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Welcome To The Rigging World

The rigging industry can be a very complicated world but by utilizing resources and gathering information you can increase your knowledge of the industry and be successful.
What Is Rigging?

Products / Devices used “below the hook”
- Nylon Slings / Assemblies
- Chain Slings / Assemblies
- Wire Rope Chokers / Assemblies
- Fittings & hardware
- Wire mesh slings
- Spreader bars and other
One of the greatest errors in our industry today is the lack of information.
BASIC HITCHES

- **Rope** (75%)
- **All Others** (80%)

- **Vertical** (100%)

- **Basket** (200%)
ALL LIFTING OPERATIONS SHOULD BE PLANNED TO AVOID HAZARDS!

It is paramount to give all “riggers” a basic understanding of the safety standards needed to perform “Overhead Lifting” operations. Most accidents happen to those who perform lifting “casually”...as a small part of their daily tasks.
INCIDENTS HAPPEN WHEN

- Incorrect rigging gear is used
- Rigging gear is worn and in need of repair
- Rigging gear is used incorrectly
- Operator not trained
Section 5(a)(1)
Shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees;
U.S. organizations that publish manufacturing and safety standards

**OSHA** – Occupational Safety and Hazard Act is the governing publication

**ASME** – American Society of Mechanical Engineers publishes safety standards and operating practices for material handling equipment and hardware
DEFINITION OF TERMS
Should vs. Shall

The term “shall” is used by OSHA and it indicates that a rule is mandatory and must be followed.

The term “should” is used by ASME and it indicates that a rule is recommended.
Process of lifting that would elevate a freely suspended load to such a position that dropping the load would present a possibility of bodily injury or property damage.
DESIGNATED PERSON

Person selected or assigned by the employer or employers representative as being qualified to perform specific duties.
COMPETENT PERSON

One who is capable of identifying existing and predictable hazards in the surroundings or working conditions, which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
One who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.
The maximum allowable working load established by the sling manufacturer.

The terms rated capacity and “working load limit” are commonly used to describe rated load.
The MAXIMUM load that shall be applied in direct tension to an undamaged straight length of a sling or other rigging equipment.

- **W.L.L.** = Working load limit
- **S.W.L.** = Safe Working Load
DESIGN FACTORS

Ratio of the breaking strength to the working load limit.

- Chain 4:1
- Wire Mesh 5:1
- Wire Rope 5:1
- Synthetics 5:1
- Hardware 5:1
It is important to note that the design factor is based on a sling as it leaves the factory. Once a lifting assembly is put into service the design factor begins to decrease with wear.
Shock Loading

Any condition of rapid lift, sudden shifting of load, or arrest of a falling load
Elongation

The ability of a load bearing material to permanently increase in length before it breaks. **Elongation** is expressed as a percentage of increase over its original length.
OSHA STANDARDS

- 1910.184 industrial
- 1926.251 construction
ASME STANDARDS

- B30.9 slings
- B30.10 hooks
- B30.16 overhead hoists
- B30.20 below the hook
- B30.21 lever hoists
- B30.26 rigging hardware
THINGS TO KNOW WHEN SELECTING THE CORRECT RIGGING

- Weight of the load
- Center of gravity
- Number of attachment points required for a balanced load
- Sling angle
- Reach
- Ambient conditions
Factors That Effect Sling Capacity

Minimum D/d Ratios

1. Alloy Steel Chain Slings - 6/1
2. Wire Rope Slings (Mechanical splice 25/1: Hand splice 15/1)
3. Synthetic Fiber Rope – 8/1
CHAIN SLINGS
ALLOY CHAIN

ADVANTAGES
- Flexible
- Impact resistant
- Repairable
- Durable
- Minimum Elongation

DISADVANTAGES
- Heavy
- Initial cost
CHAINS ASME B30.9-1
IDENTIFICATION REQUIREMENTS

- Name or trademark of manufacture.
- Grade.
- Chain size.
- Number of legs if more than one. Rated load and angle.
- Length.
- Individual sling identification (serial number)
Inspections

- Initial inspection
  - Prior to use all new, altered, modified, or repaired slings shall be inspected by a designated person

- Frequent inspection
  - A visual inspection for damage shall be performed by the end user or other designated person each day or shift of the sling being used
Are Latches Required?
Periodic Inspection

- Periodic inspection
  - A complete inspection for damage of the sling shall be periodically performed by a designated person. Each link and component shall be examined individually, taking care to expose and examine all surfaces including the inner link surfaces. The sling shall be examined for conditions such as those listed in removal criteria and a determination made to whether they constitute a hazard.
  - Periodic inspection intervals shall not exceed 1 year. The frequency of periodic inspections should be based on:
    - Frequency of slings use
    - Severity of service conditions
    - Nature of lifts being made
    - Experience gained on the service life of slings used in similar circumstances
  - Guidelines for periodic inspection intervals:
    - Normal service-yearly
    - Severe service-monthly or quarterly
    - Special service-as recommended by a qualified person
  - A written record of the most recent periodic inspection shall be maintained.
Slings
Completed by: Dan Roller on 08/06/2019
Location: St Paul Total Tool
Serial Number: NA
Status: Out of Service
Description: 1/2 X 5FT 3 1/2INSSS GR100

Type: Alloy Steel Chain

Priorities Found:  3 - High  2 - Good

<table>
<thead>
<tr>
<th>General</th>
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<tbody>
<tr>
<td>1. General Condition</td>
<td>(P) Pass</td>
</tr>
<tr>
<td>2. Tag / Identification</td>
<td>(F) Fail</td>
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<tr>
<td></td>
<td>Missing identification tag.</td>
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<table>
<thead>
<tr>
<th>Alloy Chain Overview</th>
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<tbody>
<tr>
<td>3. Master Link(s)</td>
<td>(NA) Not Applicable</td>
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<tr>
<td>4. Fitting(s)</td>
<td>(F) Fail P4</td>
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<tr>
<td>5. Chain</td>
<td>(P) Pass</td>
</tr>
<tr>
<td>6. End Connection(s) - Hook(s)</td>
<td>(F) Fail P6</td>
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<tr>
<td></td>
<td>Flat spot</td>
</tr>
<tr>
<td>7. Repairable</td>
<td>No</td>
</tr>
</tbody>
</table>

P4.1  P4.2  P6.3
CHAINS ASME B30.9-1

REMOVAL CRITERIA

- Missing or illegible identification.
- Cracks or breaks.
- Excessive wear, nicks, gouges. Minimum thickness on chain links shall not be below the excepted industry values.
- Stretched chain links or components.
- Evidence of heat damage.
- Lack of chain components to hinge freely.
- Weld splatter.
Repairs

- Slings shall be repaired only by the sling manufacturer or a qualified person.
- A repaired sling shall be marked to identify the repairing agency. Repair of hooks shall comply with ASME B30.10.
- Cracked, broken, or bent links or other components other than hooks shall not be repaired; they shall be replaced.
- Mechanical coupling links shall not be used within the body of an alloy chain sling to connect two pieces of chain.
- All repairs shall comply with the proof test standard.
Prior to initial use, all new and repaired chain and other components of an alloy steel chain sling, either individually or as an assembly, shall be proof tested by the sling manufacturer or a qualified person.
WIRE ROPE TYPES AND SLING CONFIGURATIONS

- Mechanically spliced
- Hand spliced
- Grommets
- Braided
- Sliding chokers
- Bridles
WIRE ROPE ASME B30.9-2
IDENTIFICATION REQUIREMENTS

- Name or trademark of manufacture.
- Rated Load.
- Diameter or size
- Number of legs if more than one
Inspections

- **Initial inspection**
  - Prior to use all new, altered, modified, or repaired slings shall be inspected by a designated person.

- **Frequent inspection**
  - A visual inspection for damage shall be preformed by the end user or other designated person each day or shift of the sling being used.
Periodic Inspection

- Periodic inspection
  - A complete inspection for damage of the sling shall be periodically performed by a designated person. Each link and component shall be examined individually, taking care to expose and examine all surfaces including the inner link surfaces. The sling shall be examined for conditions such as those listed in removal criteria and a determination made to whether they constitute a hazard.
  - Periodic inspection intervals shall not exceed 1 year. The frequency of periodic inspections should be based on:
    - Frequency of slings use
    - Severity of service conditions
    - Nature of lifts being made
    - Experience gained on the service life of slings used in similar circumstances
  - Guidelines for periodic inspection intervals:
    - Normal service-yearly
    - Severe service-monthly or quarterly
    - Special service-as recommended by a qualified person
  - A written record of the most recent periodic inspection shall be maintained
WIRE ROPE ASME B30.9-2

Removal Criteria

- Missing or illegible sling identification
- Broken wires
- Severe localized abrasion or scrapping
- Kinking, crushing, bird caging, or any other damage resulting in damage to the rope structure
- Evidence of heat damage
- End attachments that are cracked, deformed, or worn
- Severe corrosion of the rope, end attachments or fittings
Repairs

- Slings shall be repaired only by the sling manufacturer or a qualified person
- A repaired sling shall be marked to identify the repairing agency
- The wire rope used in the sling shall not be repaired
- Repairs to wire rope slings shall be restricted to end attachments and fittings
- All repairs shall comply with the proof test standard
Prior to initial use, all wire rope slings incorporating previously used or welded fittings and all repaired slings shall be proof tested by the sling manufacturer or a qualified person.
Synthetic Slings Advantages & Disadvantages

- **Advantages**
  - Light
  - Easy to rig
  - Low cost
  - Reduces damage to load
  - Strength to weight ratio

- **Disadvantages**
  - Low heat resistance (194 degrees max)
  - Subject to cuts, tears and abrasion
  - Subject to chemicals and UV
  - Cannot repair load bearing fibers
Sling Types

Type 1 — Basket and Choker Sling
Type 2 — Basket Sling
Type 3 — Flat Eye and Eye Sling
Type 4 — Twisted or Turned
Type 5 — Endless Sling
Type 6 — Reversed Eye
Type 8 — Wide Body Basket
Part Number System

**Sling Types** can be:
- EE - Eye and Eye
- EN - Endless
- LBB - Load Bearing Basket
- RE - Reversed Eye
- TC - Triangle Choker
- TT - Triangle Triangle
- WBB - Wide Body Basket

**Number of Plies**, 1 or 2. (More for special orders.)

**Webbing Classification** indicates grade of webbing. 9 indicates the higher strength.

**Web Width** in inches: 1, 2, 3, 4, 6, 8, 10, or 12.

**Sling Length** in Feet
Material Types

• Nylon – More Abrasive
• Poly – Not as Abrasive
• Comparable in strength
Identification

- Each sling shall be marked to show
  - Name or trademark of manufacturer
  - Manufacturers code or stock number
  - Rated loads for the type of hitches used and the angle upon which it is based
  - Type of synthetic web material
  - Number of legs if more than 1
- Sling identification can only be done by the manufacturer
Effects of the Environment

- **Temperature**
  - Polyester and nylon web slings shall not be used in contact with an object or at temperatures in excess of 194 degrees or below -40 degrees.

- **Chemically active environments**
  - The strength of synthetic webbing slings can be degraded by chemically active environments. This includes exposure to chemicals in the form of solids, liquids, gases, vapors, or fumes. The sling manufacturer or qualified person should be consulted before slings are used in chemically active environments.

- **Sunlight and Ultraviolet light**
  - The strength of synthetic webbing slings is degraded by exposure to sunlight and ultraviolet light. The sling manufacturer or qualified person should be consulted for additional retirement or inspection requirements. For additional degradation information see WSTDA-UV-sling 2003.
Inspections

- **Initial Inspection**
  - Prior to use all new, altered, modified, or repaired slings shall be inspected by a designated person

- **Frequent Inspection**
  - Visual inspection for damage shall be performed by the user or other designated person each day or shift the sling is used
  - Conditions such as those listed in removal criteria or any other condition that may result in a hazard shall cause the sling to be removed from service. Slings shall not be returned to service until approved by a qualified person
  - Written records are not required for frequent inspections
Inspections & Removal Criteria
Periodic Inspection

- **Periodic inspection**
  - A complete inspection for damage of the sling shall be periodically performed by a designated person. Each link and component shall be examined individually, taking care to expose and examine all surfaces including the inner link surfaces. The sling shall be examined for conditions such as those listed in removal criteria and a determination made to whether they constitute a hazard.
  - Periodic inspection intervals shall not exceed 1 year. The frequency of periodic inspections should be based on:
    - Frequency of slings use
    - Severity of service conditions
    - Nature of lifts being made
    - Experience gained on the service life of slings used in similar circumstances
  - Guidelines for periodic inspection intervals
    - Normal service-yearly
    - Severe service-monthly or quarterly
    - Special service-as recommended by a qualified person
  - A written record of the most recent periodic inspection shall be maintained.
Removal Criteria

- Missing or illegible sling identification
- Acid or caustic burns
- Melting or charring of any part of the sling
- Holes, tears, cuts, or snags
- Broken or worn stitching in the load bearing splice
- Knots in any part of the sling
- Discoloration and brittle or stiff areas on any part of the sling, which may mean chemical or ultraviolet/sunlight damage
- Fittings that are pitted, corroded, cracked, bent, twisted, gouged, or broken
- For hooks refer to ASME B30.10
- For rigging hardware refer to ASME B30.26
- Other conditions, including visible damage, that cause doubt as to the continued use of the sling
Repairs

- Slings shall be repaired only by a sling manufacturer or a qualified person.
- A repaired sling shall be marked to identify the repairing agency.
- All repairs shall comply with the proof testing standard.
Prior to initial use, all wire rope slings incorporating previously used or welded fittings and all repaired slings shall be proof tested by the sling manufacturer or a qualified person.
Synthetic round slings are manufactured by taking a core yarn and winding them together in multiple revolutions and enclosed with a protective cover.
Identification

- Sling identification requirements
  - Name or trademark of manufacturer
  - Manufacturers code or stock number
  - Rated loads for the types of hitches used and the angle upon which it is based
  - Core material
  - Cover material if different from the core material
  - Number of legs if more than 1
- Sling identification shall be done by the sling manufacturer
Effects of the Environment

- Temperature
  - Polyester and nylon web slings shall not be used in contact with an object or at temperatures in excess of 194 degrees or below -40 degrees.

- Chemically active environments
  - The strength of synthetic webbing slings can be degraded by chemically active environments. This includes exposure to chemicals in the form of solids, liquids, gases, vapors, or fumes. The sling manufacturer or qualified person should be consulted before slings are used in chemically active environments.

- Sunlight and Ultraviolet light
  - The strength of synthetic webbing slings is degraded by exposure to sunlight and ultraviolet light. The sling manufacturer or qualified person should be consulted for additional retirement or inspection requirements. For additional degradation information see WSTDA-UV-sling 2003.
Inspections

- **Initial Inspection**
  - Prior to use all new, altered, modified, or repaired slings shall be inspected by a designated person.

- **Frequent Inspection**
  - Visual inspection for damage shall be performed by the user or other designated person each day or shift the sling is used.
  - Conditions such as those listed in removal criteria or any other condition that may result in a hazard shall cause the sling to be removed from service. Slings shall not be returned to service until approved by a qualified person.
  - Written records are not required for frequent inspections.
Round Slings
Periodic Inspections

- Periodic Inspection
  - A complete inspection for damage to the sling shall be periodically performed by a designated person. Each sling and component shall be examined individually, taking care to expose and examine all surfaces. The sling shall be examined for conditions such as those listed in removal criteria and a determination made as to whether they constitute a hazard.
  - Periodic inspection intervals shall not exceed 1 year. The frequency of periodic inspections should be based on:
    - Frequency of slings use
    - Severity of service conditions
    - Nature of lifts being made
    - Experience gained on the service life of slings used in similar circumstances
    - Guidelines for periodic inspection intervals
    - Normal service-yearly
    - Severe service-monthly or quarterly
    - Special service-as recommended by a qualified person

- A written record of the most recent periodic inspection shall be maintained
Rounds Slings
Removal Criteria

- Missing or illegible sling identification
- Acid or caustic burns
- Evidence of heat damage
- Holes, tears, cuts, abrasive wear, or snags that expose the core yarns
- Weld splatter that exposes the core yarns
- Round slings that are knotted
- Fittings that are pitted, corroded, cracked, bent, twisted, gouged, or broken
- For hooks refer to ASME B30.10
- For rigging hardware refer to ASME B30.26
- Other conditions, including visible damage, that cause doubt as to the continued use of the sling
Repairs

- Slings shall be repaired only by a sling manufacturer or a qualified person.
- A repaired sling shall be marked to identify the repairing agency.
- All repairs shall comply with the proof testing standard.
Prior to initial use, all wire rope slings, chain slings, synthetic slings, etc. incorporating previously used or welded fittings and all repaired slings shall be proof tested by the sling manufacturer or a qualified person.
Rigging Safe

- All portions of the human body shall be kept from between the sling and the load, and from between the sling and the crane hook or hoist hook.
- Personnel should never stand in line with or next to a sling that is under tension.
- Personnel shall not stand or pass under a load.
- Personnel shall not ride the sling.
- Slings shall be stored in an area where they will not be subjected to mechanical damage, corrosive action, moisture, extreme temperatures, or kinking.
- Slings shall not be shortened or adjusted only by methods approved by the sling manufacturer or a qualified person.
- Slings shall not be shortened or lengthened by knotting or twisting.
- The sling shall be hitched in a manner providing control of the load.
Thank You
Be Safe!