-constituent of steel formed when the steel is heated above its critical temperature and rapidly quenched. This occurs in wire rope as a result of frictional heating and the mass cooling effect of the cold metal beneath. Martensite cracks very easily, and such cracks can propagate from the surface through the entire wire.
MILKING Sometimes called IRONING, it is the progressive movement of strands along the axis of the rope, resulting from the rope's movement through a restricted passage such as a tight sheave.
MODULUS OF ELASTICITY Mathematical quantity expressing the ratio, within the elastic limit, between a definite range of unit stress on a wire rope and the corresponding unit elongation.
NON-ROTATING WIRE ROPE Term, now abandoned, referring to 19 x 7 or 18 x 7 rope. See ROTATION RESISTANT ROPE.
PEENING Permanent distortion resulting from cold plastic metal deformation of the outer wires. Usually caused by *pounding* against a sheave or machine member, or by *heavy operating pressure* between rope and sheave, rope and drum, or rope and adjacent wrap of rope.
PREFORMED WIRE ROPE Wire rope in which the strands are permanently formed during fabrication into the helical shape they will assume in the wire rope.

PRESTRETCHING Subjecting a wire rope or a strand to tension prior to its intended application, for an extent and over a period of time sufficient to remove most of the CONSTRUCTIONAL STRETCH.
RATED CAPACITY The load which a new wire rope or wire rope sling may handle under given operating conditions and at an assumed DESIGN FACTOR.
REEVE To pass a rope through a hole or around a system of sheaves.
RESERVE STRENGTH The strength of a rope exclusive of the outer wires.
REVERSE BEND Reeving a wire rope over sheaves and drums so that it bends in opposing directions. See REEVE.
ROTARY LINE On a rotary drilling rig, it is the wire rope used for raising and lowering the drill pipe, as well as for controlling its position.
ROTATION-RESISTANT ROPE A wire rope consisting of an inner layer of strand laid in one direction covered by a layer of strand laid in the opposite direction. This has the effect of counteracting torque by reducing the tendency of finished rope to rotate.
SAFE WORKING LOAD This term is potentially misleading and is, therefore, in disfavor. Essentially, it refers to that portion of the nominal rope strength that can be applied either to move or sustain a load. It is misleading because it is only valid when the rope is new and equipment is in good condition. See RATED CAPACITY.
SEALE The name for a type of strand pattern that has two adjacent layers laid in one operation with any number of uniform sized wires in the outer layer, and with the same number of uniform but smaller sized wires in the inner layer.
SERVE To cover the surface of a wire rope or strand with a fiber cord or wire wrapping.

SHACKLE A U- or anchor-shaped fitting with pin.
SPECIAL FLEXIBLE WIRE ROPE Term sometimes used to describe 6 x 37 classification wire rope.
SPIRAL GROOVE A continuous helical groove that follows a path on and around a drum face, similar to a screw thread. See DRUM.
TAG LINE A small wire rope used to prevent rotation of a load.
TURN Synonymous with the term WRAP; it signifies a single wrap around a drum.
WARRINGTON The name for a type of strand pattern that is characterized by having one of its wire layers (usually the outer) made up of an arrangement of alternately large and small wires.
WIRE ROPE A plurality of wire strands helically laid about an axis.

COMMON WIRE ROPE ABBREVIATIONS & SYMBOLS FOR CHEMICAL ELEMENTS

BRT	Bright
C	Carbon
Cr	Chromium
DF	Drop-Forged
EHS	Extra-High Strength
EIPS	Extra Improved Plow Steel
FC	Fiber Core
Fe	Iron
(FW)	Filler-Wire
FSR	Flattened Strand Rope
GAC	Galvanized Aircraft Cable
GALV	Galvanized
HD	Heavy-Duty
IPS	Improved Plow Steel
IWRC	Independent Wire Rope Core
LD	Light Duty
LLL	Left Lang Lay
LRL	Left Regular Lay
Mall	Malleable
mm	Millimeter
Mn	Manganese
Mo	Molybdenum
Ni	Nickel
P	Phosphorus
PC	Poly Core
PREF	Preformed
PVC	Poly-Vinyl Chloride
RLL	Right Lang Lay
RRL	Right Regular Lay
S	Sulfur
(S)	Seale
SD	Standard Duty
SSAC	Stainless Steel Aircraft Cable
WR	Wire Rope
(WS)	Warrington-Seale
WSC	Wire Strand Core

CONVERSIONS

LINEAR MEASURE

1 millimeter = .03937 inches
1 centimeter = 10 millimeters
1 decimeter = 100 millimeters
1 meter = 3.28083 feet
1 inch = 25.4 millimeters
1kilometer = 3280.83 feet
1 mile = 1.60935 kilometers

WEIGHTS

1 metric ton = 2204.6 pounds
1 kilogram = 2.2046 pounds
1 pound = 453.6 grams

CAPACITY

1 liter = .03531 cubic feet
1 cubic foot = 28.317 liters
1 gallon = 3.785 liters

DECIMAL & METRIC EQUIVALENTS

Fraction	Decimal	Metric
1/64	.015625	.397 mm
1/32	.03125	.794 mm
3/64	.04688	1.191 mm
1/16	.0625	1.588 mm
5/64	.07813	1.985 mm
3/32	.09375	2.381 mm
7/64	.10938	2.778 mm
1/8	.125	3.175 mm
9/64	.14063	3.572 mm
5/32	.15625	3.969 mm
3/16	.1875	4.763 mm
7/32	.21875	5.556 mm

Fraction	Decimal	Metric
1/4	.250	6.350 mm
9/32	.28125	7.144 mm
5/16	.3125	7.938 mm
3/8	.375	9.525 mm
7/16	.4375	11.113 mm
1/2	.500	12.700 mm
9/16	.5625	14.288 mm
5/8	.625	15.875 mm
11/16	.6875	17.463 mm
3/4	.750	19.050 mm
7/8	.875	22.225 mm
1	1.00	25.400 mm

HOW TO ORDER

Shown below are examples of properly written orders for wire rope, aircraft cable, and hardware. Following this method in the order given will ensure the order to be correctly and promptly filled.

Wire Rope:

A	B	C	D	E	F	G	H	I
2	x	5000 ft.	1/2"	6 x 25	RRL	EIPS	BRT.	IWRC, A-1

A - Number of pieces
B - Length
C - Diameter
D - Construction
E - Lay
F - Grade
G- Finish
H - Core
I - Lubrication

AIRCRAFT CABLE:

A	B	C	D	E
2	x 5000 ft.	3/8"	7x19	GAC

A - Number of pieces
B - Length
C - Diameter
D - Construction
E - Finish or grade

FITTINGS:

A	B	C
500 pcs.	1/2"	Galv. Drop-Forged Wire Rope Clips

A - Number of pieces
B - Size
C - Product Description

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The Committee of Wire Rope Producers
American Iron & Steel Institute
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Further information is available through:

American National Standards Institute (ANSI)
New York, NY (212) 354-3300

American Petroleum Institute (API)
Washington, DC (202)682-8375

American Society for Testing Materials (ASTM)
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Occupational Safety & Health Administration (OSHA)
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Wire Rope Technical Board
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