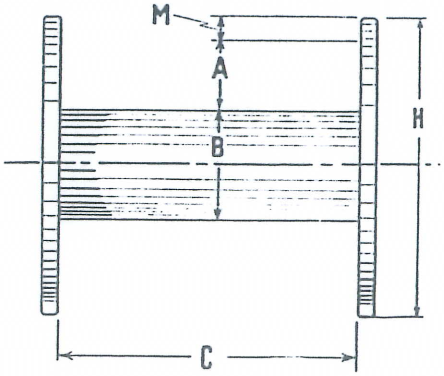
# Capacity of Drum or Reel

The following formula may be used for computing the rope capacity (L) in feet for any size drum or reel. This formula is based on uniform rope winding and will not give correct results if rope is wound non-uniformly on the reel. The dimensions shown in figure below are to be taken in inches.




L= (A + B) x A x C x K; where:—
L= Rope Length in Feet
A= Depth of Rope Layer in inches = $\frac{H-B}{2}$ —M
B= Diameter of Drum in inches
C= Width between Reel Flanges in inches
M= Desired Clearance
K= Constant as shown in table below.

| Nominal Rope Dia. | K | Nominal Rope Dia. | K | Nominal Rope Dia. | K |
|---|---|---|---|---|---|
| 1/32" | 270. | 3/4" | .466 | 3" | .029 |
| 3/64 | 119. | 13/16 | .397 | 3 1/8 | .027 |
| 1/16 | 67.2 | 7/8 | .342 | 3 1/4 | .025 |
| 5/64 | 43.0 | 1 | .262 | 3 3/8 | .023 |
| 3/32 | 29.8 | 1 1/8 | .207 | 3 1/2 | .021 |
| 7/64 | 21.8 | 1 1/4 | .168 | 3 5/8 | .020 |
| 1/8 | 16.8 | 1 3/8 | .139 | 3 3/4 | .019 |
| 5/32 | 10.7 | 1 1/2 | .116 | 3 7/8 | .017 |
| 3/16 | 7.44 | 1 5/8 | .099 | 4 | .016 |
| 7/32 | 5.48 | 1 3/4 | .086 | 4 1/8 | .0154 |
| 1/4 | 4.19 | 1 7/8 | .075 | 4 1/4 | .015 |
| 9/32 | 3.31 | 2 | .066 | 4 3/8 | .014 |
| 5/16 | 2.68 | 2 1/8 | .058 | 4 1/2 | .013 |
| 3/8 | 1.86 | 2 1/4 | .052 | 4 5/8 | .012 |
| 7/16 | 1.37 | 2 3/8 | .046 | 4 3/4 | .0116 |
| 1/2 | 1.05 | 2 1/2 | .042 | 4 7/8 | .011 |
| 9/16 | .828 | 2 5/8 | .038 | 5 | .010 |
| 5/8 | .671 | 2 3/4 | .035 | | |
| 11/16 | .554 | 2 7/8 | .032 | | |

*Note:* Value of "K" is computed from the formula: $K = \frac{.262}{d^2}$ where d = nominal rope diameter as listed in catalog.

**MARK OVERHOLT**
**TIGER GENERAL, LLC**
**6867 Wooster Pike**
**Medina, OH 44256**
**Ph. 330-725-4949 Fax 330-725-6730**
**email: mark@tigergeneral.com**
**www.tigergeneral.com**

**The following information is NOT a complete discussion of wire rope or wire rope slings. WHAT FOLLOWS IS A BRIEF OUTLINE OF THE BASIC INFORMATION REQUIRED TO SAFELY USE WIRE ROPE AND WIRE ROPE SLINGS.**

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 NOMINAL STRENGTH, sometimes called CATALOG strength, of a wire rope applies ONLY to a NEW, UNUSED rope.

4. The Nominal Strength of a wire rope SHOULD BE CONSIDERED the straight line pull which will ACTUALLY BREAK a new, UNUSED rope. The Nominal Strength of a wire rope should NEVER BE USED AS ITS WORKING LOAD.

5. To determine the working load of a wire rope, the NOMINAL 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.

   For example, a Design Factor of "5" means that the Nominal 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 OSHA, by ANSI, by ASME and similar government and industrial organizations.

   No wire rope or wire rope sling should ever be installed or used without full knowledge and consideration of the Design Factor for the application.

6. WIRE ROPES WEAR OUT. The strength of a wire rope begins to decrease when the rope is put in use, and continues to decrease with each use.

7. NEVER OVERLOAD A WIRE ROPE. This means NEVER USE the rope where the load applied to it is greater than the working load determined by dividing the Nominal Strength of the rope by the appropriate Design Factor.

8. NEVER "SHOCK LOAD" a wire rope. A sudden application of force or load can cause both visible external damage 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 it is 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 FOR ALMOST EVERY WIRE ROPE INSTALLATION. The purpose of inspection is to determine whether or not a wire rope or wire rope sling 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 OSHA, ANSI, ASME and similar organizations.

    IF IN DOUBT, REPLACE THE ROPE.

    An inspection should include verification that none of the specified removal criteria for this usage are met by checking for such things as:

    - Surface wear: Normal and unusual.
    - Broken wires: Number and location.
    - Reduction in diameter.
    - Rope stretch (elongation).
    - Integrity of end attachments.
    - Evidence of abuse or contact with another object.
    - Heat damage.
    - Corrosion.

    In addition, an inspection should include the condition of sheaves, drums and other apparatus with which the rope makes contact.

11. When a wire rope has been removed from service because it is no longer suitable for use, 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 the rope assembly or rope system, and this must be given due consideration is 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 cause damage to a wire rope.
    - Broken wires mean a loss of strength.
    - Kinks permanently damage a wire rope and must be avoided.
    - Wire ropes are damaged by knots, and wire ropes with knots must never be used.
    - 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 wires and the resulting arcing will damage a wire rope.

# INSPECTION OF WIRE ROPE AND STRUCTURAL STRAND

## Wire Rope

Carefully conducted inspections are necessary to ascertain the condition of wire rope at various stages of its useful life. The object of wire rope inspection is to allow for removal of the rope from service before the rope's condition, as a result of usage, could pose a hazard to continued normal operations.

The individual making the inspection should be familiar with the product and the operation as his judgment is a most critical factor. Various safety codes, regulations, and publications give inspection requirements for specific applications.

The following inspection procedure, taken from the ASME B-30 series, serves as a model of typical inspection requirements.

### Frequent Inspection

All running ropes and slings in service should be visually inspected once each working day. A visual inspection consists of observation of all rope and end connections which can reasonably be expected to be in use during daily operations. These visual observations should be concerned with discovering gross damage such as listed below, which may be an immediate hazard:

- Distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement or core protrusion.
- General corrosion.
- Broken or cut strands.
- Number, distribution and type of visible broken wires.
- Lubrication.

Special care should be taken when inspecting portions subjected to rapid deterioration such as flange points, crossover points and repetitive pickup points on drums.

Special care should also be taken when inspecting certain ropes such as:

- Rotation-resistant ropes such as 19 x 7 and 8 x 19, because of their higher susceptibility to damage and increased deterioration when working on equipment with limited design parameters.
- Boom hoist ropes because of the difficulties of inspection and important nature of these ropes.

When damage is discovered, the rope should either be removed from service or given an inspection as detailed in the section below.

### Periodic Inspection

The inspection frequency should be determined by a qualified person and should be based on such factors as: expected rope life as determined by experience on the particular installation or similar installations, severity of environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads.

Periodic inspections with a signed report should be performed by an appointed or authorized person. This inspection should cover the *entire length* of rope. The individual wires in the strands of the rope should be visible to this person during the inspection. Any deterioration resulting in appreciable loss of original strength, such as described below, should be noted and determination made as to whether further use of the rope would constitute a hazard:

- Distortion of the rope such as kinking, birdcaging, crushing, unstranding, main strand displacement, or core protrusion.
- Reduction of rope diameter below normal diameter due to loss of core support, internal or external corrosion, or wear of outside wires.
- Severely corroded or broken wires at end connections.
- Severely corroded, cracked, bent, worn, or improperly applied end connections.
- Lubrication.

Special care should be taken when inspecting portions subjected to rapid deterioration such as the following:

- Portions in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited.
- Portions of the rope at or near terminal ends where corroded or broken wires may protrude.

### Rope Replacement

No precise rules can be given for determination of the exact time for replacement of rope, since many variable factors are involved. Continued use in this respect depends largely upon good judgment by an appointed or authorized person in evaluating remaining strength in a used rope, after allowance for deterioration disclosed by inspection. Continued rope operation depends upon this remaining strength.

Conditions such as the following should be sufficient reason for questioning continued use of the rope or increasing the frequency of inspection:

- In running ropes, six randomly distributed broken wires in one lay, or three broken wires in one strand in one lay. (The number of wire breaks beyond which concern should be shown varies with rope usage and construction. For general application 6 and 3 are satisfactory. Ropes used on overhead and gantry cranes (as defined in ASME B-30, 2-1983) can be inspected to 12 and 4. Rotation resistant ropes should be inspected to 4 and 2.)

Wire rope removal criteria are based on the use of steel sheaves. If synthetic sheaves are used, consult the sheave or equipment manufacturer.

• One outer wire broken at the contact point with the core of the rope which has worked its way out of the rope structure and protrudes or loops out from the rope structure.
• Wear of one-third the original diameter of outside individual wires.
• Kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure.
• Evidence of any heat damage from any cause.
• Valley breaks.
• Reductions from nominal rope diameter of more than:

| Reduction of | Nominal Rope Diameters |
|---|---|
| 1/64" | Up to & inc. 5/16" |
| 1/32" | over 5/16" thru 1/2" |
| 3/64" | over 1/2" thru 3/4" |
| 1/16" | over 3/4" thru 1-1/8" |
| 3/32" | over 1-1/8" |

• In standing ropes, more than two broken wires in one lay in section beyond end connections or more than one broken wire at an end connection.

Replacement rope shall have a strength rating at least as great as the original rope furnished by the equipment manufacturer or as originally specified. Any deviation from the original size, grade, or construction shall be specified by the equipment manufacturer, original design engineer, or a qualified person.

## Ropes Not In Regular Use

All rope which has been idle for a period of a month or more due to shutdown or storage of equipment on which it is installed should be given inspections as previously described before being placed in service. This inspection should be for all types of deterioration and should be performed by an appointed or authorized person.

## Inspection Records

Frequent Inspection—no records required.

Periodic Inspection: In order to establish data as a basis for judging the proper time for replacement a signed report of rope condition at each periodic inspection should be kept on file. This report should include points of deterioration previously described.

A long range inspection program should be established and include records of examination of ropes removed from service so a relationship can be established between visual observation and actual condition of the internal structure.

# Galvanized Structural Wire Strand

Carefully conducted inspections performed and recorded on a regular basis are necessary to ascertain the condition of structural strand at various stages of its useful life. The object of inspection is to allow for removal of the strand from service before its condition, as a result of usage, could pose a hazard to continued normal operations.

The individual making the inspection should be familiar with the operation, as his judgment is a most critical factor. Special care should be taken at end terminations or at dampener devices, as these are generally the most critical areas. Conditions such as corrosion, number, type and distribution of broken wires, and diameter reduction should be evaluated and compared with previous inspection results.

The actual condition of the strand and inspection history together can then be used to decide if continued use of the product is advisable.

**NOTE:** Special methods and techniques may be used by wire rope engineers or qualified persons to determine the possible existence of internal corrosion or broken wires in structural strand or similar conditions which may exist out of sight in terminal connections.

**EXAMPLE:** Wire breaks may sometimes occur just inside the nose of the socket making visual inspection difficult. Judgments on wire integrity can be made by tapping or "sounding" the wire by a person experienced in this inspection technique. If you have doubt about the method to use for inspection, or the condition of the strand or fitting, contact your nearest Bridon American Sales/Service location.

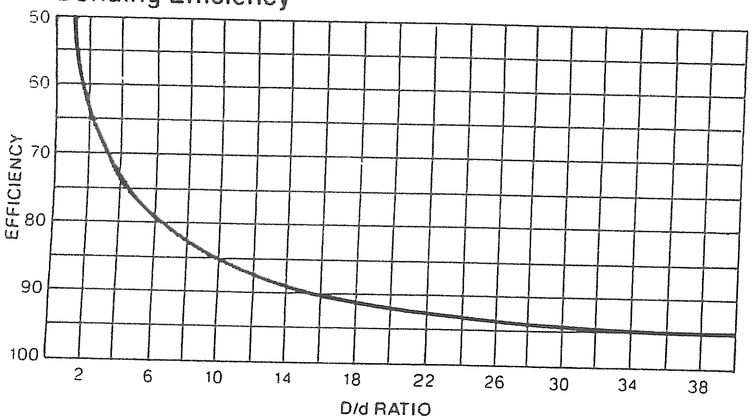
For further information on wire rope inspection refer to the American Iron & Steel Institute's Wire Rope Users Manual.

# INSTALLATION, OPERATION AND MAINTENANCE RECOMMENDATIONS

## Matching the Wire Rope with Sheaves and Drums

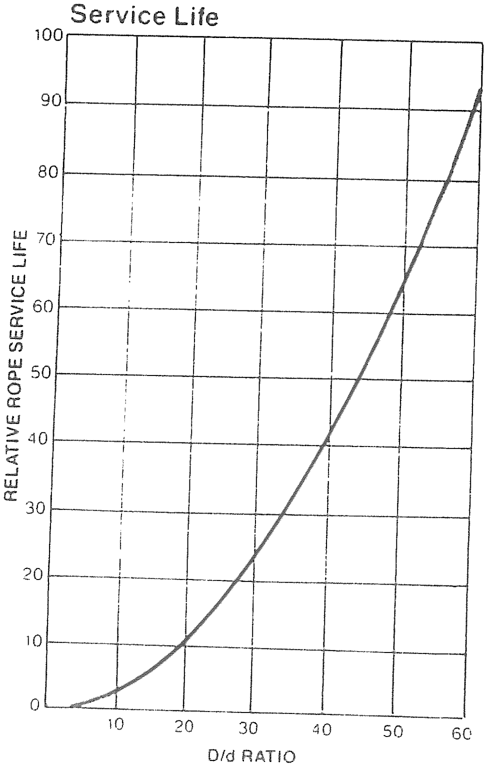
The ratio of the diameter of the wire rope to the diameter of operating sheaves and drums (D/d ratio) is particularly important to service life. A sheave or drum that is too small for the rope diameter will cause premature failure due to bending stresses.

### Bending Efficiency




Efficiency falls as the D/d ratio becomes smaller. This curve, based on static test data only, illustrates the decline of bending efficiency for 6 x 19 and 6 x 37 classification ropes as the D/d ratio is reduced.

### Service Life




Service life increases as the D/d ratio becomes larger. This curve, based on bending and tensile stresses only, illustrates the relative performance increase.

| Sheave Diameter Factors | | |
|---|---|---|
| *D/d Ratios<br>*D-Sheave Tread Diameter d-Nominal Rope Diameter | | |
| Rope Construction | Recommended | Minimum |
| 6 x 7 | 72 | 42 |
| 19 x 7 | 51 | 34 |
| 6 x 19 S | 51 | 34 |
| 6 x 21 FW | 45 | 30 |
| 6 x 25 FW | 39 | 26 |
| 6 x 36 WS | 35 | 23 |
| 8 x 25 FW | 32 | 21 |
| 6 x 41 WS | 32 | 21 |

To calculate the recommended or minimum sheave diameter for any given rope, find the rope construction and multiply the rope diameter by the value shown. (Ex.: Recommended sheave diameter for a 6 x 19 classification wire rope of ¾" diameter would be 51 x .75 = 38¼")

Rope speed also affects fatigue life. Higher operating rates require larger sheaves.

Reverse bends from one sheave to another should be avoided. Other factors that affect bending fatigue life are load, number of cycles and condition of the sheaves and drums. Consult Bridon American for specific recommendations.

## Matching Grooves to the Wire Rope

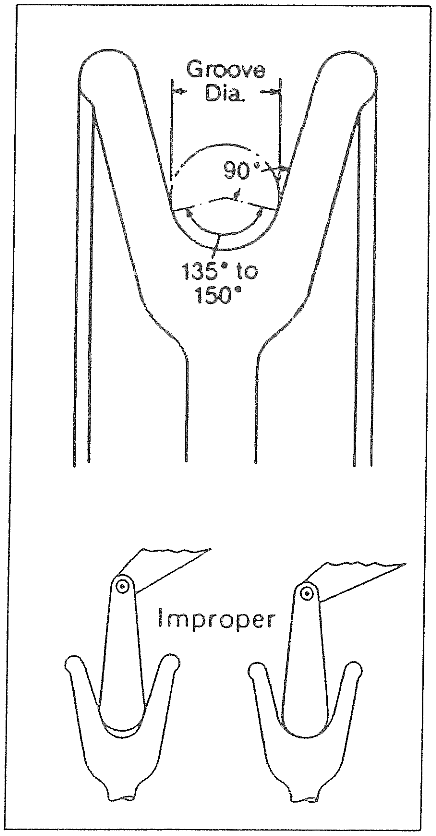
Grooves should be spaced so that one wrap of rope does not rub against the next wrap during operation.

Grooves in sheaves and drums should be slightly larger than the wire rope to permit the rope to adjust itself to the groove. Tight grooves will cause excessive wear to outer wires; large grooves do not support the rope properly.

Wire ropes are manufactured slightly larger than nominal size. Maximum allowable oversize tolerances are shown in the following table.

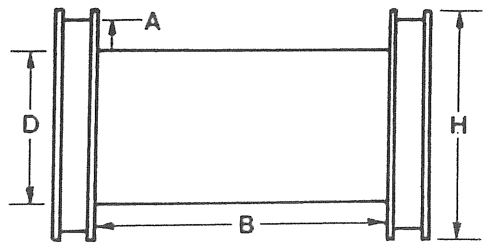
| Nominal Rope Diameter inches | Tolerance | |
|---|---|---|
| | Under | Over |
| up to ⅛ | – 0 | + 8% |
| over ⅛ to 3/16 | – 0 | + 7% |
| over 3/16 to ¼ | – 0 | + 6% |
| over ¼ | – 0 | + 5% |

As a rope is run through a groove, both become smaller. A used groove can be too small for a new rope; thus accelerating rope wear. A compromise between rope life and machining frequency must be made.




Grooves should have an arc of contact with the wire rope between 135 and 150 degrees. They should be tapered to permit the rope to enter and leave the groove smoothly. Field inspection groove guages are made to the nominal diameter of the rope plus ½ of the alllowable rope oversize tolerance. When the field inspection guage fits perfectly, the groove is at the minimum permissible contour.

## Calculating Drum Capacity




The length of rope that can be wound on a drum or reel may be calculated as follows. L = the length of rope in feet. All other dimensions are in inches.

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

K= Constant obtained by dividing .2618 by the square of the actual rope diameter.

| Values of K | | | |
|---|---|---|---|
| Rope Dia. | K | Rope Dia. | K |
| 1/4" | 3.29 | 1 1/8" | .191 |
| 5/16" | 2.21 | 1 1/4" | .152 |
| 3/8" | 1.58 | 1 3/8" | .127 |
| 7/16" | 1.19 | 1 1/2" | .107 |
| 1/2" | .925 | 1 5/8" | .0886 |
| 9/16" | .741 | 1 3/4" | .0770 |
| 5/8" | .607 | 1 7/8" | .0675 |
| 3/4" | .428 | 2" | .0597 |
| 7/8" | .308 | 2 1/8" | .0532 |
| 1" | .239 | 2 1/4" | .0476 |

A = $\frac{H - D}{2}$ – Desired clearance, in inches.

B = Traverse in inches.

D = Barrel Diameter in inches.

H = Flange Diameter in inches.

L = Rope length in feet.

# Common Wire Rope Abuses

Neglect and abuse are the two chief enemies of wire rope life. One costly form of neglect is lack of proper field lubrication. Abuse takes many forms: improper reeling or unreeling, wrong size or worn sheaves, improper storage, bad splicing are a few.

## Condition of Machinery

Wire rope performance depends upon the condition of the equipment on which it operates; poorly maintained equipment will usually result in reduced rope life.

## Effects of Shock-loading And Vibration

The destructive effects of jerking or shock-loading are visually noticeable. Vibration has somewhat the same effect, and is equally destructive. An individual shock may be slight, but many rapidly repeated slight shocks can have the effect of several large shocks.

Vibration which occurs directly above a load is often unavoidable. "Whipping" of the section of rope immediately above the load is also common. In these cases, rapid wire fatigue is possible. For reasons of safety, this section should be examined regularly.

Wire rope failure is usually cumulative. Each repeated overstress brings the rope nearer to failure. Thus, a wire rope may become fatigued to a point close to failure under a heavy load, and actually fail under a *much lighter load.*

## Overstressing

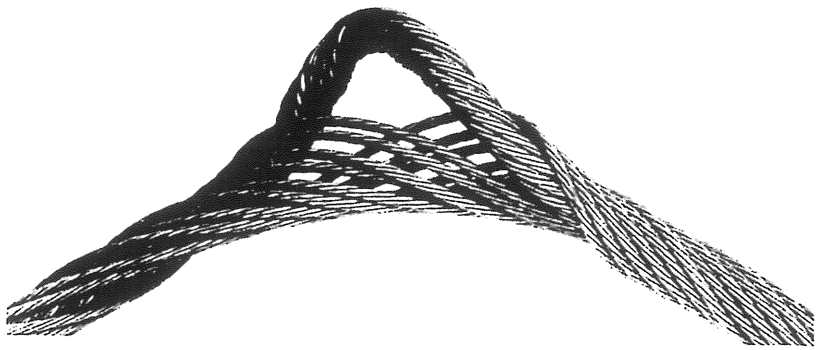
In any hoisting operation, there should be no slack in the wire rope when the load is applied. Otherwise, the resulting stress will be excessive.

Overstressing can also be the result of too-rapid acceleration or deceleration. Wire rope will withstand considerable stress if the load is applied slowly. As with ordinary twine, a quick snap will cause overstressing and breakage. This applies both when starting to lift a load, and when bringing it to a stop.

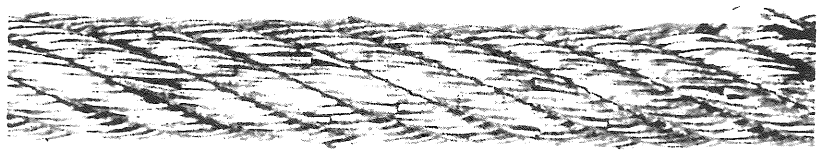
## Corrosion

Corrosion can seriously shorten wire rope life, both by metal loss and by formation of corrosion pits in the wires. These pits act as stress-concentration points in the wires in much the same manner as do nicks.

**Crushing.** Because of loose winding on drum, rope was pulled in between underlying wraps and crushed out of shape.

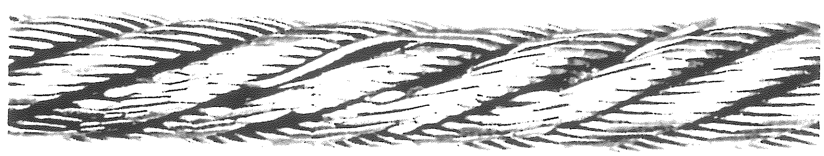


**Too sudden load release.** The sudden release of a load caused birdcaging. Here individual strands open away from each other, displacing the core.



**Lack of lubrication.** Premature breakage of wires resulted from "locking" of strands, which was caused by insufficient lubrication.

**Infrequent inspection.** Neglect of periodical inspection left this rope in service too long, resulting in considerable abrasion.



**Improper handling.** Kink or "dog leg" was caused by improper handling and/or installation. A kink causes excessive localized or spot abrasion.

Wire rope left on machines shut down for long periods of time deteriorates rapidly. To preserve the rope for future use, it should be removed, cleaned, and thoroughly lubricated.

## Causes of Corrosion Damage

Pitting, erosion, and surface effects of many different types can all result in corrosion damage. Because they tend to increase corrosion, the following conditions should be considered and noted when applicable, during the ordering of wire rope — acid and alkaline solutions, gases, fumes, brine and salt air, sulphurous compounds, and high humidity and temperature. Lubricants are readily available to reduce the severity of attack of most of these conditions.

## Effects of Severe Heat

Where wire rope is subjected to severe heat (e.g., foundry cranes) it will not give the service expected because it will deteriorate more quickly.

Wire ropes exposed to hot-metal handling or other extreme heat sometimes require independent wire rope cores.

## Shifting Ropes From One Job to Another

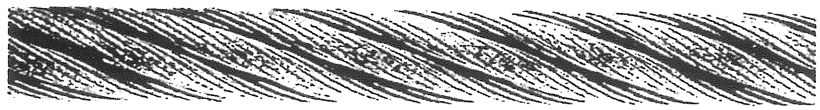
Sometimes an idle wire rope from one operation is installed on another to keep the rope in continuous service. This extremely poor practice is an expensive "economy."

Because wire rope tends to "set" to the conditions of its particular operating job, the differing bends, abrasions, and stresses of a new operation can produce premature failure. Therefore, for maximum life and efficiency, a rope should be used only on the job for which it has been specified.

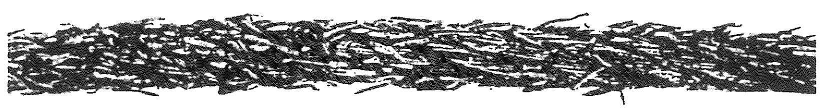
## Machinery Operation

Some operators are harder on their machinery than others and as a result they get shorter rope life. In certain instances, enough extra work is done to more than offset the additional wear-and-tear on equipment and wire rope. The operation may be more efficient from the production standpoint as a result, but those in charge of rope purchases should be made aware of the probable reduction in rope life and increased rope costs.

**Reverse bending.** Running this rope over one sheave and under another caused fatigue breaks in wires.

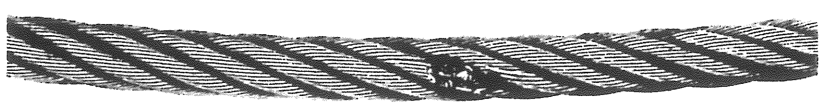


**Excessive exposure to elements.** Too much exposure combined with surface wear and loss of lubrication caused corrosion and pitting.

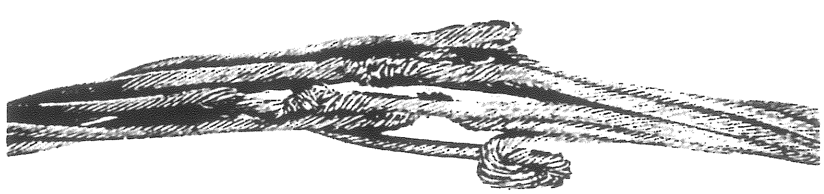


**Too long in service.** Repeated winding and overwinding of this rope on a drum while it was under heavy stress caused the unusually severe wear shown.

**Undersize sheave grooves.** Sheaves were too small, causing strands to pinch. Wires then fail in the valley between the strands.

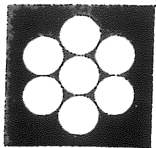
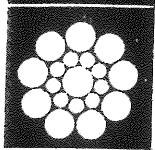
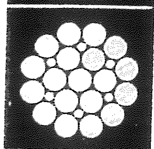
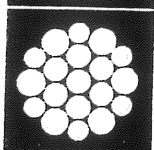
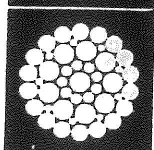
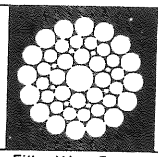
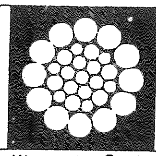
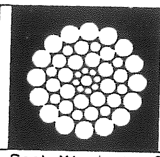
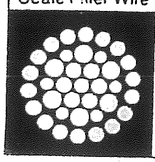


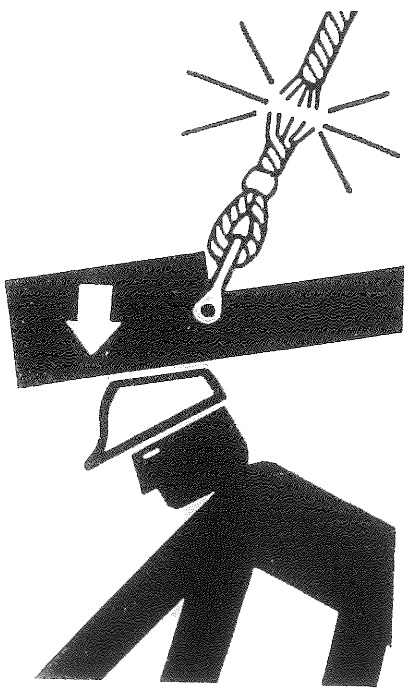
**Poor work procedures.** Damage to strands and wires resulted from electric arcing.



**Lack of knowledge.** Here's what occurs when a loop which has been "pulled through" and tightened remains in service.

# TYPES OF WIRE ROPE

| | | |
|---|---|---|
|  | Single Size | The basic strand construction has wires of the same size wound around a center. |
|  | Seale | Large outer wires with the same number of smaller inner wires around a core wire. Provides excellent abrasion resistance but less fatigue resistance. When used with an IWRC, it offers excellent crush resistance over drums. |
|  | Filler Wire | Small wires fill spaces between large wires to produce crush resistance and a good balance of strength, flexibility and resistance to abrasion. |
|  | Warrington | Outer layer of alternately large and small wires provides good flexibility and strength but low abrasion and crush resistance. |
|  Seale Filler Wire  Filler Wire Seale  Warrington Seale  Seale Warrington Seale | | Many commonly used wire ropes use combinations of these basic constructions. |
|  | **Multiple Operation** | One of the above strand designs may be covered with one or more layers of uniform-sized wires. |



# WARNING

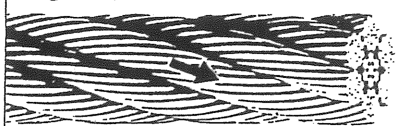
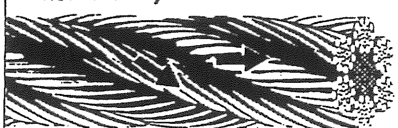
Wire Rope WILL FAIL if worn-out, overloaded, misused, damaged, improperly maintained or abused.

Wire Rope failure may cause serious injury or death.

Protect yourself and others:

- ALWAYS INSPECT wire rope for WEAR, DAMAGE or ABUSE BEFORE USE.
- NEVER USE wire rope that is WORN-OUT, DAMAGED or ABUSED.
- NEVER OVERLOAD a wire rope.
- INFORM YOURSELF: Read and understand manufacturer's literature or "Wire Rope and Wire Rope Sling Safety Bulletin."
- REFER TO APPLICABLE CODES, STANDARDS and REGULATIONS for INSPECTION REQUIREMENTS and REMOVAL CRITERIA.*

* For additional information or the Bulletin, ask your employer or wire rope supplier.

| Lay | Definition | Characteristics |
|---|---|---|
| **Regular Lay**  | Most common lay in which the wires wind in one direction and the strands the opposite direction. (right lay shown) | Less likely to kink and untwist; easier to handle; more crush resistant than lang lay. |
| **Lang Lay**  | Wires in strand and strands of rope wind the same direction. (right lay shown) | Increased resistance to abrasion; greater flexibility and fatigue resistance than regular lay; will kink and untwist. |
| **Right Lay**  | Strands wound to the right around the core. (regular lay shown) | The most common construction. |
| **Left Lay**  | Strands wound to the left around the core. (regular lay shown) | Not generally used with construction equipment. |
| **Alternate Lay**  | Alternate strands of right regular lay and right lang lay. | Combines the best features of regular and lang lay for boom hoist or winch lines. |

Strands Wires

## Elastic Stretch

*Elastic stretch* results from recoverable deformation of the metal itself. Here, again, a quantity cannot be precisely calculated. However, the following equation can provide a reasonable approximation for a good many situations.

$$\text{Changes in length (ft)} = \frac{\text{Change in load (lb)} \times \text{Length (ft)}}{\text{Area (inches}^2\text{)} \times \text{Modulus of Elasticity (psi)}}$$

The modulus of elasticity is given below.

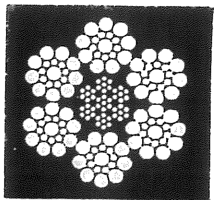
### Approximate Modulus of Elasticity
(Pounds per square inch)

| Rope Classification | Zero through 20% Loading | 21 to 65% Loading* |
|---|---|---|
| 6 x 7 with fiber core | 11,700,000 | 13,000,000 |
| 6 x 19 with fiber core | 10,800,000 | 12,000,000 |
| 6 x 37 with fiber core | 9,900,000 | 11,000,000 |
| 8 x 19 with fiber core | 8,100,000 | 9,000,000 |
| 6 x 19 with IWRC | 13,500,000 | 15,000,000 |
| 6 x 37 with IWRC | 12,600,000 | 14,000,000 |

*Applicable to new rope, i.e., not previously loaded.

# GENERAL PURPOSE WIRE ROPES
## 6 x 19 Classification

6 x 19 Classification ropes provide an excellent balance between fatigue and wear resistance. They give excellent service with sheaves and drums of moderate size. 6 x 19 Classification ropes contain 6 strands with 15 through 26 wires per strand, no more than 12 of which are outside wires.



**6x19 Seale**

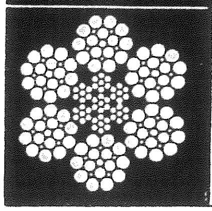
*Characteristics*

Resistant to abrasion and crushing; medium fatigue resistance

*Typical Applications*

Haulage rope, choker rope, rotary drilling line

IWRC shown; fiber core available



**6x21 Filler Wire**

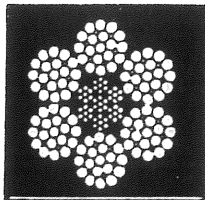
*Characteristics*

Less abrasion resistance; more bending fatigue resistance

*Typical Applications*

Pull Ropes, load lines, backhaul ropes, draglines

IWRC shown, fiber core available



**6x25 Filler Wire**

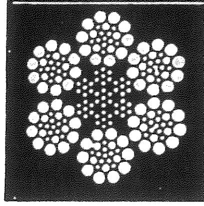
*Characteristics*

Most flexible rope in classification; best balance of abrasion and fatigue resistance

*Typical Applications*

Most widely used of all wire ropes - cranes hoists, skip hoists, haulage, mooring lines, conveyors, etc.

IWRC shown; fiber core available



**6x26 Warrington Seale**

*Characteristics*

Good balance of abrasion and fatigue resistance

*Typical Applications*

Boom hoists, logging and tubing lines

IWRC shown; fiber core available

### 6 x 19 Classification Rope

| Diameter, in. | Nominal Strength,* Tons (Bright or Drawn Galvanized)† | | | | | | Approximate Wt./Ft., lb. | |
|---|---|---|---|---|---|---|---|---|
| | EEIP | | EIP | | IPS | | | |
| | IWRC | Fiber Core | IWRC | Fiber Core | IWRC | Fiber Core | IWRC | Fiber Core |
| 1/4 | ... | ... | 3.40 | 3.02 | 2.94 | 2.74 | 0.116 | 0.105 |
| 5/16 | ... | ... | 5.27 | 4.69 | 4.58 | 4.26 | 0.18 | 0.164 |
| 3/8 | ... | ... | 7.55 | 6.71 | 6.56 | 6.10 | 0.26 | 0.236 |
| 7/16 | 11.2 | 9.90 | 10.2 | 9.09 | 8.89 | 8.27 | 0.35 | 0.32 |
| 1/2 | 14.6 | 12.9 | 13.3 | 11.8 | 11.5 | 10.7 | 0.46 | 0.42 |
| 9/16 | 18.5 | 16.2 | 16.8 | 14.9 | 14.5 | 13.5 | 0.59 | 0.53 |
| 5/8 | 22.7 | 20.0 | 20.6 | 18.3 | 17.9 | 16.7 | 0.72 | 0.66 |
| 3/4 | 32.4 | 28.6 | 29.4 | 26.2 | 25.6 | 23.8 | 1.04 | 0.95 |
| 7/8 | 43.8 | 38.6 | 39.8 | 35.4 | 34.6 | 32.2 | 1.42 | 1.29 |
| 1 | 57.5 | 50.0 | 51.7 | 46.0 | 44.9 | 41.8 | 1.85 | 1.68 |
| 1 1/8 | 71.5 | 63.0 | 65.0 | 57.9 | 56.5 | 52.6 | 2.34 | 2.13 |
| 1 1/4 | 87.9 | 77.5 | 79.9 | 71.0 | 69.4 | 64.6 | 2.89 | 2.63 |
| 1 3/8 | 106.0 | 93.0 | 96.0 | 85.4 | 83.5 | 77.7 | 3.50 | 3.18 |
| 1 1/2 | 125.0 | 111.0 | 114.0 | 101.0 | 98.9 | 92.0 | 4.16 | 3.78 |
| 1 5/8 | 145.0 | 129.0 | 132.0 | 118.0 | 115.0 | 107.0 | 4.88 | 4.44 |
| 1 3/4 | 168.0 | 149.0 | 153.0 | 136.0 | 133.0 | 124.0 | 5.67 | 5.15 |
| 1 7/8 | 191.0 | 169.0 | 174.0 | 155.0 | 152.0 | 141.0 | 6.50 | 5.91 |
| 2 | 218.0 | 192.0 | 198.0 | 176.0 | 172.0 | 160.0 | 7.39 | 6.72 |
| 2 1/8 | ... | ... | 221.0 | 197.0 | 192.0 | 179.0 | 8.35 | 7.59 |
| 2 1/4 | ... | ... | 247.0 | 220.0 | 215.0 | 200.0 | 9.36 | 8.51 |
| 2 3/8 | ... | ... | 274.0 | 244.0 | 239.0 | 222.0 | 10.4 | 9.48 |
| 2 1/2 | ... | ... | 302.0 | 269.0 | 262.0 | 244.0 | 11.6 | 10.5 |
| 2 5/8 | ... | ... | 331.0 | ... | 288.0 | 268.0 | 12.8 | 11.6 |
| 2 3/4 | ... | ... | 361.0 | | 314.0 | 292.0 | 14.0 | 12.7 |

*Acceptance strength is not less than 2½% below the nominal strengths listed

†Galvanizing. For class A galvanized wire rope (EIP and IPS grades only), deduct