

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

**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.

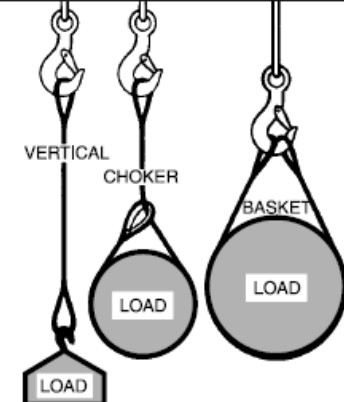
In addition, an inspection should include the condition of sheaves, drums and other apparatus with which the rope makes contact.

**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.



## Every Lift Uses 1 of 3 Basic Hitches

**VERTICAL**, or straight, attachment is simply using a sling to connect a lifting hook or other device to a load. Full rated load of the sling may be used, but never exceeded. A tagline should be used on such a lift to prevent rotation which can damage the sling. A sling with a hand-tucked splice can unlay and fail if the sling is allowed to rotate.

**CHOKER** hitches reduce lifting capability of a sling, since this method of rigging affects the ability of the wire rope components to adjust during the lift, places angular loading on the body of the sling, and creates a small diameter bend in the sling body at the choke point.

**BASKET** hitches distribute a load equally between the two legs of a sling, within limitations imposed by the angles at which legs are rigged to the load. (See discussion of sling angles below.)

## Basic Factors Concerning Use of Wire Rope Slings

1. **RATED LOAD** (Rated Capacity) of a wire rope sling is based upon the Nominal, or Catalog, Strength of the wire rope used in the sling, AND FACTORS which affect the overall strength of the sling. These factors include ATTACHMENT or SPLICING EFFICIENCY, the number of parts of rope in the sling, type of hitch (e.g., straight pull, choker hitch, basket hitch), DIAMETER AROUND WHICH THE BODY OF THE SLING IS BENT, and the diameter of pin (or hook) over which the eye of the sling is rigged.

2. **RATED LOAD** of a sling is different for each of the three basic methods of rigging (See graphic above.). These rated loads are available from your wire rope sling supplier and may be indicated on the tag attached to the sling at the time it is fabricated (if requested by the user).

3. **WARNING:** A hand-tucked eye splice can unlay (unravel) and fail if the sling is allowed to rotate during use.

4. **NEVER "SHOCK LOAD" A SLING.** There is no practical way to estimate the actual force applied by shock loading. The rated load of a wire rope sling can easily be exceeded by a sudden application of force, and damage can occur to the sling. The sudden release of a load can also damage a sling.

5. The **BODY** of a wire rope sling should be **PROTECTED** with corner protectors, blocking or

padding against damage by sharp edges or corners of a load being lifted. Sharp bends that distort the sling body damage the wire rope and reduce its strength.

6. **ANY ANGLE** other than vertical at which a sling is rigged increases the loading on the sling.

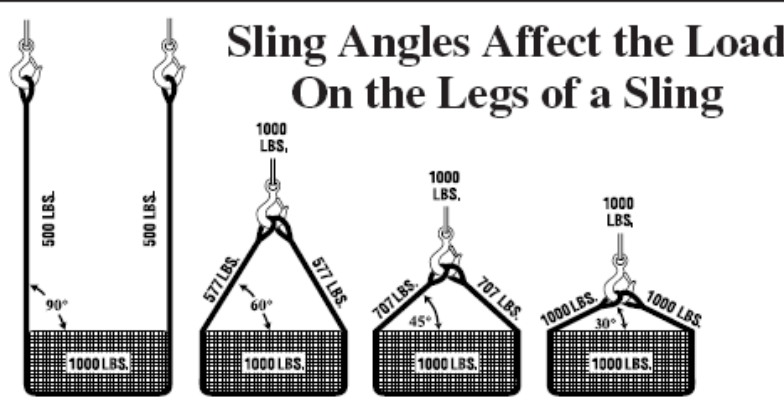
7. A sling should be given a **VISUAL INSPECTION BEFORE EACH LIFT OR USAGE** to determine if it is capable of safely making the intended lift.

An inspection should include looking for such things as:

- Broken wires.
- Kinks or distortions of the sling body.
- Condition of eyes and splices, and any attached hardware.
- Reduction in diameter of the rope.
- Any damage.
- Corrosion.

8. Whenever a sling is found to be deficient, the eyes must be cut, or other end attachments or fittings removed to prevent further use, and the sling body discarded.

9. A **SLING EYE** should never be used over a hook or pin with a body diameter larger than the natural width of the eye. **NEVER FORCE AN EYE ONTO A HOOK.** The eye should always be used on a hook or pin with **AT LEAST THE DIAMETER OF THE ROPE.**



### Sling Angles Affect the Load On the Legs of a Sling

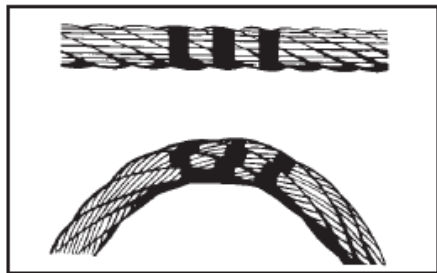
**SLING ANGLE** (also called Angle of Loading) is the angle measured between a horizontal line and the sling leg or body. This angle is very important and can have a dramatic effect on the rated load of the sling. As illustrated here, when this angle **DECREASES**, the **LOAD ON EACH LEG INCREASES**. This principle applies whether one sling is used with legs at an angle in a basket hitch, or for multi-leg bridle slings. Horizontal sling angles of **LESS THAN 30 DEGREES SHALL NOT BE USED.**

# A Wire Rope Is a “Machine” With Many Moving Parts

A wire rope is a machine, by dictionary definition: “An assemblage of parts...that transmit forces, motion, and energy one to another in some predetermined manner and to some desired end.”

A typical wire rope may contain dozens – even hundreds – of individual wires which are formed and fabricated to operate at close bearing tolerances one to another. When a wire rope bends, each of its many wires slides and adjusts in the bend to accommodate the difference in length between the inside and the outside of the bend. The sharper the bend, the greater the movement.

Every wire rope has three basic components: (1) The wires which form the strands and collectively provide rope strength; (2) The strands, which are laid helically around

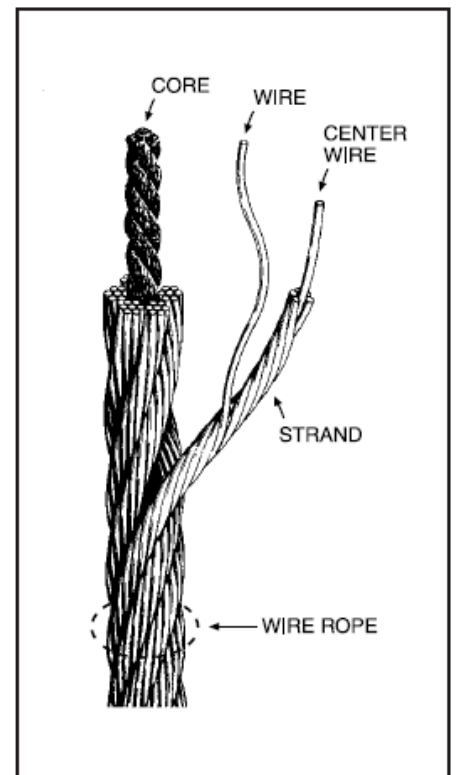


the core; and, (3) The core, which forms a foundation for the strands. The core may be either a fiber rope, an Independent Wire Rope Core (IWRC), which is actually a smaller wire rope, or a strand similar to the outer strands of the rope; only an IWRC or strand core contributes strength to the rope; and an IWRC normally provides only 7 1/2% of the wire rope’s Nominal Strength.

The greatest differences in wire ropes are found in the strands, which may vary widely in the pattern and number of wires which are laid together.

The wires of a rope may be made of various metals, including steel, iron, stainless steel, monel, and bronze. The material of which the wires are made is the primary determinant of rope strength. By far the most widely used metal is high-carbon steel.

Carbon steel wire ropes come in various Grades. The term “Grade” is used to designate the Nominal Strength of the wire rope. The most common rope Grades are Traction Steel (TS), Plow Steel (PS), Improved Plow Steel (IPS), Extra Improved Plow Steel (EIPS), and Extra Extra Improved Plow Steel (EEIPS).



One cannot determine the Grade of a wire rope by its feel or appearance. To properly evaluate a rope system you must obtain the Grade from your employer or wire rope supplier.





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# WIRE ROPE AND WIRE ROPE SLING SAFETY BULLETIN

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Wire Rope Technical Board

	<table border="1"><tr><td data-bbox="673 898 1286 968"> <b>WARNING</b></td></tr><tr><td data-bbox="673 968 1286 1020"><b>Wire Rope WILL FAIL</b> if worn-out, overloaded, misused, damaged, improperly maintained or abused.</td></tr><tr><td data-bbox="673 1020 1286 1050"><b>Wire rope failure may cause serious injury or death!</b></td></tr><tr><td data-bbox="673 1050 1286 1071"><b>Protect yourself and others:</b></td></tr><tr><td data-bbox="673 1071 1286 1344"><ul style="list-style-type: none"><li>● <b>ALWAYS INSPECT</b> wire rope for <b>WEAR, DAMAGE</b> or <b>ABUSE BEFORE USE.</b></li><li>● <b>NEVER USE</b> wire rope that is <b>WORN-OUT, DAMAGED</b> or <b>ABUSED.</b></li><li>● <b>NEVER OVERLOAD</b> a wire rope.</li><li>● <b>INFORM YOURSELF:</b> Read and understand manufacturer's literature or "Wire Rope and Wire Rope Sling Safety Bulletin".<sup>*</sup></li><li>● <b>REFER TO APPLICABLE CODES, STANDARDS</b> and <b>REGULATIONS</b> for <b>INSPECTION REQUIREMENTS</b> and <b>REMOVAL CRITERIA.</b><sup>*</sup></li></ul></td></tr><tr><td data-bbox="673 1344 1286 1396"><sup>*</sup> For additional information or the <b>BULLETIN</b>, ask your employer or wire rope supplier.</td></tr><tr><td data-bbox="673 1396 1286 1436">© 1993, Wire Rope Technical Board <span style="float: right;">Form No. 193</span></td></tr></table>	 <b>WARNING</b>	<b>Wire Rope WILL FAIL</b> if worn-out, overloaded, misused, damaged, improperly maintained or abused.	<b>Wire rope failure may cause serious injury or death!</b>	<b>Protect yourself and others:</b>	<ul style="list-style-type: none"><li>● <b>ALWAYS INSPECT</b> wire rope for <b>WEAR, DAMAGE</b> or <b>ABUSE BEFORE USE.</b></li><li>● <b>NEVER USE</b> wire rope that is <b>WORN-OUT, DAMAGED</b> or <b>ABUSED.</b></li><li>● <b>NEVER OVERLOAD</b> a wire rope.</li><li>● <b>INFORM YOURSELF:</b> Read and understand manufacturer's literature or "Wire Rope and Wire Rope Sling Safety Bulletin".<sup>*</sup></li><li>● <b>REFER TO APPLICABLE CODES, STANDARDS</b> and <b>REGULATIONS</b> for <b>INSPECTION REQUIREMENTS</b> and <b>REMOVAL CRITERIA.</b><sup>*</sup></li></ul>	<sup>*</sup> For additional information or the <b>BULLETIN</b> , ask your employer or wire rope supplier.	© 1993, Wire Rope Technical Board <span style="float: right;">Form No. 193</span>
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