

DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

DIRECTOR'S OFFICE

GENERAL INDUSTRY SAFETY STANDARDS

(By authority conferred on the director of the department of licensing and regulatory affairs by sections 16 and 21 of 1974 PA 154 and Executive Reorganization Order Nos. 1996-2, 2003-1, 2008-4, and 2011-4, MCL 445.2001, 445.2011, 445.2025, and 445.2030)

PART 49. SLINGS

R 408.14901 Scope.

Rule 4901. This part sets forth the requirements for slings and their construction, care, and use in, around, and about a place of employment.

Types of slings included in this part are: chain, wire rope, metal mesh, 3-strand natural or synthetic rope, and synthetic web made from nylon, polyester, and polypropylene.

History: 1979 AC.

Editor's note: Former R 408.14901--R 408.14910, pertaining to the board of safety compliance and appeals, have been renumbered R 408.19901--R 408.19910.

R 408.14902 Adoption of standard.

Rule 4902. (1) The following standard is adopted by reference in these rules, American Society of Mechanical Engineers Standard ASME B-30.9 "Slings," 1990 edition. This standard may be purchased from IHS Global, 15 Inverness Way East, Englewood, Colorado, 80112, USA, telephone number: 1-800-854-7179 or via the internet at web-site: <http://global.ihs.com> at a cost as of the time of adoption of these amendments of \$93.00.

(2) The standard adopted in subrule (1) of this rule is also available for inspection at the Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, 7150 Harris Drive, P.O. Box 30643, Lansing, Michigan, 48909-8143.

(3) Copies of the standard adopted in subrule (1) of this rule may be obtained from the publisher or may also be obtained from the Department of Licensing and Regulatory Affairs, MIOSHA Standards Section, 7150 Harris Drive, P.O. Box 30643, Lansing, Michigan, 48909-8143, at the cost charged in this rule, plus \$20.00 for shipping and handling.

History: 2014 AACCS.

R 408.14903 Definitions; A, B.

Rule 4903. (1) "Angle of loading" means the inclination of a leg or branch of a sling, measured from the horizontal or vertical plane as shown in figure 5, provided that an angle of loading of 5 degrees or less from the vertical may be considered a vertical angle of loading.

(2) "Basket hitch" means a sling configuration whereby the sling is passed under the load and has both ends, end attachments, eyes, or handles on the hook or a single master link.

(3) "Braided wire rope" means a wire rope formed by plaiting component wire ropes.

(4) "Bridle wire rope sling" means a sling composed of multiple wire rope legs, with the top ends gathered in a fitting that goes over the lifting hook.

History: 1979 AC.

R 408.14904 Definitions; C.

Rule 4904. (1) "Cable laid endless sling-mechanical joint" means a wire rope sling made endless by joining the ends of a single length of cable laid rope with 1 or more metallic fittings.

(2) "Cable laid grommet-hand tucked" means an endless wire rope sling made from 1 length of rope wrapped 6 times around a core formed by hand, tucking the ends of the rope inside the 6 wraps.

(3) "Cable laid rope" means a wire rope composed of 6 wire ropes wrapped around a fiber or wire rope core.

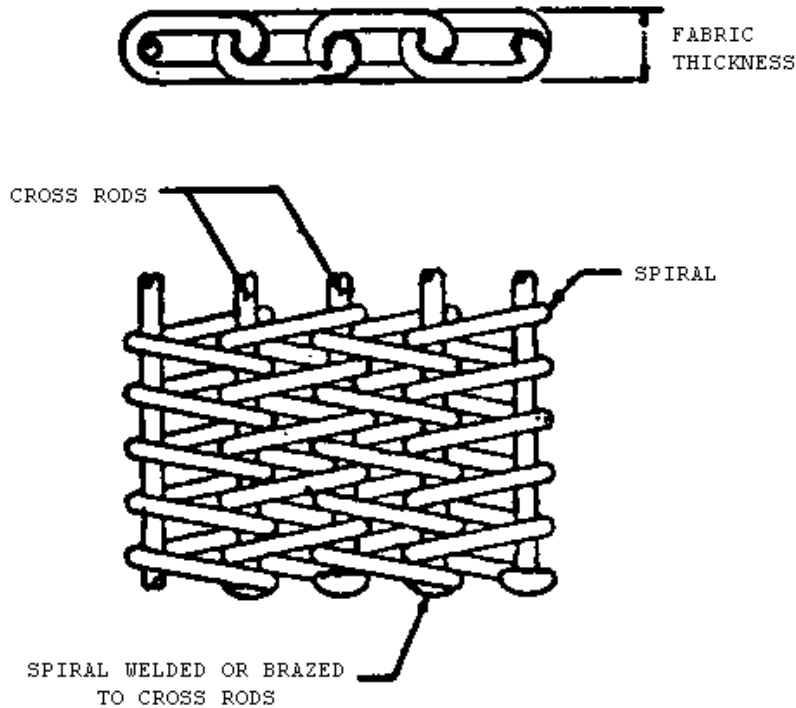
(4) "Cable laid rope sling-mechanical joint" means a wire rope sling made from a cable laid rope, with eyes fabricated by pressing or swaging 1 or more metal sleeves over the rope junction.

(5) "Choker hitch" means a sling configuration with 1 end of the sling passing under the load and through an end attachment, handle, or eye on the other end of the sling.

(6) "Coating" means an elastomer, or other suitable material, applied to a sling or to a sling component to impart desirable properties.

(7) "Cross rod" means a wire used to join spirals of metal mesh to form a complete fabric. (See figure 2 "Metal Mesh Construction")

FIGURE 2
METAL MESH CONSTRUCTION



History: 1979 AC; 2014 AACS.

R 408.14905 Definitions; D to H.

Rule 4905. (1) "Designated" means to be selected or assigned by the employer or the employer's representative as being qualified to perform specific duties.

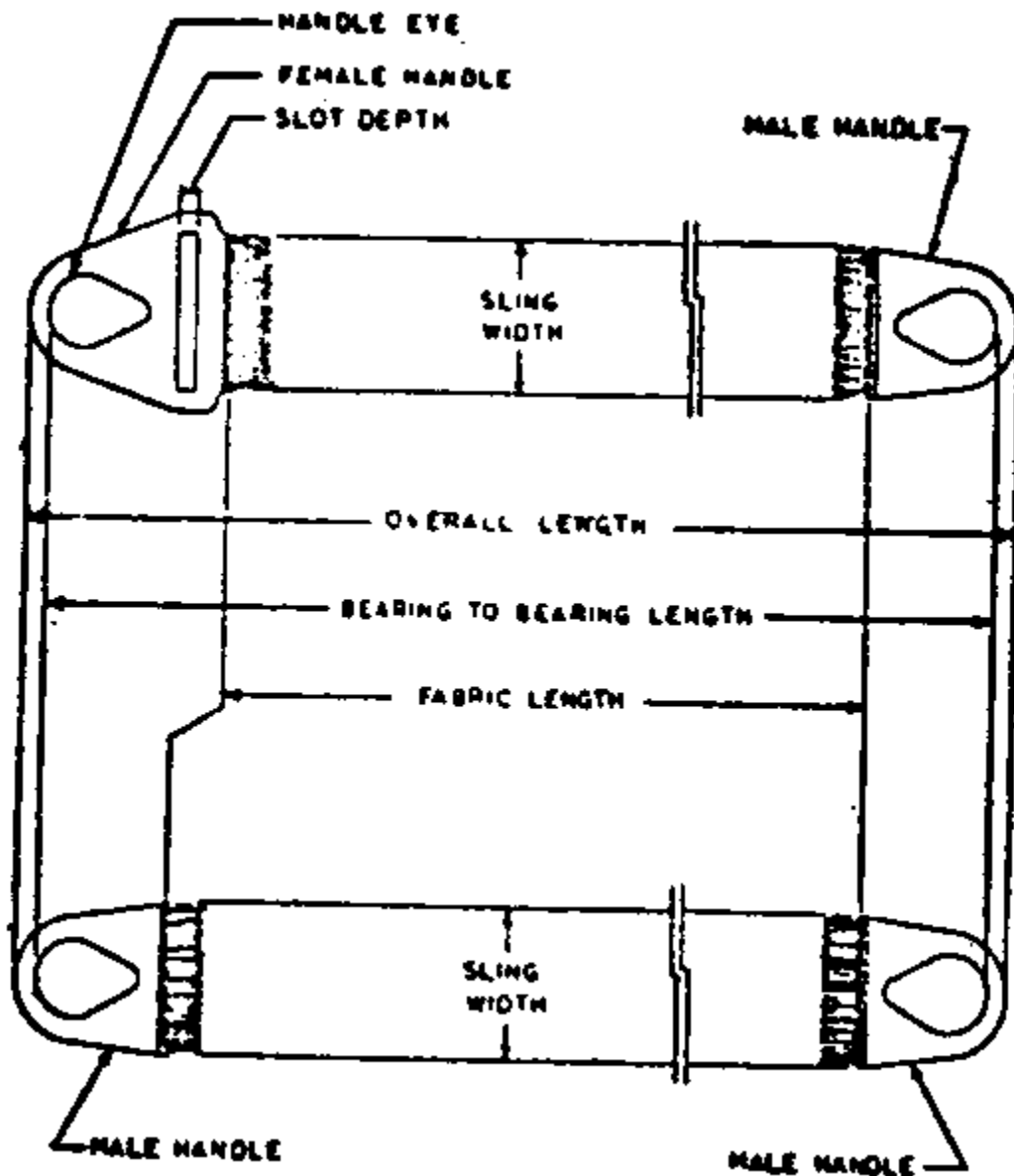
(2) "Female handle of a choker sling" means a handle with a handle eye and a slot of such dimension as to permit passage of a male handle, thereby allowing the use of a metal mesh sling in a choker hitch. (See figure 1 "Metal Mesh Sling")

(3) "Handle" means a terminal fitting to which metal mesh fabric is attached. (See figure 1 "Metal Mesh Sling")

(4) "Handle eye" means an opening in a handle of a metal mesh sling shaped to accept a hook, shackle, or other lifting device. (See figure 1 "Metal Mesh Sling")

(5) "Hitch" means a sling configuration whereby the sling is fastened to an object or load, either directly to it or around it.

FIGURE 1
METAL MESH SLING (Typical)



History: 1979 AC; 2014 AACS.

R 408.14906 Definitions; L, M.

Rule 4906. (1) "Link" means a single ring of a chain.

(2) "Male handle" or "triangle" means a handle with a handle eye.

(3) "Master coupling link" means an alloy steel welded coupling link used as an intermediate link to join alloy steel chain to master links. (See figure 3 "Major Components of a Quadruple Sling")

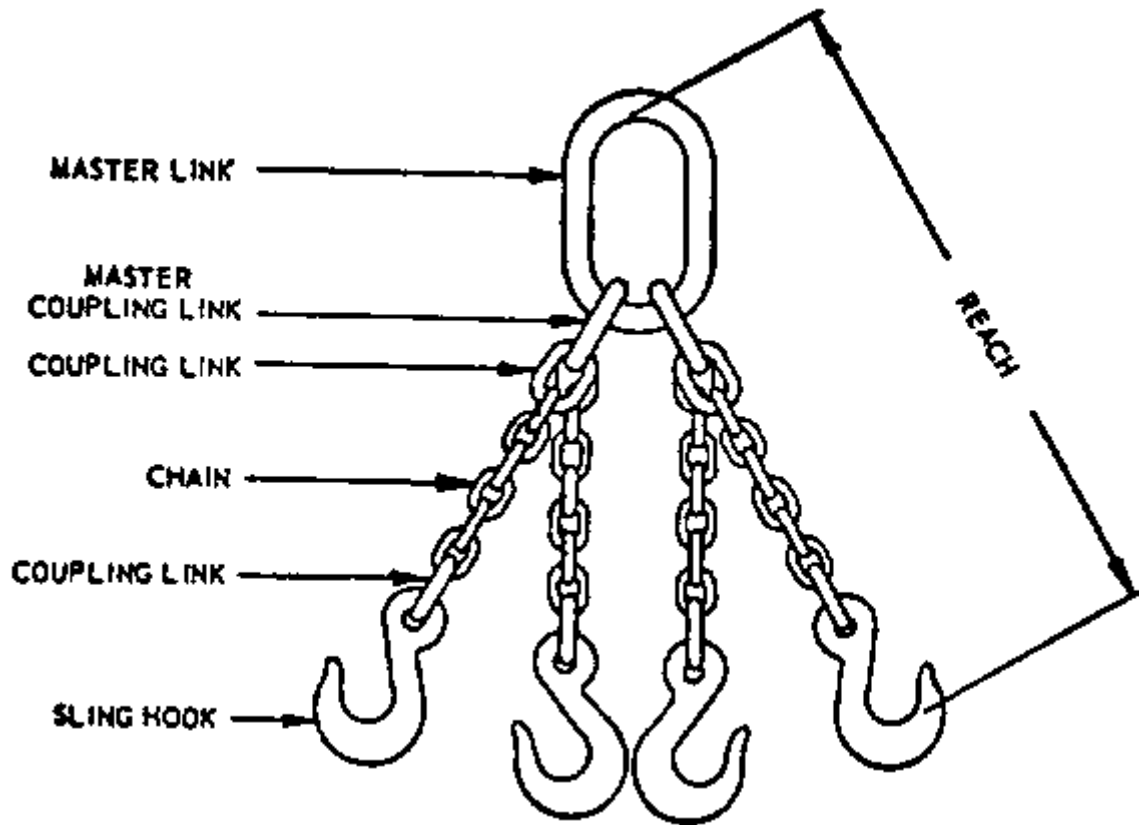
(4) "Master link" or "gathering ring" means a forged or welded steel link used to support

all members (legs) of an alloy steel chain sling or wire rope sling. (See figure 3 “Major Components of a Guadruple Sling”)

(5) "Mechanical coupling link" means a nonwelded, mechanically closed steel link used to attach master links and hooks to alloy steel chain.

(6) "Metal mesh" or "fabric" means the flexible portion of a metal mesh sling, consisting of a series of transverse coils and cross rods.

FIGURE 3
MAJOR COMPONENTS OF A GUADRUPLE SLING



History: 1979 AC; 2014 AACS.

R 408.14907 Definitions; P to R.

Rule 4907. (1) "Proof load" means a load applied in performance of a proof test.

(2) "Proof test" means a nondestructive tension test performed by the sling manufacturer, or an equivalent entity, to verify construction and workmanship of a sling.

(3) "Rated capacity" means the maximum working load permitted by the provisions of this part.

(4) "Reach" means the effective length of an alloy steel chain sling, measured from the top bearing surface of the upper terminal component to the bottom bearing surface of the lower terminal component.

History: 1979 AC.

R 408.14908 Definitions; S to V.

Rule 4908. (1) "Selvage edge" means the finished edge of synthetic webbing designed to prevent unraveling.

(2) "Sling" means an assembly which connects the load to the material handling equipment for the purpose of lifting or hoisting.

(3) "Sling manufacturer" means a person or organization that assembles sling components into their final form for sale to users.

(4) "Spiral" means a single transverse coil that is the basic element from which metal mesh is fabricated. (See figure 2 "Metal Mesh Construction")

(5) "Strand laid endless sling-mechanical joint" means a wire rope sling made endless from 1 length of rope, with the ends joined by 1 or more metallic fittings.

(6) "Strand laid grommet-hand tucked" means an endless wire rope sling made from 1 length of strand wrapped 6 times around a core formed by hand tucking the ends of the strand inside the 6 wraps.

(7) "Strand laid rope" means a wire rope made with strands, usually 6 or 8, wrapped around a fiber core, wire strand core, or independent wire rope core.

(8) "Vertical hitch" means a method of supporting a load by a single, vertical part or leg of the sling. (See figure 4 "Basic Sling Configurations with Vertical Legs")

FIGURE 4
 BASIC SLING CONFIGURATIONS WITH VERTICAL LEGS

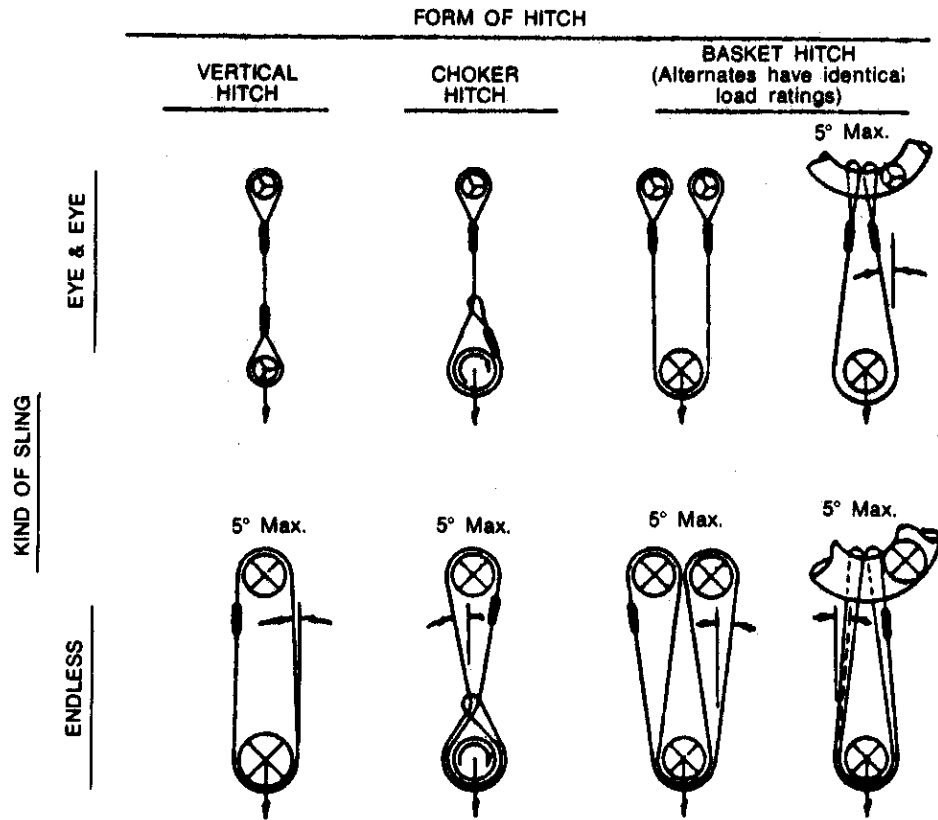
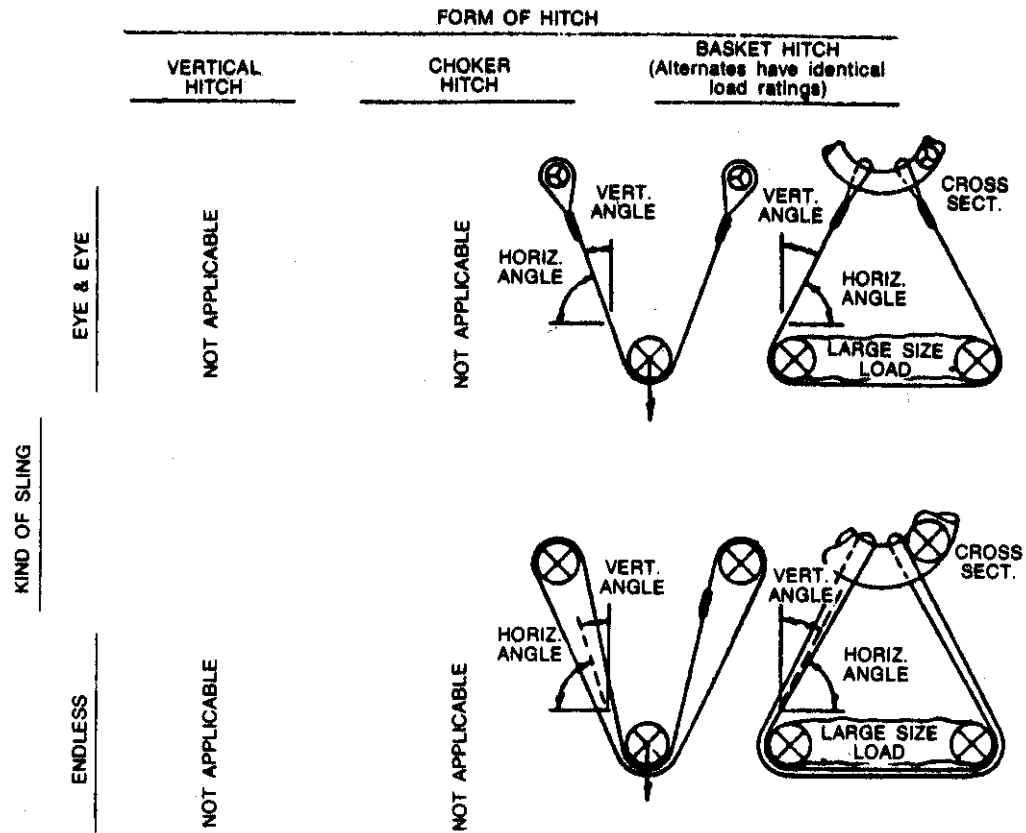


FIGURE 5
SLING CONFIGURATIONS WITH ANGLED LEGS



Not es: Angles 5 degrees or less from the vertical may be considered vertical angles.

For slings with legs more than 5 degrees off vertical, the actual angle as shown in Figure 5 must be considered.

EXPLANATION OF SYMBOLS: MINIMUM DIAMETER OF CURVATURE



Represents a contact surface which shall have a diameter of curvature at least double the diameter of the rope from which the sling is made



Represents a contact surface which shall have a diameter of curvature at least 8 times the diameter of the rope.



Represents a load in a choker hitch and illustrates the rotary force on the load and/or the slippage of the rope in contact with the load. Diameter of curvature of lead surface shall be at least double the diameter of the rope.

History: 1979 AC; 2014 AACS.

R 408.14911 General operating practices.

Rule 4911. (1) Whenever a sling is used, the following practices shall be followed:

- (a) A damaged or defective sling, as described in this standard, shall not be used.
- (b) A sling shall not be shortened with bolts, knots, or other makeshift devices.
- (c) Sling legs shall not be kinked.
- (d) A sling shall not be loaded in excess of its rated capacity.
- (e) A sling used in a basket hitch shall have the load balanced to prevent slipping.
- (f) A sling shall be securely attached to its load.
- (g) A sling, other than an alloy steel chain, shall be padded or protected from the sharp corners of its load.
- (h) A suspended load shall be kept clear of all obstructions.
- (i) An employee shall be kept clear of a suspended load and a load about to be lifted.
- (j) An employee's hand or finger shall not be placed between the load and sling while the sling is being tightened.
- (k) Slack in a sling shall be removed gradually.
- (l) A sling shall not be pulled from under a load when the load is resting on the sling.
- (2) Employers shall 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.
- (3) Employers shall not use slings without affixed and legible identification markings.

History: 1979 AC; 2014 AACS.

R 408.14912 Inspections generally; removal of sling from service.

Rule 4912. (1) A sling and all fastenings shall be inspected for damage and defects by a designated employee before each day's use.

(2) Where service conditions warrant, additional inspections shall be performed during sling use.

(3) A damaged or defective sling, as described in this part, shall be immediately removed from service.

History: 1979 AC.

R 408.14913 Rescinded.

History: 1979 AC; 1998-2000 AACS.

ALLOY STEEL CHAIN SLINGS

R 408.14921 Sling identification.

Rule 4921. An alloy steel chain sling shall have a permanently affixed, durable identification, stating the size, grade, rated capacity, and reach.

History: 1979 AC; 2014 AACCS.

R 408.14922 Rated capacity of attachments.

Rule 4922. (1) A hook, ring, oblong link, pear-shaped link, welded or mechanical coupling link, or other attachment shall have a rated capacity at least equal to that of the alloy steel chain with which they are used, or the sling shall not be used in excess of the rated capacity of the weakest component.

(2) A makeshift link or fastener formed from bolts or rods, or other such attachments, shall not be used.

History: 1979 AC; 2014 AACCS.

R 408.14923 Inspections; records; removal from service; proof testing.

Rule 4923. (1) In addition to the inspection prescribed by R 408.14912, an employer shall designate an employee to make a thorough periodic inspection of an alloy steel chain sling in use on a regular basis. An employer shall determine the regularity of inspection based on all of the following factors:

- (a) Frequency of sling use.
- (b) Severity of service conditions.
- (c) Nature of lifts being made.
- (d) Experience gained on the service life of slings used in similar circumstances.

The designated employee shall inspect an alloy steel chain sling at least once every 12 months.

(2) The employer shall make and maintain a record of the most recent month in which each alloy steel chain sling was thoroughly inspected and shall make the record available for examination.

(3) The employee designated to make the inspection of an alloy steel chain sling shall make a thorough inspection for all of the following:

- (a) Wear.
- (b) Defective welds.
- (c) Deformation.

(d) An increase in length beyond acceptable limits established in this part. If the defects or deteriorations are present, then the designated employee shall immediately remove the sling from service.

(4) The employer shall ensure that, before use, each new, repaired, or reconditioned alloy steel chain sling, including all welded components in the sling assembly, is proof-tested by the sling manufacturer in accordance with ASME B-30.9 "Slings," 1990 edition, as adopted in R 408.14902.

(5) The employer shall retain a certificate of the proof test and shall make it available for examination.

(6) If the chain size at any point of the link is less than that stated in Table 1, the employer shall remove the chain from service.

TABLE 1
MINIMUM ALLOWABLE CHAIN SIZE AT ANY POINT OF LINK

Chain size (inches)	Maximum allowable wear
1/4	13/64
3/8	19/64
1/2	25/64
5/8	31/64
3/4	19/32
7/8	45/64
1	13/16
1 1/8	29/32
1 1/4	1
1 3/8	1-3/32
1 1/2	1-3/16
1 3/4	1-13/32

History: 1979 AC; 1998-2000 AACS; 2014 AACS.

R 408.14924 Safe operating temperatures.

Rule 4924. Employers shall permanently remove an alloy steel-chain slings from service if it is heated above 1,000 degrees F. When exposed to service temperatures in excess of 600 degrees F, employers shall reduce the maximum working-load limits permitted by the chain manufacturer in accordance with the chain or sling manufacturer's recommendations.

History: 1979 AC; 2014 AACS.

R 408.14925 Repairing; reconditioning, and proof testing.

Rule 4925. (1) A worn or damaged alloy steel chain sling or attachment shall not be used until repaired.

(2) When welding or heat treating is performed, a sling shall not be used unless repaired, reconditioned, and proof tested by the sling manufacturer.

(3) A mechanical coupling link or low carbon steel repair link shall not be used to repair broken lengths of chain.

History: 1979 AC; 2014 AACCS.

R 408.14926 Cracked or deformed links or hooks; removal from service.

Rule 4926. (1) Alloy steel chain slings with cracked or deformed master links, coupling links, or other components shall be removed from service.

(2) A sling shall be removed from service if the hook is cracked, has been opened more than 15% of the normal throat opening measured at the narrowest point, or twisted more than 10 degrees from the plane of the unbent hook.

History: 1979 AC; 2014 AACCS.

WIRE ROPE SLINGS

R 408.14931 Safe operating temperatures; sling use.

Rule 4931. (1) A wire rope sling shall not be used with loads in excess of the rated capacities. A sling shall be used only in accordance with the manufacturer's recommendations.

(2) A fiber core wire rope sling of any grade shall be permanently removed from service if it is exposed to a temperature in excess of 200 degrees Fahrenheit.

(3) When a nonfiber core wire rope sling of any grade is used at a temperature above 400 degrees Fahrenheit or below minus 60 degrees Fahrenheit, recommendations of the sling manufacturer regarding use at that temperature shall be followed.

(4) Employers shall use only wire-rope slings that have permanently affixed and legible identification markings as prescribed by the manufacturer and that indicate the recommended safe working load for the type of hitch used, the angle upon which it is based, and the number of legs if more than 1.

History: 1979 AC; 2014 AACCS.

R 408.14932 Minimum sling lengths.

Rule 4932. (1) Cable laid and a 6 x 19 and 6 x 37 sling shall have a minimum clear length of wire rope 10 times the component rope diameter between splices, sleeves, or end fittings.

(2) A braided sling shall have a minimum clear length of wire rope 40 times the component rope diameter between the loops or end fittings.

(3) A cable laid grommet, strand laid grommet, and endless sling shall have a minimum circumferential length of 96 times their body diameter.

History: 1979 AC; 2014 AACCS.

R 408.14933 Welded end attachment; certificate of proof test.

Rule 4933. (1) Welding of an end attachment, except covers to thimbles, shall be performed prior to the assembly of the sling.

(2) All welded end attachments shall not be used unless proof tested by the manufacturer at twice their rated capacity prior to initial use. The employer shall retain a certificate of the proof test, and make it available for examination.

History: 1979 AC; 2014 AACS.

R 408.14934 Removal from service.

Rule 4934. A wire rope sling shall be removed from service if any of the following conditions are present:

(a) Ten randomly distributed broken wires in 1 rope lay, or 5 broken wires in 1 strand in 1 rope lay.

(b) Wear or scraping of 1/3 the original diameter of outside individual wires.

(c) Kinking, crushing, bird caging, or any other damage resulting in distortion of the wire rope structure.

(d) Evidence of heat damage.

(e) End attachments that are cracked, deformed, or worn.

(f) Hooks that have been opened more than 15% of the normal throat opening measured at the narrowest point, or twisted more than 10 degrees from the plane of the unbent hook.

(g) Corrosion of the rope or end attachments.

History: 1979 AC; 2014 AACS.

R 408.14935 Forming eyes.

Rule 4935. An eye in a wire rope sling shall not be formed by using a knot or a wire rope clip.

History: 1979 AC; 2014 AACS.

METAL MESH SLINGS

R 408.14941 Sling marking; rated capacity; coatings.

Rule 4941. (1) Each metal mesh sling shall have permanently affixed to it a durable marking that states the rated capacity for vertical basket hitch and choker hitch loadings.

(2) A handle shall have a rated capacity at least equal to the metal fabric and exhibit no deformation after proof testing.

(3) Coatings which diminish the rated capacity of a sling shall not be applied.

History: 1979 AC; 2014 AACS.

R 408.14942 Attachment of handle.

Rule 4942. The fabric and handles shall be joined to ensure all of the following:

- (a) The rated capacity of the sling is not reduced.
- (b) The load is evenly distributed across the width of the fabric.
- (c) Sharp edges will not damage the fabric.

History: 1979 AC; 2014 AACCS.

R 408.14943 Sling testing.

Rule 4943. All new and repaired metal mesh slings, including handles, shall not be used unless proof tested by the manufacturer at a minimum of 1 1/2 times their rated capacity. Elastomer impregnated slings shall be proof tested before coating.

History: 1979 AC; 2014 AACCS.

R 408.14944 Sling use; safe operating temperatures.

Rule 4944. (1) A metal mesh sling shall not be used to lift loads in excess of their rated capacities.

(2) A sling shall be used only in accordance with the manufacturer's recommendations.

(3) A metal mesh sling which is not impregnated with elastomers may be used in a temperature range from minus 20 degrees Fahrenheit to plus 550 degrees Fahrenheit without decreasing the working load limit.

(4) A metal mesh sling impregnated with polyvinyl chloride or neoprene may be used only in a temperature range from zero degrees to plus 200 degrees Fahrenheit.

(5) For operations outside these temperature ranges in subrule (3) and (4) of this rule or for metal mesh slings impregnated with other materials, the sling manufacturer's recommendations shall be followed.

History: 1979 AC; 2014 AACCS.

R 408.14945 Removal from service; repairs; records.

Rule 4945. (1) A metal mesh sling shall be immediately removed from service if any of the following conditions are present:

(a) A broken weld or broken brazed joint along the sling edge.

(b) Reduction in wire diameter of 25% due to abrasion or 15% due to corrosion.

(c) Lack of flexibility due to distortion of the fabric.

(d) Distortion of the female handle so that the depth of the slot is increased more than 10%.

(e) Distortion of either handle so that the width of the eye is decreased more than 10%.

(f) A 15% reduction of the original cross sectional area of metal at any point around the handle eye.

(g) Distortion of either handle out of its plane.

(2) A metal mesh sling which is repaired shall not be used unless repaired by a metal mesh sling manufacturer.

(3) Once repaired, each sling shall be permanently marked or tagged, or a written record maintained, to indicate the date and nature of the repairs and the person or organization that performed the repairs. Records of repairs shall be made available for examination.

History: 1979 AC; 2014 AACCS.

NATURAL AND SYNTHETIC FIBER ROPE SLINGS

R 408.14951 Sling use; rated capacity; diameter of curvature; safe operating temperatures.

Rule 4951. (1) A fiber rope sling made from conventional 3 strand construction fiber rope shall not be used with a load in excess of the rated capacities.

(2) A fiber rope sling shall have a diameter of curvature meeting not less than the minimums prescribed in figures 4 and 5.

(3) A sling shall be used only in accordance with the manufacturer's recommendations.

(4) A natural or synthetic fiber rope sling, except for a wet frozen sling, may be used in a temperature range from minus 20 degrees Fahrenheit to plus 180 degrees Fahrenheit without decreasing the working load limit. For operations outside this temperature range and for wet frozen slings, the sling manufacturer's recommendations shall be followed.

(5) Employers shall use natural and synthetic fiber-rope slings that have permanently affixed and legible identification markings stating the rated capacity for the type of hitch used and the angle upon which it is based, type of fiber material, and the number of legs if more than 1.

History: 1979 AC; 2014 AACCS.

R 408.14952 Splicing.

Rule 4952. A spliced fiber rope sling shall not be used unless it has been spliced in accordance with the following minimum requirements and in accordance with any additional recommendations of the manufacturer:

(a) In manila rope, an eye splice shall consist of at least 3 full tucks, and short splices shall consist of at least 6 full tucks, 3 on each side of the splice center line.

(b) In synthetic fiber rope, an eye splice shall consist of at least 4 full tucks, and short splices shall consist of at least 8 full tucks, 4 on each side of the center line.

(c) A strand end tail shall not be trimmed flush with the surface of the rope immediately adjacent to the full tucks. This applies to all types of fiber rope and both eye and short splices. For fiber rope under 1 inch in diameter, the tail shall project at least 6 rope diameters beyond the last full tuck. For fiber rope 1 inch in diameter and larger, the tail shall project at least 6 inches beyond the last full tuck. Where a projecting tail interferes with the use of the sling, the tail shall be tapered and spliced into the body of the rope, using at least 2 additional tucks, which will require a tail length of approximately 6 rope diameters beyond the last full tuck.

(d) A fiber rope sling shall have a minimum clear length of rope between eye splices equal to 10 times the rope diameter.

- (e) A knot shall not be used in lieu of a splice.
- (f) A clamp not designed specifically for fiber ropes shall not be used for splicing.
- (g) For any eye splice, the eye shall be of a size to provide an included angle of not greater than 60 degrees at the splice when the eye is placed over the load or support.

History: 1979 AC; 2014 AACS.

R 408.14953 End attachments.

Rule 4953. A fiber rope sling shall not be used if an end attachment in contact with the rope has a sharp edge or projection.

History: 1979 AC; 2014 AACS.

R 408.14954 Removal from service; prohibition.

Rule 4954. (1) A natural and synthetic fiber rope sling shall be immediately removed from service if any of the following conditions are present:

- (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 hardware in the sling.

(2) Only a fiber rope sling made from new rope shall be used. Use of a repaired or reconditioned fiber rope sling is shall not be used.

History: 1979 AC; 2014 AACS.

SYNTHETIC WEB SLINGS

R 408.14961 Marking or coding rated capacities.

Rule 4961. Each sling shall be marked or coded to show the rated capacities for each type of hitch and type of synthetic web material.

History: 1979 AC; 2014 AACS.

R 408.14962 Webbing size and edges.

Rule 4962. Synthetic webbing shall be of uniform thickness and width, and selvage edges shall not be split from the webbing's width.

History: 1979 AC; 2014 AACS.

R 408.14963 Fittings.

Rule 4963. (1) Fittings shall be both of the following:

- (a) Of a minimum breaking strength equal to that of the sling.
- (b) Free of all sharp edges that could in any way damage the webbing.

(2) 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.

History: 1979 AC; 2014 AACCS.

R 408.14964 Use; safe operating temperatures.

Rule 4964.

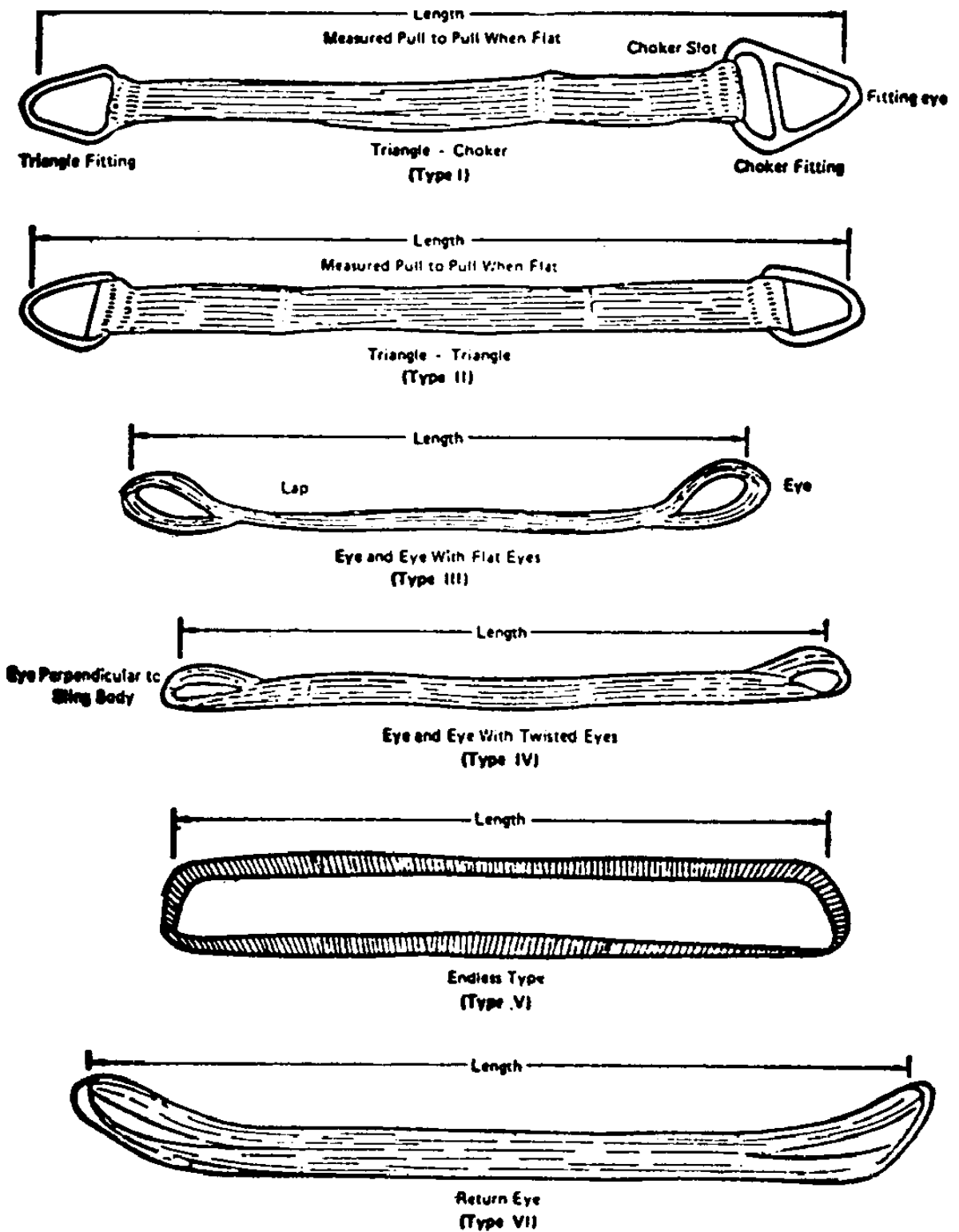
(1) When a synthetic web sling is used, the following precautions shall be taken:

- (a) A nylon web sling shall not be used where fumes, vapors, sprays, mists, or liquids of acids or phenolics are present.
- (b) A polyester and polypropylene web sling shall not be used where fumes, vapors, sprays, mists, or liquids of caustics are present.
- (c) A web sling with aluminum fittings shall not be used where fumes, vapors, sprays, mists, or liquids of caustics are present.

(2) A synthetic web sling of polyester and nylon shall not be used at a temperature in excess of 180 degrees Fahrenheit.

(3) A polypropylene web sling shall not be used at a temperature in excess of 200 degrees Fahrenheit. (See figure 6 “Basic Synthetic Web Sling Constructions.”)

FIGURE 6
 BASIC SYNTHETIC WEB SLING CONSTRUCTIONS



History: 1979 AC; 2014 AACCS.

R 408.14965 Removal from service; repairs; certificate of proof test; prohibition.

Rule 4965. (1) A synthetic web sling 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.

(2) A synthetic web sling shall be repaired only by a sling manufacturer.

(3) Each repaired sling shall be proof tested by the manufacturer to twice the rated capacity prior to its return to service. The employer shall retain a certificate of the proof test and make it available for examination.

(4) A sling, including webbing and fittings, which has been repaired in a temporary manner shall not be used.

History: 1979 AC; 2014 AACCS.