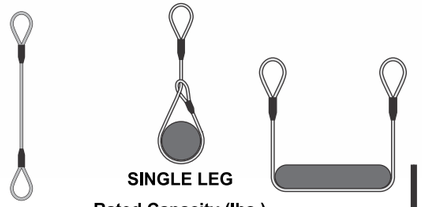
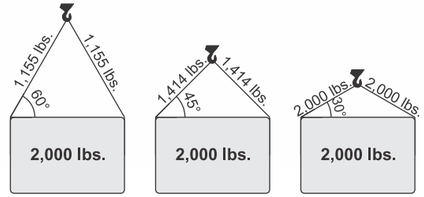
WIRE ROPE SLINGS
WORKING LOAD LIMITS

Design Factor 5:1



Wire Rope Class	Rope Dia. (in.)	SINGLE LEG Rated Capacity (lbs.) Vertical	Choker	V. Basket	60°Bskt	45°Bskt	30°Bskt	DOUBLE LEG Rated Capacity (lbs)* 60°	45°	30°	TRIPLE LEG Rated Capacity (lbs)* 60°	45°	30°	QUAD LEG Rated Capacity (lbs)* 60°	45°	30°
6 x 26 EIPS, IWRC	1/4	1,300	960	2,600	2,200	1,800	1,300	2,200	1,800	1,300	3,400	2,800	2,000	4,600	3,600	2,600
	5/16	2,000	1,480	4,000	3,400	2,800	2,000	3,400	2,800	2,000	5,200	4,200	3,000	7,000	5,600	4,000
	3/8	2,800	2,200	5,800	5,000	4,200	2,900	5,000	4,200	2,900	7,200	6,000	4,200	9,600	8,000	5,600
	7/16	3,800	2,800	7,800	6,800	5,600	3,900	6,800	5,600	3,900	9,800	8,000	5,800	13,200	10,800	7,600
	1/2	5,000	3,800	10,200	8,800	7,200	5,100	8,800	7,200	5,100	13,000	10,600	7,600	17,400	14,200	10,000
	9/16	6,400	4,800	12,800	11,000	9,000	6,400	11,000	9,000	6,400	16,600	13,600	9,600	22,200	18,000	12,800
	5/8	7,800	5,800	15,600	13,600	11,000	7,800	13,600	11,000	7,800	20,200	16,600	11,800	27,000	22,000	15,600
	3/4	11,200	8,200	22,000	19,400	15,600	11,000	19,400	15,600	11,000	29,000	23,800	16,800	38,800	31,600	22,400
	7/8	15,200	11,200	30,000	26,000	21,200	15,000	26,000	21,200	15,000	39,400	32,200	22,800	52,600	43,000	30,400
6 x 36 EIPS, IWRC	1	19,600	14,400	40,000	34,000	28,200	20,000	34,000	28,200	20,000	51,000	41,600	29,400	67,800	55,400	39,200
	1 1/8	24,000	18,200	48,000	42,000	34,000	24,000	42,000	34,000	24,000	62,400	51,000	36,000	83,200	67,800	48,000
	1 1/4	30,000	22,000	60,000	52,000	42,400	30,000	52,000	42,400	30,000	78,000	63,600	45,000	104,000	84,800	60,000
	1 3/8	36,000	26,000	72,000	62,000	51,000	36,000	62,000	51,000	36,000	93,600	76,400	54,000	124,800	101,800	72,000
	1 1/2	42,000	32,000	84,000	74,000	59,400	42,000	74,000	59,400	42,000	109,200	89,000	63,000	145,400	118,800	84,000
	1 3/4	56,000	42,000	114,000	98,000	80,600	57,000	98,000	80,600	57,000	145,400	118,800	84,000	194,000	158,400	112,000
	2	74,000	56,000	146,000	126,000	103,200	73,000	126,000	103,200	73,000	192,200	157,000	111,000	256,000	209,200	148,000



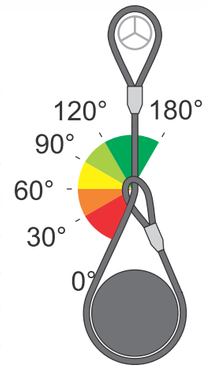
Basket Hitch

Capacity Reduction		Sling Tension	
Angle/Deg Horizontal	Loss Factor	Angle/Deg Horizontal	Loss Factor
90	1.000	90	1.000
80	0.985	80	1.015
70	0.940	70	1.064
60	0.866	60	1.155
50	0.766	50	1.305
45	0.707	45	1.414
35	0.574	35	1.742
30	0.500	30	2.000

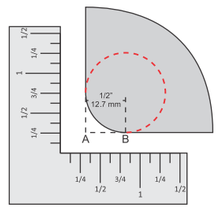
Choker Hitch

Choker Sling Angle	Rated Capacity % *Note
Over 120º	100
90º - 120º	87
60º - 89º	74
30º - 59º	62
0º - 29º	49

Note: Percent of sling rated capacity in a choker hitch.



D/d Rating Capacities



D/d Ratio	Strength Efficiency	D/d Ratio	Strength Efficiency
25/1	100%	6/1	80%
20/1	92%	4/1	75%
15/1	88%	2/1	65%
10/1	86%	1/1	50%
8/1	84%		

WARNING! NEVER EXCEED THE WORKING LOAD LIMIT. ALWAYS CHECK THE IDENTIFICATION TAG TO DETERMINE IF THE SLINGS RATED CAPACITY IS APPROPRIATE FOR THE LIFT. RATINGS LISTED ARE FOR NEW SLINGS ONLY AND APPLY ONLY TO SUPER SLINGS PRODUCTS. ALWAYS INSPECT THE SLING BEFORE USE.

All wire rope slings manufactured by Super Slings Inc. are done so in accordance with ASME B30.9-1 in conjunction with Alberta Occupational Health & Safety standards. For a copy of these standards and requirements please visit www.asme.org or work.alberta.ca/occupational-health-safety.html

INSPECTION & REMOVAL CRITERIA - ASME B30.9

INSPECTION

All slings shall be visually inspected by the person handling the sling each day they are used. In addition, a periodic inspection shall be performed by a designated person, at least annually, and shall include a record of the inspection.

1. Distortion of the rope in the sling such as kinking, crushing, unstranding, birdcaging, main strand displacement or core protrusion. Loss of rope diameter in short rope lengths or unevenness of outer strands should provide evidence the sling should be replaced.
2. General corrosion. 3. Broken or cut strands. 4. Number, distribution, and type of visible broken wires.

REPLACEMENT

Condition such as the following should be sufficient reason for consideration of sling replacement.

1. For standard lay and single part slings ten randomly distributed broken wires in one rope lay, or five broken wires in one rope strand in one rope lay.
2. Severe localized abrasion or scraping.
3. Kinking, crushing, birdcaging, or any damage resulting in distortion of the rope structure.
4. Evidence of heat damage.
5. End attachments that are cracked, deformed, or worn to the extend that the strength of the sling is substantially affected.
6. Hooks should be inspected in accordance with ASME B30.10
7. Severe corrosion of the rope or end attachments.

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WIRE ROPE SLING WARNINGS & USAGE

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WARNING!

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
- 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 & Wire Rope Sling Safety Bulletin".
- REFER TO APPLICABLE CODES, STANDARDS and REGULATIONS for INSPECTION REQUIREMENTS and REMOVAL CRITERIA

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 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 LIMIT.
5. To determine the working load limit of a wire rope, the NOMINAL strength MUST BE REDUCED by a DESIGN FACTOR (formerly called 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 OH&S, by ANSI, by ASME and similar government and industrial organizations.
No wire rope slings 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 limit 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 OH&S FOR ALMOST EVERY WIRE ROPE INSTALLATION. The purpose of inspection is to determine whether or not a wire rope or wire rope slings may continue to be safely used on that application. Inspection criteria, including number of broken wires, wear and elongation have been established by OH&S, ANSI, ASME and similar organizations.

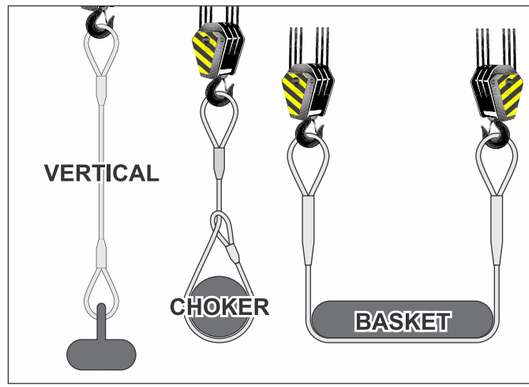
IF IN DOUBT, REPLACE THE ROPE>

Ann 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 limit of the rope assembly or rope system, and this must be given due consideration in 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 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 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 the 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 linitations imposed by the angles at which legs are rigged to theload. (See discussions of slings angles below.)

Basic Factors Concerning Use of Wire Rope Slings

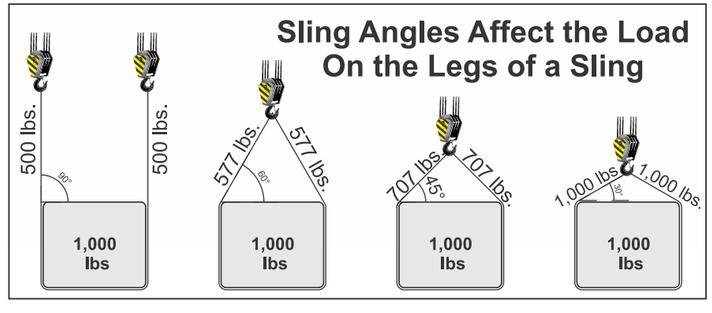
1. RATED LOAD (Rated Capacity) of a wire rope slings is based upon the Nominal, or Catalog, Strength of the wire rope used on the sling, AND FACTORS which affect the overall strength of the sling. These factors include ATTACHMENT or SPLICING EFFICIENCY, the number of parts of rope in the sling, type 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 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 slings 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, clocking 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. The term "sharp" does not imply sharp to the touch, radius of the corner and weight of load directly affect the damage a corner or edge can make to a wire rope sling.
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:

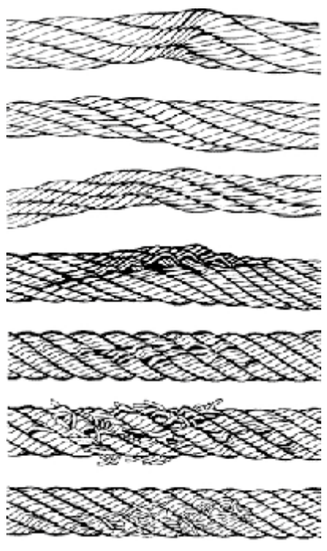
- Broken wires.
- Kinks or distortions of the sling body.
- Conditions of eyes and splices, and any attached hardware
- Reduction in diameter of the rope.
- Corrosion
- Any other damage

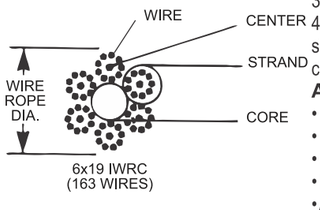
8. Whenever a sling is found to be deficient, the eyes must be cut, or other end attachments or fittings removed to prevent further use, and the sling body discarded.
9. A SLING EYE should never be used over a hook or pin with a diameter larger than the normal width of the eye. NEVER FORCE AN EYE ONTO A HOOK. The eye should always be used on a hook or pin with AT LEAST THE DIAMETER OF THE ROPE.

SLING ANGLE (also called Angle of Loading) is the angle measured between a horizontal line and the sling 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.



WIRE ROPE SLING WARNINGS & USAGE





Frequency of Inspections

Both ASME B.30.9 and most Provincial Regulations require that wire rope slings receive two types of inspections:

PRIOR TO USE visual inspection, and additional inspections where severe conditions warrant.

Daily inspections are intended to detect serious damage or deterioration which would weaken the sling. Look for obvious things, such as broken wires, kinks, crushing, broken attachments, severe corrosion.

Additional inspections must be carried out by a designated person who must have good knowledge of wire rope.

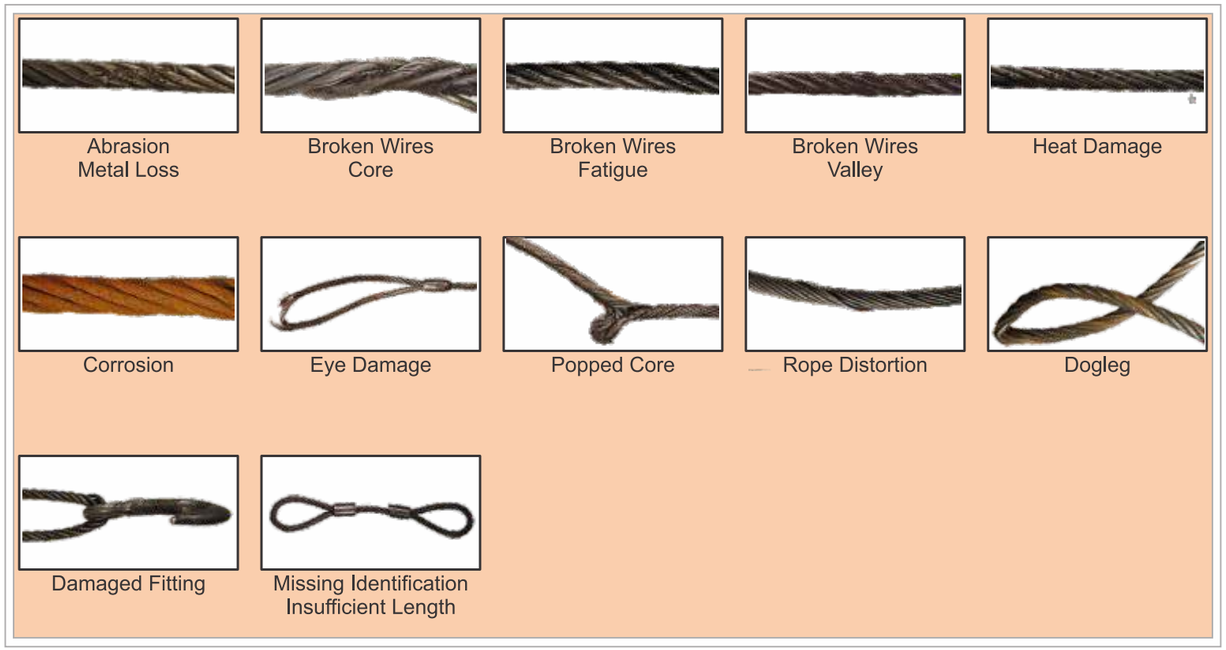
The frequency of these regular inspections should be based on:

1) frequency of sling use
2) severity of service conditions
3) nature of lifts
4) prior experience based on service life of slings used in similar circumstances.

An inspection should look for:

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

Typical Wire Rope Damage



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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."

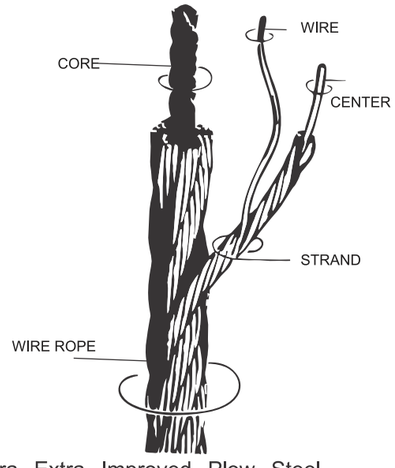
A typical wire rope may contain dozens - even hundreds - of individual wires which are formed and fabricated to operate at close bearing tolerances one to another. When a wire rope bends, each of its many wires slides to accommodate the difference in length between the inside and the outside of the bend.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

Every wire rope had three basic components: (1) The wires which for 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 fibre rope, an Independent Wire Rope Core (IWRC), which is actually a smaller wire rope, or a strand similar to the outer strands of the wire rope; only an IWRC or strand core contributes strength to the rope; and an IWRC normally provides only 7 ½ % 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.

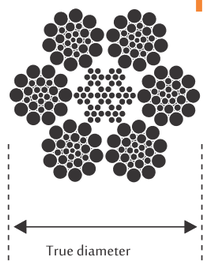
Carbon steel wire ropes come in various Grades. The term "Grade" is used to designate the Nominal Strength of the wire rope. The most common rope Grades are Traction Steel (TS), Plow Steel (PS), Improved Plow Steel (IPS), Extra Improved Plow Steel (EIPS), and



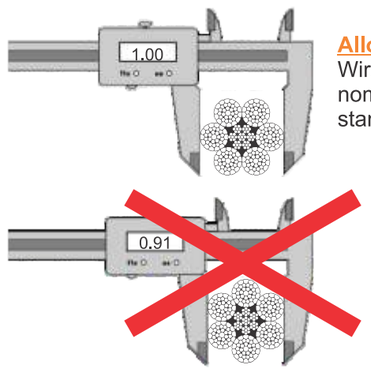
Extra Extra Improved Plow Steel (EEIPS).

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.

How to Measure Wire Rope Diameter



The correct diameter of a wire rope is the diameter of a circumscribed circle that will enclose all the strands. It's the largest cross sectional measurement as shown here. You should make the measurement carefully with calipers. The illustrations at left show the correct and incorrect methods of measuring a wire rope's diameter.



Allowable Tolerance in wire rope diameter

Wire rope is normally made slightly larger than its catalog (or nominal) size. The following chart lists the size tolerances of standard wire rope.

Nominal Rope Diameter	Tolerance	
	Under	Over
0" - 1/8"	-0	+ 8%
Over 1/8 - 3/16"	-0	+ 7%
Over 3/16 - 5/16"	-0	+ 6%
Over 5/16"	-0	+ 5%