

INDUSTRIAL SLINGS

Alloy Steel Chain

Wire Rope

Fiber Rope

Wire Mesh

Synthetic Web

Tuflex Roundslings

OSHA Regulations

As Interpreted by Lift-All

**Plus Recommendations
for Care and Maintenance**



Purpose

The declared congressional purpose and policy of OSHA rules and regulations are “to assure, so far as possible, every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources.”

Who Must Comply

OSHA provisions apply to every employer who has one or more employees and who is engaged in a business affecting commerce. The provisions apply in all 50 states, the District of Columbia, and all US possessions.

Federal, State, and local government employees are specifically excluded from coverage. In addition, working conditions protected under Federal occupational safety and health laws (such as the Federal Coal Mine Health and Safety Act and the Atomic Energy Act) are also exempt.

Special OSHA standards exist regulating the use of certain types of slings in the maritime and construction industries.

Effective Date

July 27, 1975 is the date the OSHA rules and regulations on Industrial Slings became effective.

OSHA Revisions Effective 7-8-11

The load-capacity tables previously used in standard 1910.184 will no longer apply. Instead, employers are prohibited from loading slings in excess of the recommended safe working load as prescribed on permanently affixed identification markings. The revisions also prohibit the use of slings that do not have permanently affixed identification markings.

In addition to the OSHA standards, the OSHA General Duty Clause specifies that employers can be cited for not providing their employees with a workplace free from recognized, serious hazards that are not addressed by an OSHA standard. As an example, if a roundsling user fails to protect roundslings from edges that are not adequately rounded to Lift-All instructions, that user could be cited by OSHA under the General Duty Clause.

Notice

This is not an official document of OSHA. The information contained in this booklet was compiled from the Code of Federal Regulations, Title 29, Part 1910.184 and represents Lift-All's best interpretation of the official OSHA requirements. No official interpretation of ruling by OSHA as to the applicability or requirement of any OSHA standard or other Federal law is contained in this booklet. Nor does it contain any determination by OSHA as to exactly what is required to comply with the OSHA standards.

Therefore, no guarantee, representation, or expressed or implied warranty is made by the Lift-All Co., Inc. as to the sufficiency of any matters included herein to meet official requirements. Lift-All can assume no responsibility in connection with the use of this booklet.

Safe Operating Practices (Recommendations)

Effect of Angle on Rated Capacities

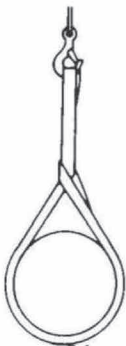
The sling angle affects the amount of tension applied to the sling. As the sling angle decreases, the tension on each leg increases. This principle applies when one sling is used to lift at an angle or when a basket hitch, attached to a single hook, or multi-legged bridle sling is used. The table below provides information on increased tension as a function of sling-to-load angle. Multiply the amount of load applied to each leg of the sling by the tension factor to determine the increased tension on each leg. The use of slings at angles of less than 30 degrees should be avoided.

Angle in Degrees *	Tension Factor
90	1.000
85	1.004
80	1.015
75	1.035
70	1.064
65	1.104
60	1.155
55	1.221
50	1.305
45	1.414
40	1.555
30	2.000

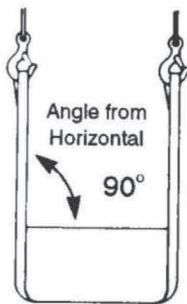


Vertical Hitch

*angle from the horizontal



Choker Hitch



Vertical Basket Hitch

Types Of Slings Covered

OSHA standards on Industrial Slings cover 5 major types of slings: alloy chain, wire rope, wire mesh, fiber rope and synthetic webbing. Slings of these 5 types and those not covered by the standard must be used in accordance with the manufacturer's recommendations.

Care & Maintenance Recommendations

This booklet also contains care and maintenance recommendations which will help you get longer sling life and lower your sling costs. Most of the suggestions are not required by OSHA, however, in some instances the OSHA requirements in the preceding sections are reemphasized.

Requirements Applicable To All Types Of Slings

The following is a list of the requirements that apply in the use of ALL 5 major types of slings listed in the OSHA standard. Specific requirements applicable to each individual type of sling are outlined on pages 5 through 11 of this booklet.

SAFE OPERATING PRACTICES—Whenever any sling is used, the following practices shall be observed:

- 1— Slings that are damaged or defective shall not be used.
- 2— Slings shall not be shortened with knots or bolts or other makeshift devices.
- 3— Sling legs shall not be kinked.
- 4— Slings shall not be loaded in excess of their rated capacities.
- 5— Slings used in a basket hitch shall have the loads balanced to prevent slippage.
- 6— Slings shall be securely attached to their loads.
- 7— Slings shall be padded or protected from the sharp edges of their loads.
- 8— Suspended loads shall be kept clear of all obstruction.
- 9— All employees shall be kept clear of loads about to be lifted and of suspended loads.
- 10— Hands or fingers shall not be placed between the sling and its load while the sling is being tightened around the load.
- 11— Shock loading is prohibited.
- 12— A sling shall not be pulled from under a load when the load is resting on the sling.
- 13— Employers must not load a sling in excess of its recommended safe working load as prescribed by the sling manufacturer on the identification markings permanently affixed to the sling.
- 14— Employers must not use slings without affixed and legible identification markings.

INSPECTIONS—Each day before being used, the sling and all fastenings and attachments shall be inspected for damage or defects by a competent person designated by the employer. Additional inspections shall be performed during sling use where service conditions warrant. Damaged or defective slings shall be immediately removed from service.

Alloy Chain Sling Requirements

SAFE OPERATING PRACTICES and INSPECTIONS previously listed under REQUIREMENTS APPLICABLE TO ALL TYPES OF SLINGS on page 4 of this booklet must be followed when Alloy Steel Chain Slings are used. The following are ADDITIONAL requirements that apply specifically to Alloy Steel Chain Slings:

- 1— A sling shall not be used in excess of the rated capacity of the weakest component.
- 2— Makeshift links or fasteners formed from bolts or rods, or other such attachments shall not be used.
- 3— In addition to the inspection requirements listed on page 2 of this booklet, each sling shall have a THOROUGH inspection at least every 12 months by a competent person. This inspection must include a thorough inspection for damage, wear, defective welds, deformation and increase in length. Where such defects or deterioration are present, the sling shall be immediately removed from service. A record of the most recent month in which each sling was THOROUGHLY inspected must be available for examination.
- 4— Every new, repaired, or reconditioned sling must be proof tested before use in accordance with paragraph 5.2 of ASTM spec A391-65 (ANSI G61.1-1968) and a certificate of the proof test must be available for examination
- 5— Slings heated above 1000°F must be permanently removed from service. When exposed to service temperatures above 600°F the rated capacity must be reduced in accordance with the chain manufacturer's recommendations.
- 6— When welding or heat treating is performed on a sling, it shall not be used unless repaired, reconditioned and proof tested by the sling manufacturer (or an equivalent entity).
- 7— Broken lengths of chain must not be repaired by means of mechanical coupling links or low carbon steel repair links.
- 8— A sling must be removed from service if the chain size at any point of any link is less than that shown in OSHA table N-184-2.
- 9— A sling with worn or damaged master links, coupling links or other components must be removed from service. Slings shall also be removed from service if hooks are cracked, have been opened more than 15% of the normal throat opening or twisted more than 10 degrees from the plane of the unbent hook

CARE & MAINTENANCE (Recommendations)

Periodic cleaning and oiling will reduce wear and ease inspection. When storing, hang in a dry, clean place removed from the immediate work area to avoid accidental damage or entanglement.

When loading slings, make sure to evaluate the effect of leg angles and compare to the sling's rated capacity. Permanent damage may result if lifts are made with twists or knots in chain legs. Shock-loading must be avoided or permanent damage can result.

Wire Rope Sling Requirements

SAFE OPERATING PRACTICES AND INSPECTIONS previously listed under REQUIREMENTS APPLICABLE TO ALL TYPES OF SLINGS on page 4 of this booklet must be followed when Wire Rope Slings are used. The following are ADDITIONAL requirements that apply specifically to Wire Rope Slings:

- 1— Minimum sling lengths. Slings made from cable laid rope, 6 x 19 class and 6 x 37 class rope must have a minimum clear length of wire rope 10 times the component rope diameter between splices, sleeves or end fittings. Braided slings must have a minimum clear length of wire rope 40 times the component rope diameter between the loops or end fittings. Cable laid grommets, strand laid grommets, and endless slings must have a minimum circumferential length of 96 times their body diameter.
- 2— When exposed to temperatures in excess of 200° F, fiber core slings of all classes shall be permanently removed from service. When metallic core slings are used above 400°F or below 60°F, the recommendations of the sling manufacturer must be followed.
- 3— Welding of end attachments (except covers to thimbles) must not be performed after sling is assembled.
- 4— All welded end attachments must be proof tested by the manufacturer (or equivalent entity) at twice the rated capacity prior to initial use and a certificate of the proof test must be available for examination.
- 5— Slings must be immediately removed from service if any of the following conditions exist:
 - a. One rope lay containing 10 randomly distributed broken wires
 - b. One strand in one rope lay containing 5 broken wires
 - c. Wear or scraping of 1/3 the original diameter of outside individual wires.
 - d. Kinking, crushing, bird caging or any other damage resulting in distortion of the wire rope structure.
 - e. Evidence of heat damage
 - f. Corrosion of the rope or end attachments
 - g. End attachments are cracked, deformed or worn
 - h. Hooks opened more than 15% of the normal throat opening or twisted more than 10 degrees from the plane of the unbent hook

CARE & MAINTENANCE (Recommendations)

When hooking up, avoid twists and loops. All sharp corners of the load should be blunted. Severely scuffed or cut wires and strands can result from pinching sharp load edges and catching between or under loads. The same damage can occur from turning in a basket hitch. If the size of the load is underestimated, the effect of sling angles ignored, or a sling of insufficient capacity used, the result may be a deformed thimble, broken wires in valleys and bent fittings. Blocking and using IWRC ropes reduce the chances of crushed rope. Deformed fittings are caused by overloading, side pulls, loading out of plane, point loading of hooks and other forms of abuse. Longer life will be obtained if dirt, sand and other foreign material is removed and the sling relubed to forestall rust. When storing, hang up in a clean, dry place away from the work area to avoid accidental damage or entanglement.

Wire Mesh Sling Requirements

SAFE OPERATING PRACTICES and INSPECTIONS previously listed under REQUIREMENTS APPLICABLE TO ALL TYPES OF SLINGS on page 4 of this booklet must be followed when Wire Mesh Slings are used. The following requirements apply specifically to Wire Mesh Slings:

- 1—All new and repaired slings must be proof tested at a minimum of 1 1/2 times rated capacity before putting into service, and the end fittings exhibit no deformation after proof testing.
- 2—Only slings constructed in the following manner shall be used:
 - a. end fittings must be at least as strong as the mesh.
 - b. the mesh and end fittings must be joined so that: the rated capacity of the sling is not reduced, the load is evenly distributed across the mesh width, and sharp edges of fittings will not damage the mesh.
 - c. If elastomer coated, the coating must not diminish the rated capacity of the sling and the sling must be proof tested before it is coated.
- 3—Slings not impregnated with elastomers may be used in a temperature range from -20°F to plus 550°F without decreasing the rated capacity. Slings impregnated with neoprene or PVC may be used only in a temperature range from 0° to plus 200°F. The sling manufacturer's recommendations must be followed for operations outside these temperature ranges or for slings impregnated with other materials.
- 4—Repaired slings must not be used unless they were repaired by a wire mesh sling manufacturer (or an equivalent entity). Once a sling is repaired: the date it was repaired, the nature of the repair, and the entity making the repairs must be permanently marked or tagged on the sling or else a written record maintained to indicate this information.
- 5—Slings must be immediately removed from service if any of the following conditions are present:
 - 1—a broken weld or broken brazed joint
 - 2—reduction in wire diameter of:
 - a. 25% due to abrasion
 - b. 15% due to corrosion
 - 3—lack of flexibility due to distortion of the fabric
 - 4—distortion of the choker fitting so that the depth of the slot is increased more than 10%
 - 5—distortion of an end fitting so that the width of the crane hook opening is decreased more than 10%
 - 6—a 15% reduction of the original cross sectional area of metal at any point around the crane hook opening.
 - 7—distortion of either end fitting out of its plane

CARE & MAINTENANCE RECOMMENDATIONS

Before using a sling, make sure it contains the proper type of mesh for the application intended. When using a choke hitch, be positive the center of gravity of the load falls within the width of the mesh. Corners of loads should be kept away from the end fittings and the mesh adjacent to the fitting to avoid distortion of the sling. When a load is lifted with a pair of slings they should be attached to a spreader beam.

Natural and Synthetic Fiber Rope Sling Requirements

SAFE OPERATING PRACTICES and INSPECTIONS previously listed under REQUIREMENTS APPLICABLE TO ALL TYPES OF SLINGS on page 4 of this booklet must be followed when Fiber Rope Slings are used. The following are ADDITIONAL requirements that apply specifically to Fiber Rope Slings:

- 1— When wet frozen slings are used or when slings are used above 180°F or below -20°F the recommendations of the sling manufacturer must be followed.
- 2— Slings must not be used unless they were spliced in accordance with the following requirements:
 - a. manila rope—eye splices must contain at least 3 full tucks and short splices must contain at least 6 full tucks (3 on each side of the splice centerline).
 - b. synthetic fiber rope — eye splices must contain at least 4 full tucks and short splices must contain at least 8 full tucks (4 on each side of the splice centerline).
- 3— Slings must not be used unless the strand end tails:
 - a. project at least 6 rope diameters beyond the last full tuck on slings under 1" diameter.
 - b. project at least 6" beyond the last full tuck on slings 1" diameter or larger.
- 4— Slings must have a minimum clear length of rope between eye splices equal to 10 times the rope diameter.
- 5— Clamps not designed specifically for fiber ropes, and knots must not be used in lieu of splicing.
- 6— Eyes must be large enough to provide an included angle of not greater than 60° at the splice when the eye is placed over the load or support.
- 7— Slings with end attachments containing sharp edges or projections in contact with the rope must not be used.
- 8— Only slings made from new rope may be used. Repaired or reconditioned slings are prohibited.
- 9— Slings must be immediately removed from service if any of the following conditions exist:
 - a. abnormal wear
 - b. powdered fiber between strands
 - c. broken or cut fibers
 - d. variations in the size or roundness of strands
 - e. discoloration or rotting
 - f. distortion of the sling's hardware

CARE AND MAINTENANCE (Recommendations)

Keep slings on racks, off the floor, so that they will not be damaged or create a hazard. Natural fiber slings may mildew and rot when left outside or in a damp condition. Keep them clean and dry. Do not maintain a suspended load with natural fiber ropes. They have short fibers and the rope may part when under load for a long time. Know what you are buying and have the manufacturer tag each sling with its capacity, and sling material. Inspect tails of splices before each lift to make sure they are not getting shorter. If they are, the splice isn't holding. Cut the sling in half and discard.

Synthetic Web Sling Requirements

SAFE OPERATING PRACTICES and INSPECTIONS previously listed under REQUIREMENTS APPLICABLE TO ALL TYPES OF SLINGS on page 4 of this booklet must be followed when Synthetic Web Slings are used. The following are ADDITIONAL requirements that apply specifically to Synthetic Web Slings:

- 1—Slings must contain web that is of uniform thickness and width, and selvage edges must not be split from the webbing's width.
- 2—Fittings must be free of all sharp edges that could damage the webbing and must be of a minimum breaking strength equal to that of the sling.
- 3—Stitching shall be the only method used to attach end fittings to webbing and to form eyes. The thread shall be in an even pattern and contain a sufficient number of stitches to develop the full breaking strength of the sling.
- 4—Web slings must not be exposed to fumes, vapors, sprays, mists or liquids of the following chemicals:
 - a. acids and phenolics - do not use nylon
 - b. caustics - do not use polyester, polypropylene, or slings with aluminum fittings
- 5—Nylon and polyester slings must not be used at temperatures above 200°F.
- 6—Repaired slings must not be used unless they were repaired and proof tested by a sling manufacturer (or an equivalent entity). The proof test must be twice the rated capacity, and a certificate of the proof test must be available for examination. Slings which have been repaired in a temporary manner must not be used.
- 7—Slings shall be immediately removed from service if any of the following conditions are present:
 - a. acid or caustic burns
 - b. melting or charring of any part of the sling surface
 - c. snags, punctures, tears or cuts
 - d. broken or worn stitches
 - e. distortion of fittings

CARE & MAINTENANCE (Recommendations)

Slings containing red core warning yarns should be discarded when one or more red yarns clearly appear. Wear on slings can be reduced or eliminated by means of blocking, wear pads or other methods of protection. Sunlight is also a factor. The strength of some slings has been reduced 40% after one year of outside exposure.

Tuflex Roundsling Requirements

SAFE OPERATING PRACTICES for slings not covered by the OSHA standard must be used in accordance with the manufacturer's recommendations. In addition to the REQUIREMENTS APPLICABLE TO ALL TYPES OF SLINGS on page 4, Lift-All recommends using Synthetic Roundslings in accordance with the following:

Inspect Sling for Damage

Damage to a roundsling can significantly reduce its capacity to hold or lift loads and increases the chance that the sling will fail during use. If you are not sure if a sling is damaged, **DO NOT USE IT.**

How to inspect slings

Perform a visual inspection of the entire sling and feel along its entire length for any of the types of conditions listed below. Remove sling from service immediately if **ANY** of the listed types of damage are detected. Never ignore sling damage or attempt to perform temporary repairs of damaged slings (e.g., tie knots in the sling, etc.)

Removal from service criteria:

- a. Any damage to the sling cover that exposes the red striped core yarns of the roundsling, such as excessive abrasive wear, holes, tears, cuts, snags or embedded materials.
- b. Broken or worn stitches in the cover exposing the core yarns.
- c. Identification tag is missing or not readable.
- d. Slings that have been tied into knots.
- e. Any heat or chemical damage, i.e., acid or alkali burns, melting or weld spatter.
- f. Fittings with any cracks, excessive wear, or other damage such as deformation, corrosion, or pitting.
- g. Hooks with throat opened more than 15% or twisted more than 10 degrees out of plane.
- h. Any conditions which cause doubt as to the strength of the sling.

Avoid actions that cause damage to slings, such as:

- 1— Using hooks, shackles or other hardware that have edges or rough surfaces
- 2— Twisting, kinking or knotting the sling
- 3— Using slings to pull on stuck or constrained objects, or for towing purposes
- 4— Dropping or dragging slings on the ground, floor or over abrasive surfaces
- 5— Shortening or connecting slings by knotting, twisting, or other methods not approved by the sling manufacturer or qualified person
- 6— Exposing slings to temperatures above 200°F (90°C), or below -40°F (-40°C)
- 7— "Tip loading" a sling hook instead of centering it in the base or "bowl" of the hook
- 8— Driving over slings with a vehicle or other equipment
- 9— Accelerating or decelerating the load too quickly (i.e., "shock loading")
- 10— Exposing slings to damaging acids or alkalis

Exposure of Slings to Edges

Edges do not need to be “sharp” to cause failure of the sling. Table 3-1 shows the minimum allowable edge radii suitable for contact with unprotected roundslings. Chamfering or cutting off edges is not an acceptable substitute for fully rounding the edges to the minimum radius. Slings can also be damaged from contact with edges or burrs at the sling connections.

Figure 3-1. Measure the edge radius. The radius is equal to the distance between points A and B.

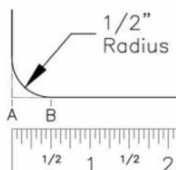


Table 3-1 Minimum Edge Radii suitable for contact with unprotected polyester roundslings

Vertical Rated Capacity (Lbs.)	Minimum Edge Radii	
	(in.)	(in.)
2,600	.14	3/16
5,300	.21	1/4
8,400	.26	5/16
10,600	.30	5/16
13,200	.33	3/8
16,800	.40	7/16
21,200	.41	7/16
25,000	.44	7/16
31,000	.50	1/2
40,000	.56	9/16
53,000	.67	11/16
66,000	.72	3/4
90,000	.87	7/8

For further information on minimum edge radii, Contact Lift-All or see WSTDA RS-1.

Sling Hardware and Connections

Connection surfaces must be smooth to avoid abrading or cutting roundslings. Roundslings can also be damaged or weakened by excessive compression between the sling and the connection points if the size of the attachment hardware or connection area is not large enough to avoid this damage. Select and use proper connection hardware that conforms to the size requirements listed for choker and vertical hitches, or for basket hitches.

(Contact Lift-All, or see WSTDA RS-1 for information about how to calculate whether a smaller connection size is allowable when tension on a roundsling is less than its capacity.)

Maintain and Store Sling Properly

Attempt to keep slings clean and free of dirt, grime and foreign materials. If slings are cleaned, use only mild soap and water, and:

- Do not use bleaching agents
- Do not machine wash or tumble dry slings, as this can significantly reduce their strength

When not in use, slings should be stored in an area free from environmental or mechanical sources of damage, such as: weld spatter, splinters from grinding or machining, or sources of UV, heat, or chemical exposure, etc.

Safety Is Efficient

The proper care and use of Lift-All slings will make them last longer. While it takes a few extra minutes to inspect a sling prior to its use and to care for it after it has done the job, the time and effort is well spent in eliminating hazardous conditions.

Inspection and Testing

Inspection facilities are available at all Lift-All plants. Proof-testing and certificates of test are available upon request.



**DIRECTED TOLL FREE #
(800) 909-1964
FAX: (717) 898-1215**

www.lift-all.com

e-mail: lift-all@lift-all.com

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