

Disclaimer for Total Tool Supply Inc. Rigging Training & Lifting Safety Training

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A photograph of three men in a rigging or construction environment. The man on the left is in the foreground, wearing a dark blue shirt, a white hard hat with a red light, and safety glasses. He is looking upwards. The man in the middle is wearing a light grey t-shirt and a white hard hat, also looking upwards. The man on the right is wearing a red polo shirt and a white hard hat with a green logo, looking towards the camera. They are surrounded by rigging equipment, including cables and pulleys, against a clear blue sky.

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

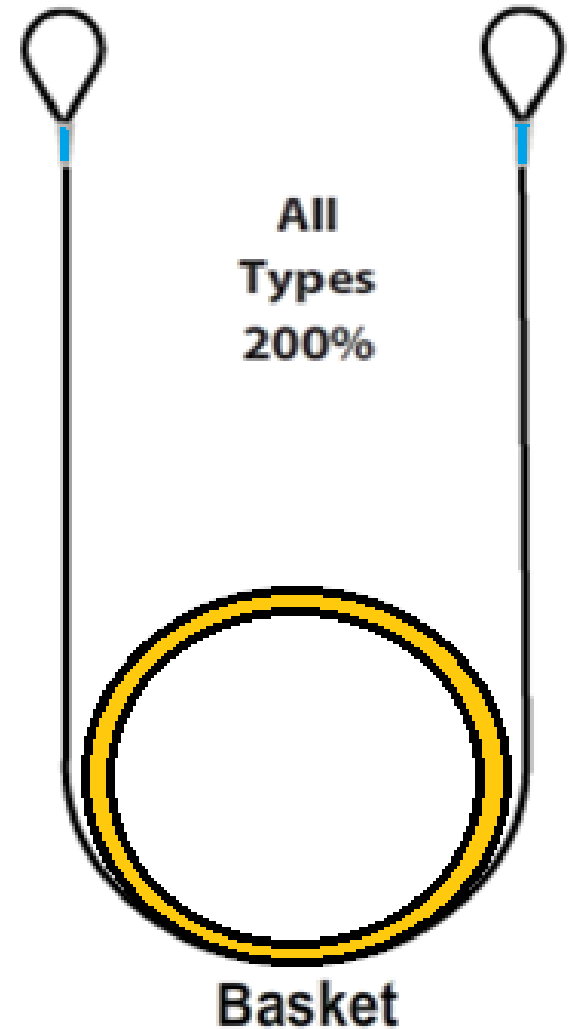
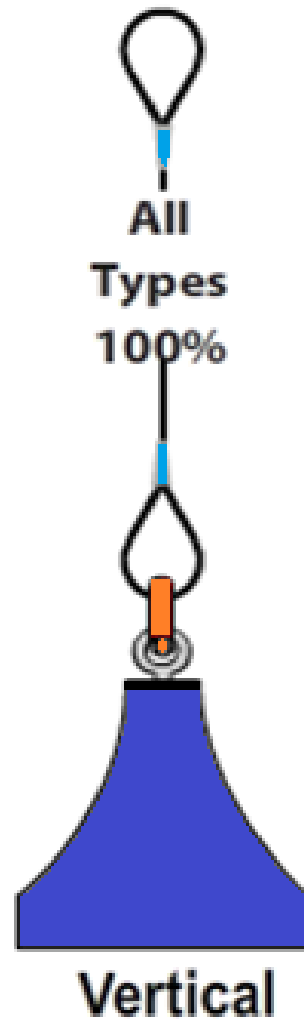
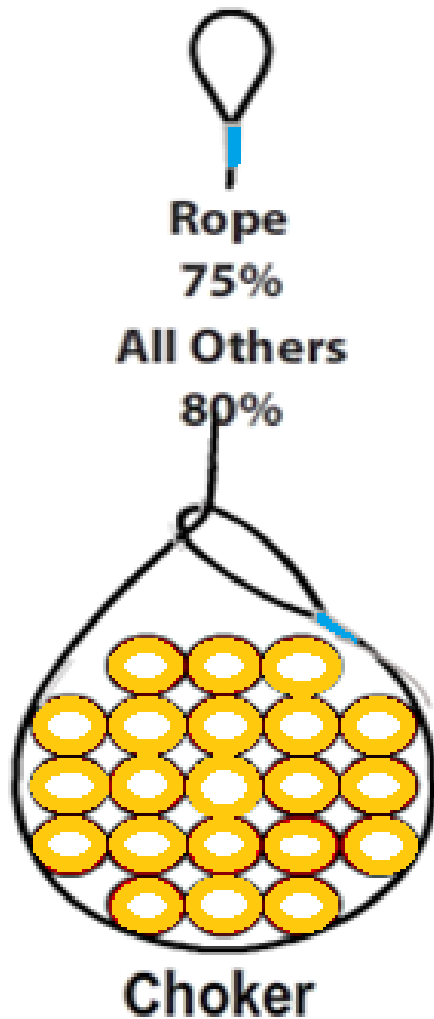


KNOWLEDGE IS KEY

A low-angle photograph of a construction site. Two large tower cranes are visible, their lattice structures reaching towards a bright sun in a blue sky with scattered white clouds. In the lower right, the concrete frame of a building under construction is visible. A semi-transparent dark blue rectangular box is overlaid in the center of the image, containing white text.

One of the greatest errors in our industry today is the lack of information.

BASIC HITCHES

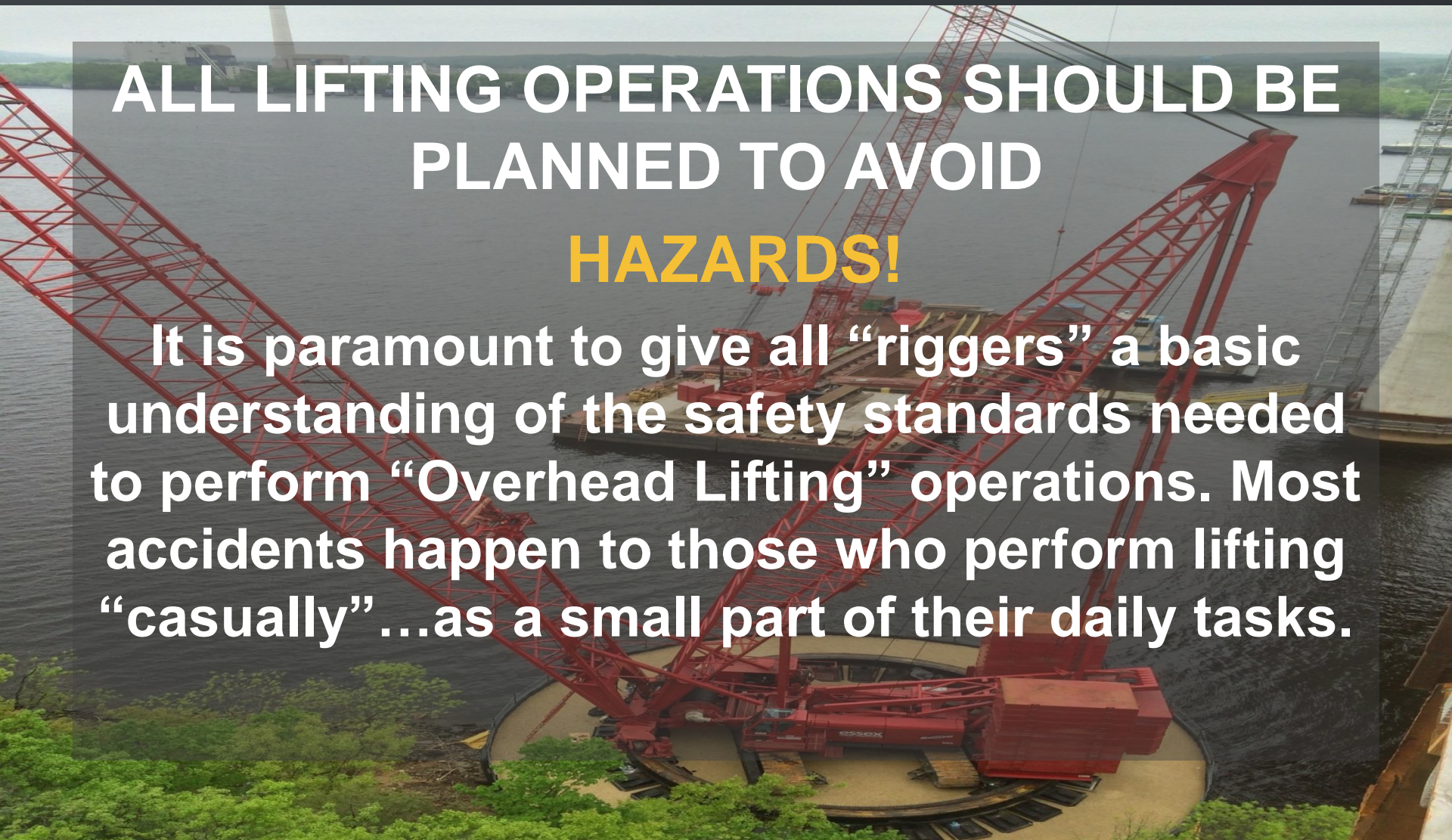


Why is training important?

**ALL LIFTING OPERATIONS SHOULD BE
PLANNED TO AVOID**

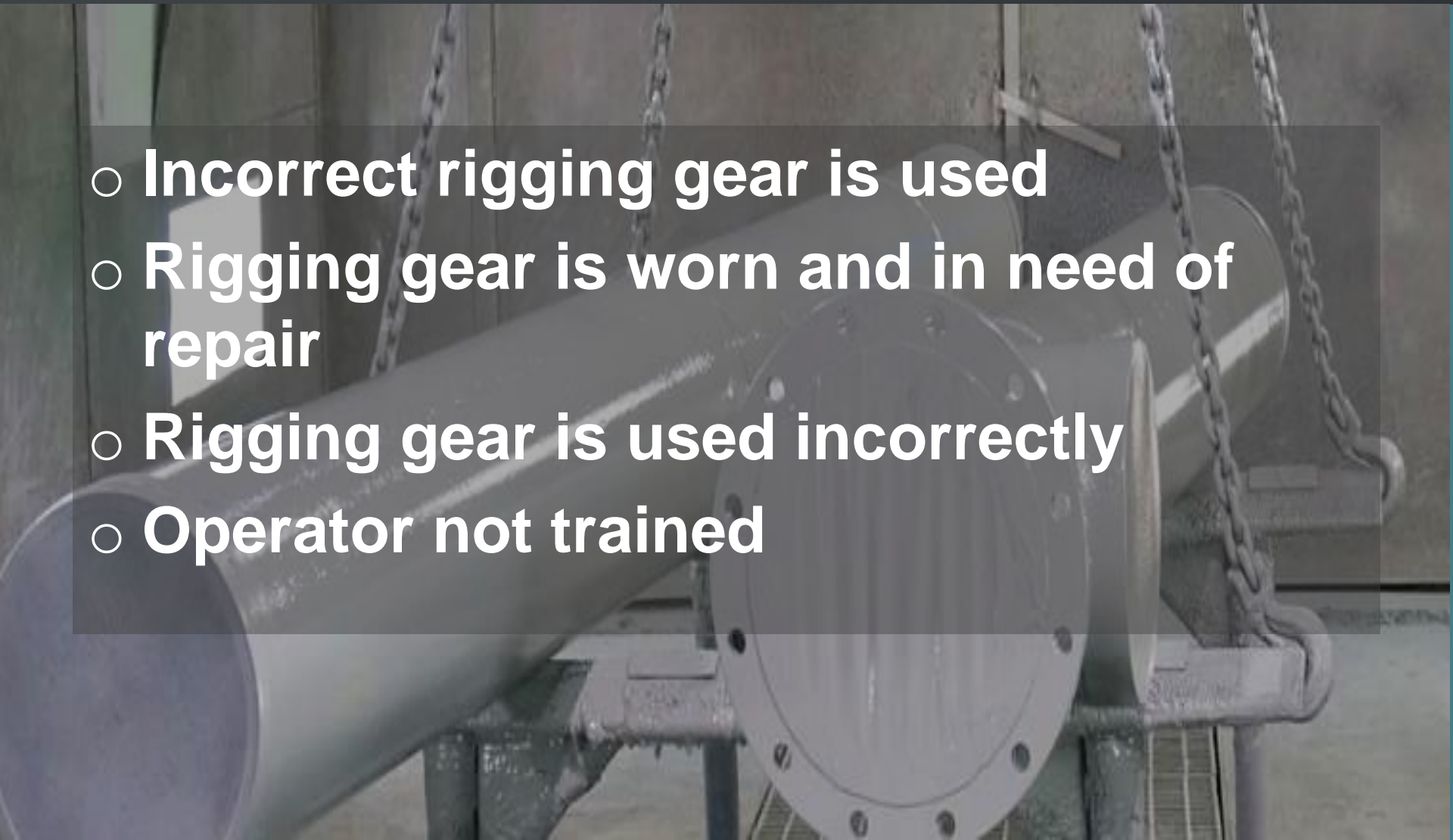
HAZARDS!

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**



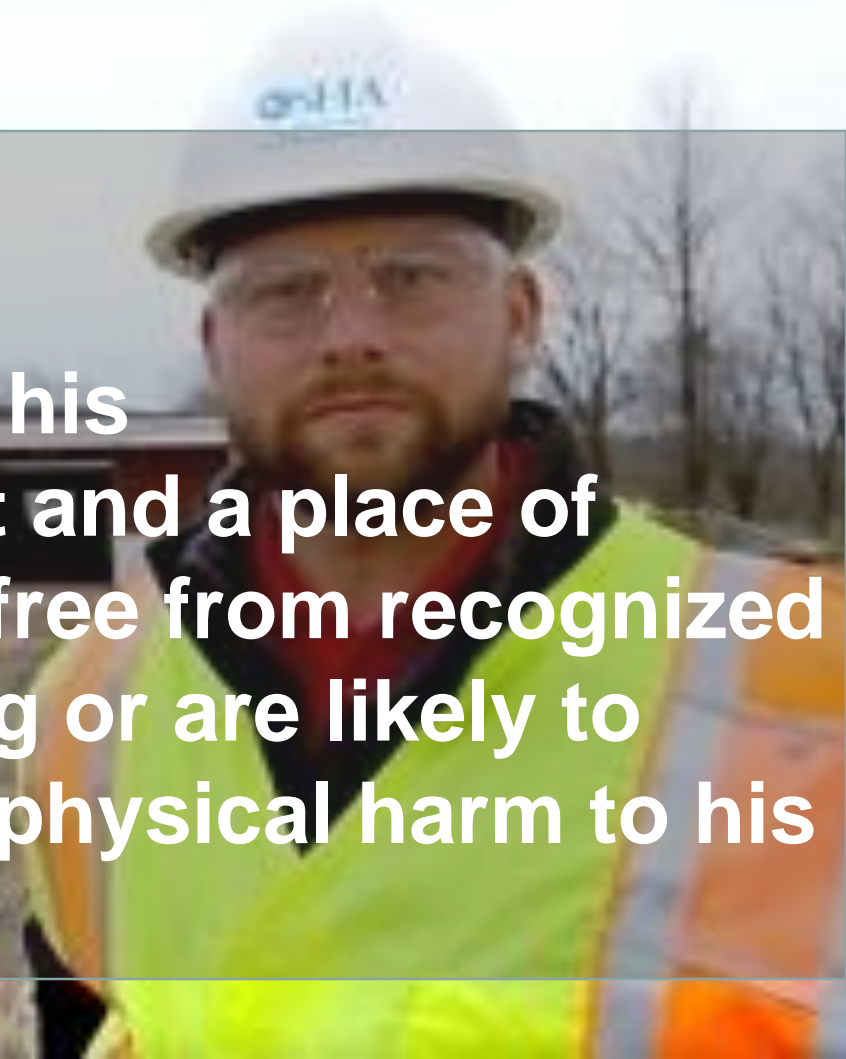




OSHA GENERAL DUTY CLAUSE

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



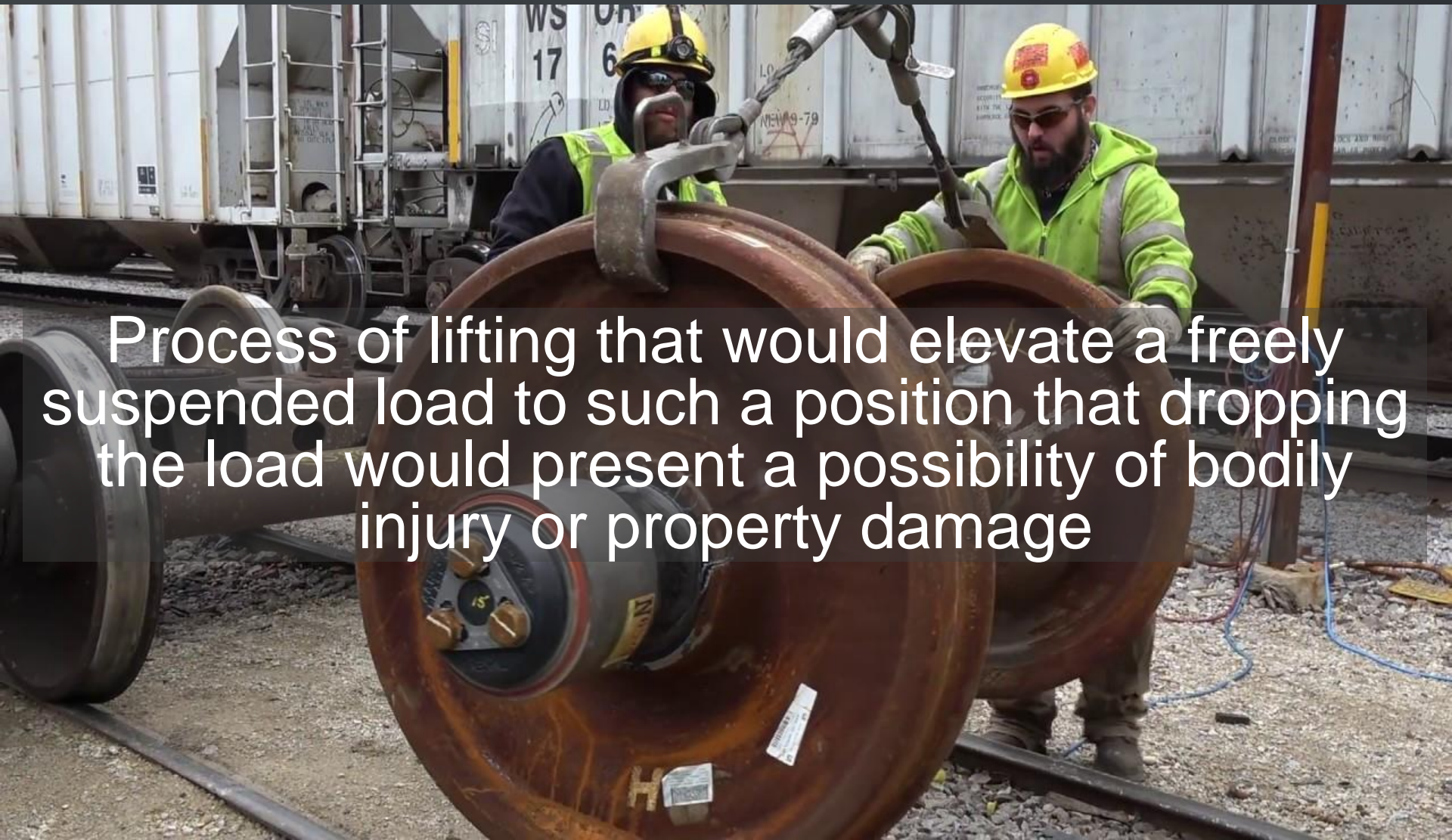
OSHA / ASME

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.

Overhead Lifting



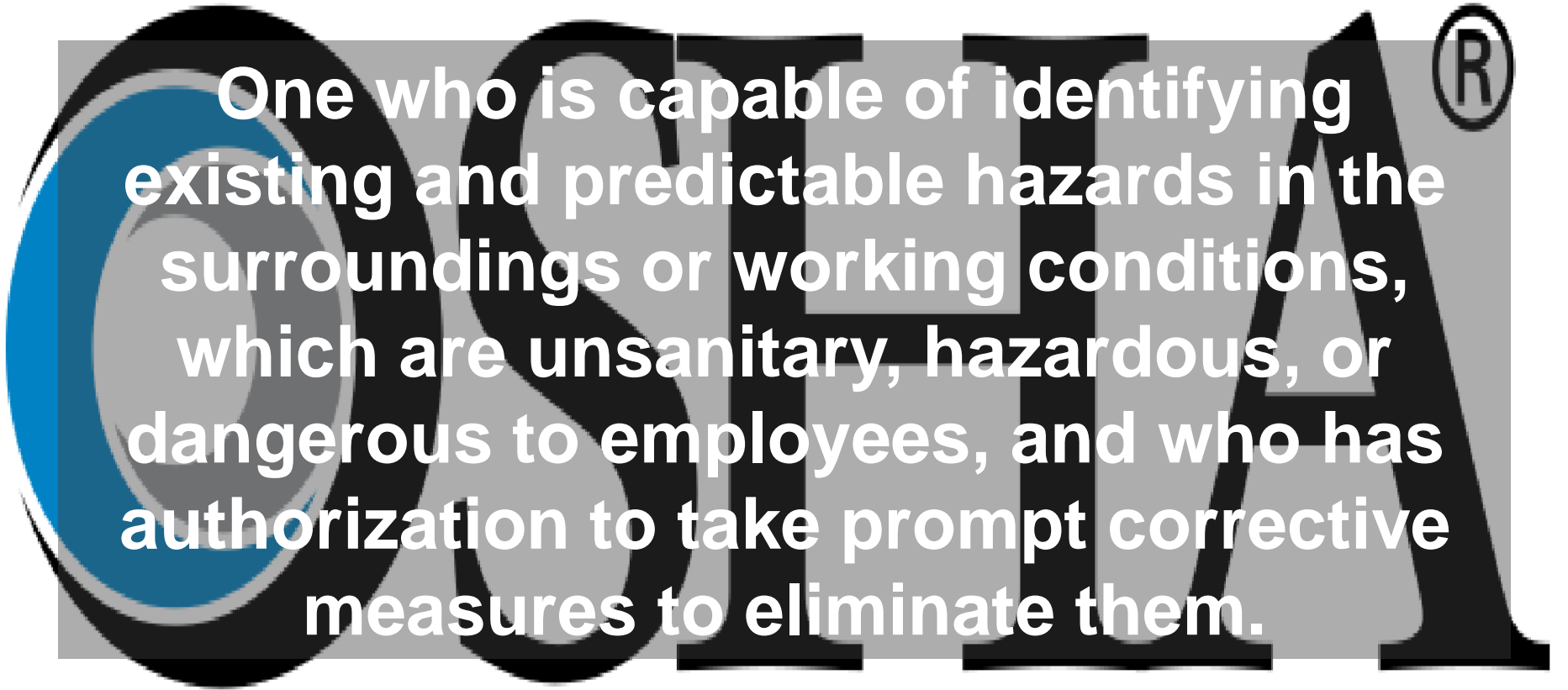
Process of lifting that would elevate a freely suspended load to such a position that dropping the load would present a possibility of bodily injury or property damage

DESIGNATED PERSON

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

SETTING THE STANDARD

COMPETENT PERSON

The background of the slide features a large, stylized logo for the Occupational Safety and Health Administration (OSHA). The logo consists of the letters "OSHA" in a bold, black, sans-serif font. To the left of the letters is a circular emblem with a blue outer ring and a white inner circle. To the right of the letters is a registered trademark symbol (®).

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.

QUALIFIED PERSON

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.

RATED LOAD

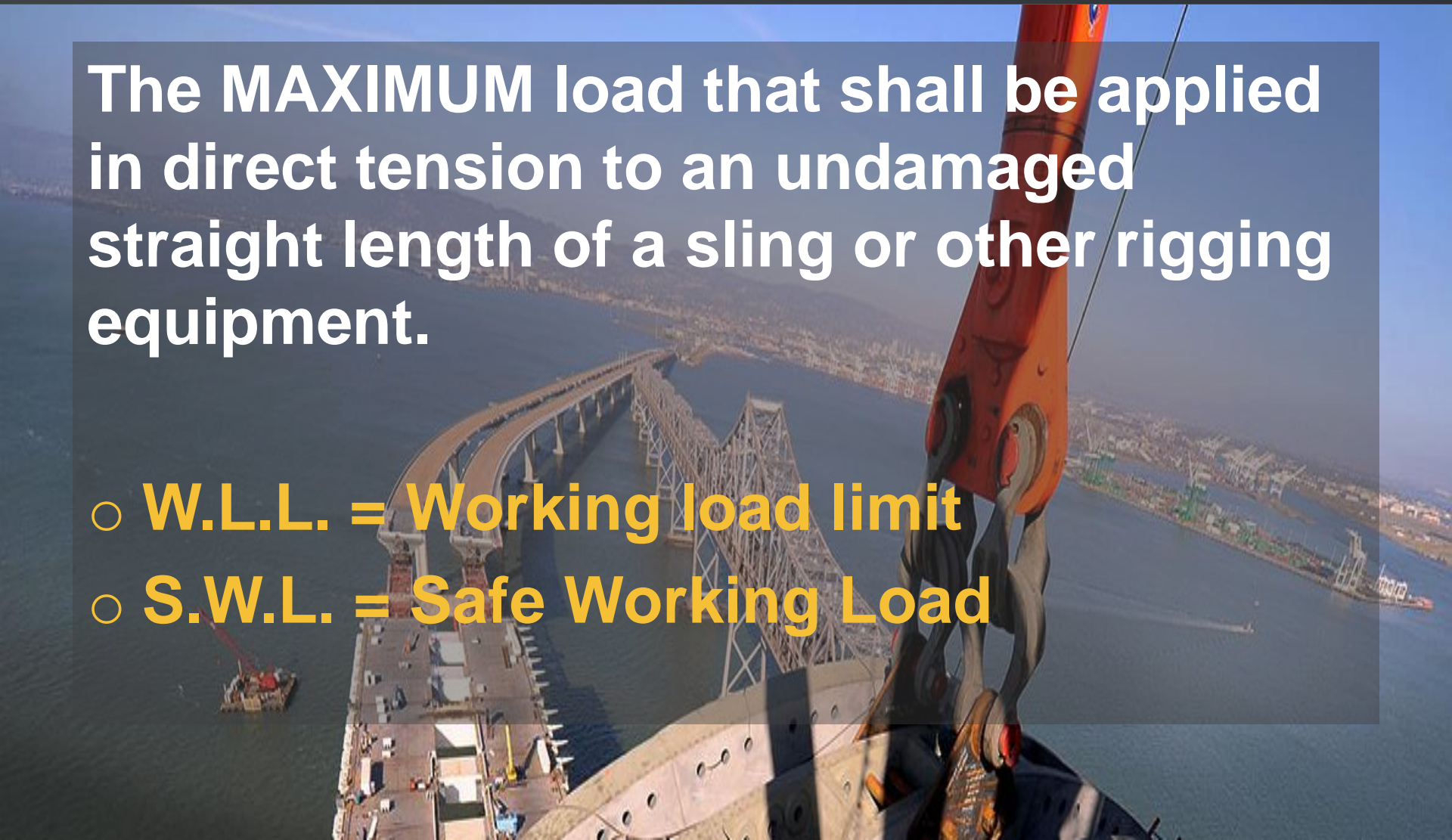
The maximum allowable working load established by the sling manufacturer.

The terms rated capacity and “working load limit” are commonly used to describe rated load

WORKING LOAD LIMIT

The MAXIMUM load that shall be applied in direct tension to an undamaged straight length of a sling or other rigging equipment.

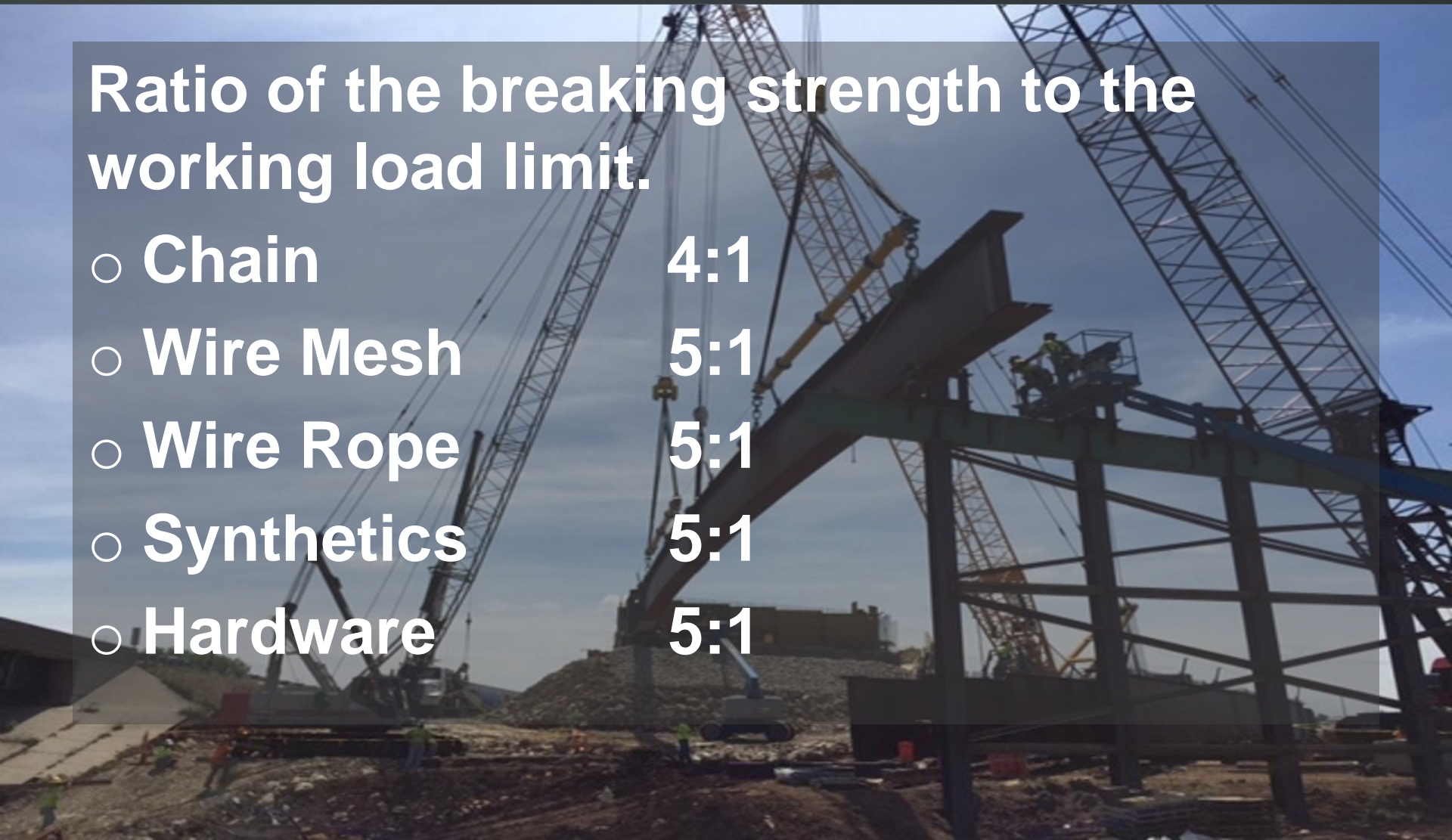
- W.L.L. = Working load limit
- S.W.L. = Safe Working Load



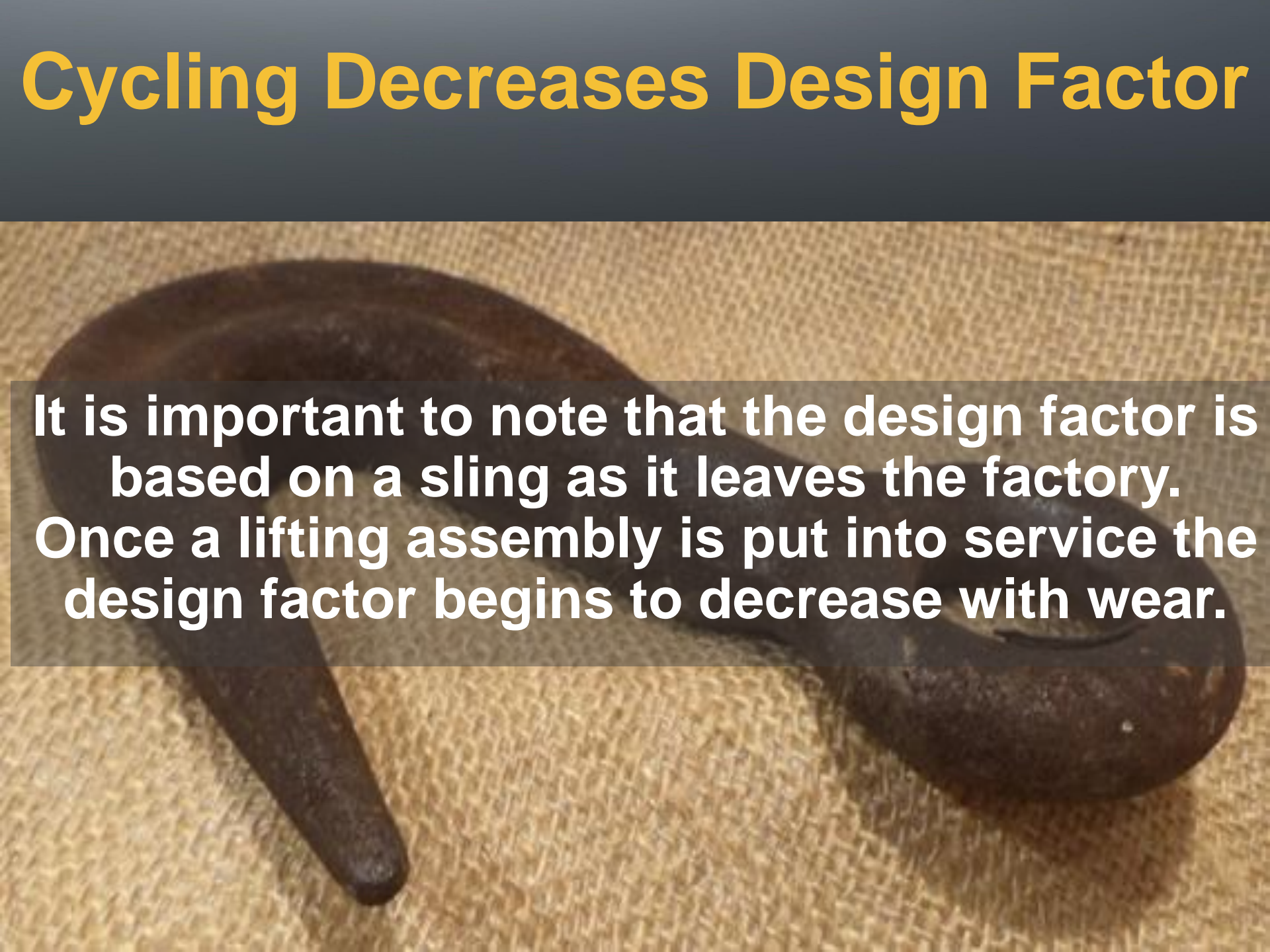
DESIGN FACTORS

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



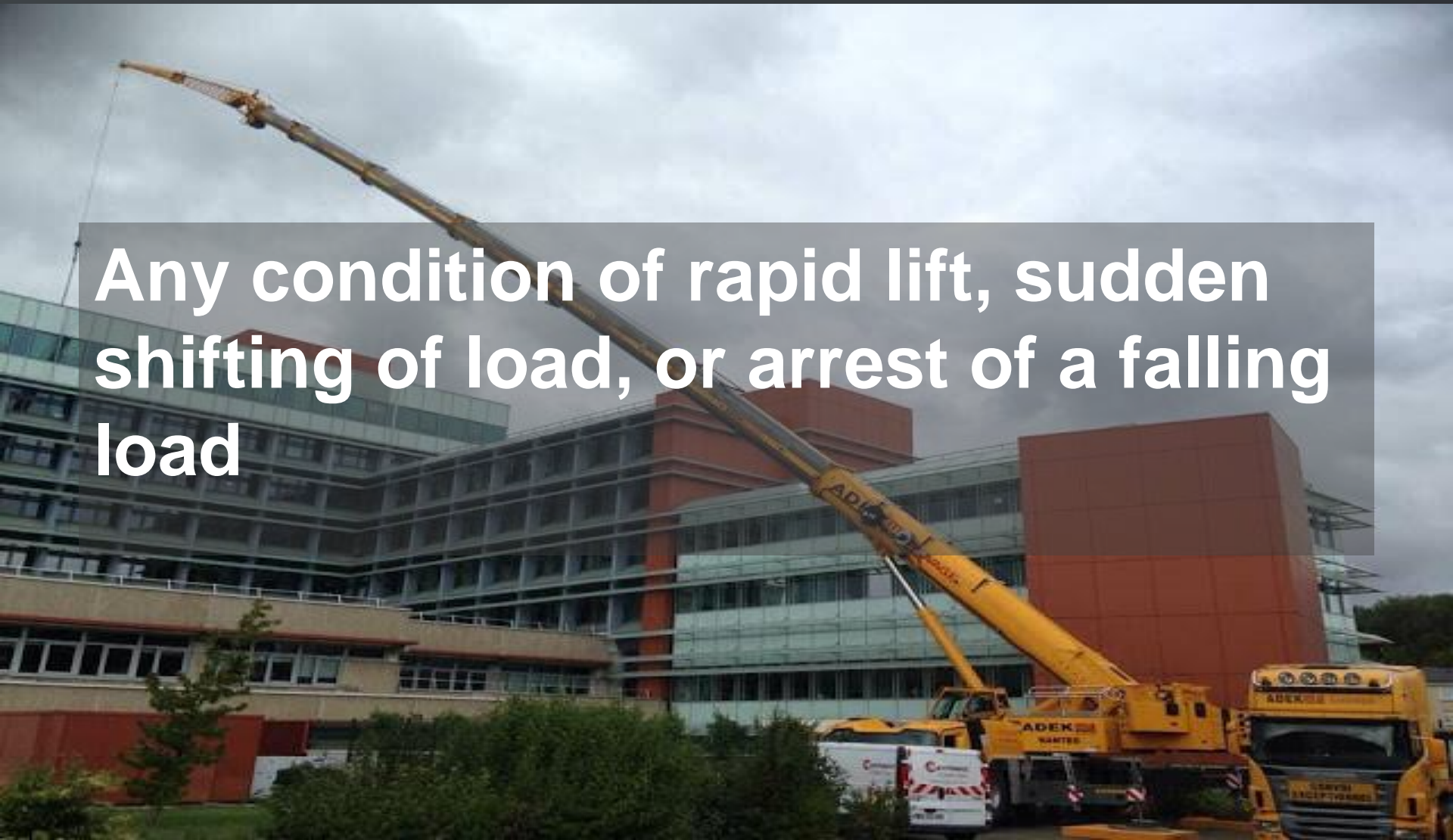
Cycling Decreases Design Factor



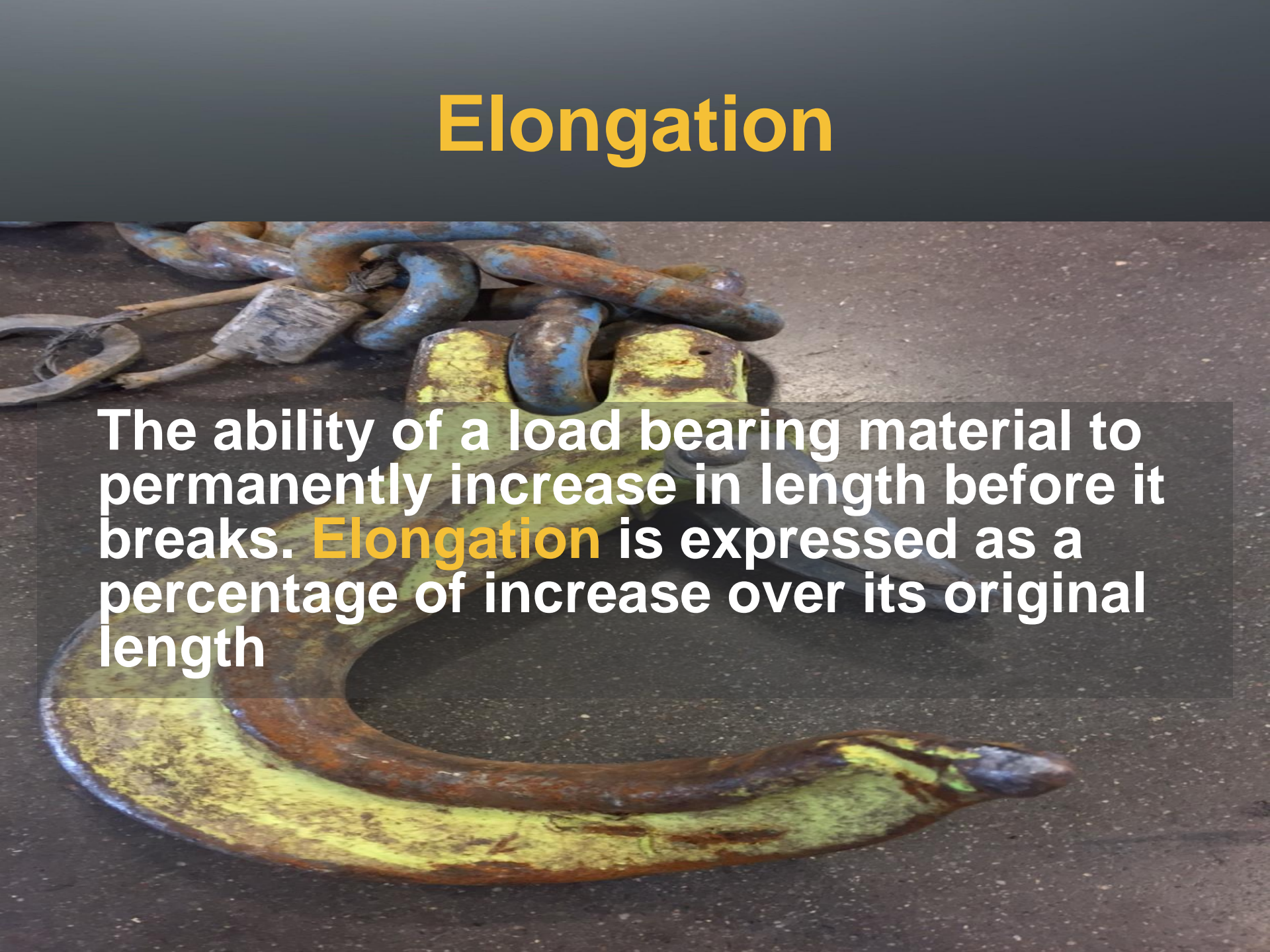
It is important to note that the design factor is based on a sling as it leaves the factory. Once a lifting assembly is put into service the design factor begins to decrease with wear.

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

- 
- The OSHA logo is a large, light gray oval with a dark gray border. Inside the oval, the word "OSHA" is written in a large, bold, black serif font. A registered trademark symbol (®) is located to the upper right of the "A".
- 1910.184 industrial
 - 1926.251 construction

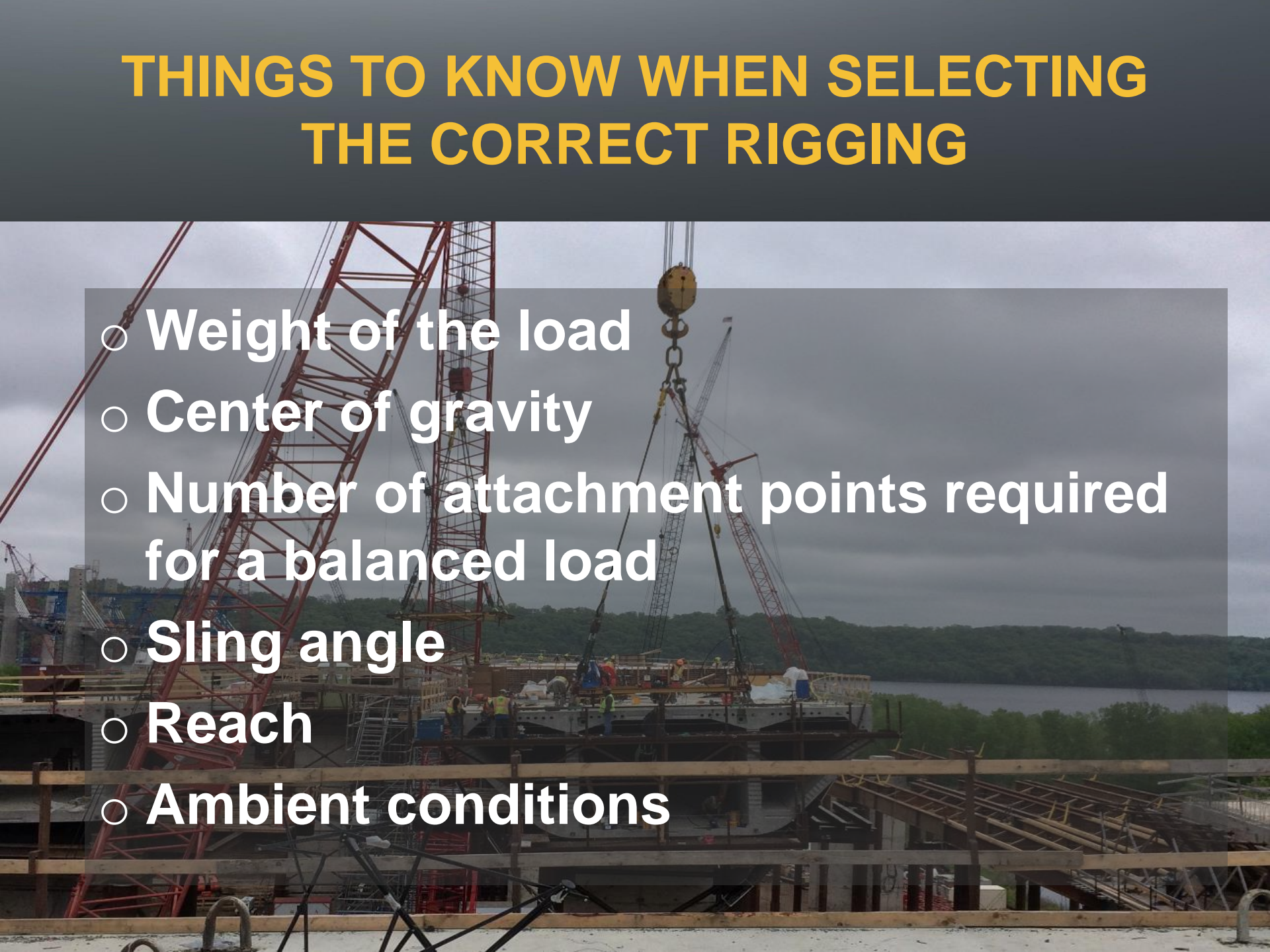
ASME STANDARDS

- B30.9 slings
- B30.10 hooks
- B30.16 overhead hoists
- B30.20 below the hook
- B30.21 lever hoists
- B30.26 rigging hardware

SLING SELECTION

The image shows two heavy-duty lifting slings laid out on a grey concrete floor in a workshop. Each sling consists of a thick, braided steel cable with a red metal hook at one end and a blue protective sleeve at the other. The slings are arranged in a V-shape, with their hooks pointing towards the bottom corners of the frame. In the background, various workshop items are visible, including a large spool of wire, a blue metal frame, and a black barrel. The text 'SLING SELECTION' is overlaid in the center in a bold, yellow, sans-serif font.

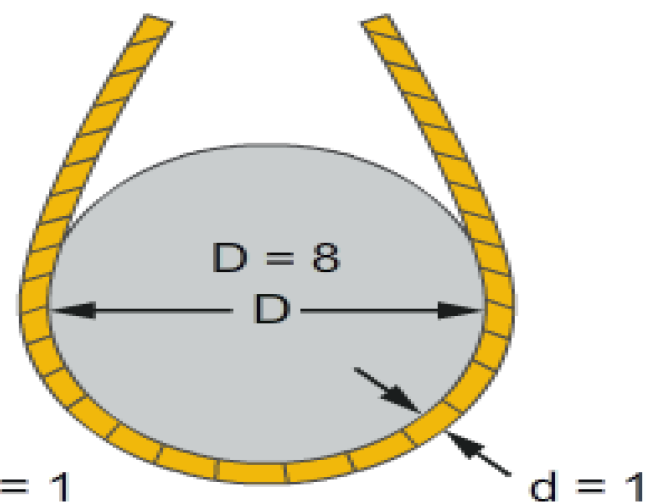
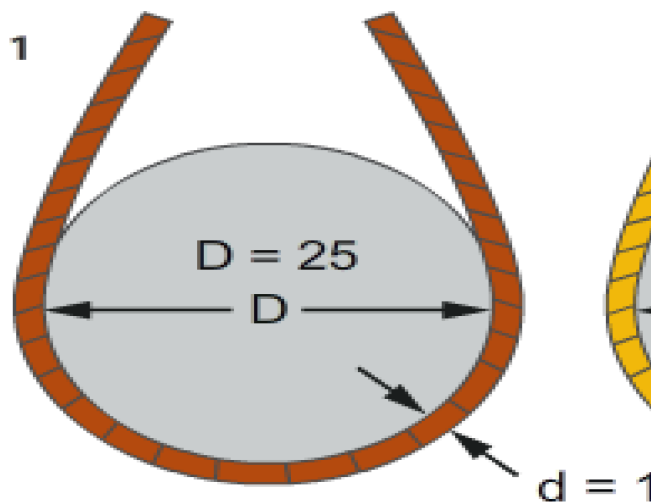
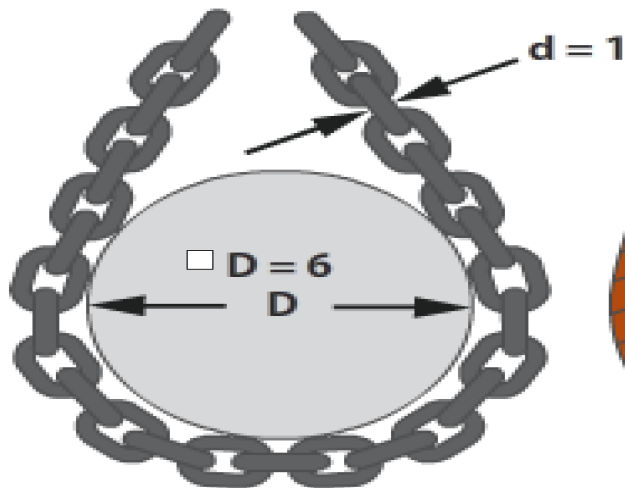
THINGS TO KNOW WHEN SELECTING THE CORRECT RIGGING

- Weight of the load
 - Center of gravity
 - Number of attachment points required for a balanced load
 - Sling angle
 - Reach
 - Ambient conditions
- 
- A photograph of a large-scale construction project, likely a bridge or industrial facility. Several large red lattice-boom cranes are visible, with one in the foreground prominently lifting a large, dark, rectangular object. The scene is set against a backdrop of a river and green hills under a cloudy sky. The foreground shows a concrete structure with rebar and wooden formwork.

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



A close-up photograph of a heavy-duty metal chain sling. The image shows a large, dark, weathered metal hook or shackle with a circular opening. A thick, dark metal chain link is attached to the bottom of the hook. The metal surface is rough, with visible rust and wear. The background is a dark, textured surface.

CHAIN SLINGS

ALLOY CHAIN

ADVANTAGES

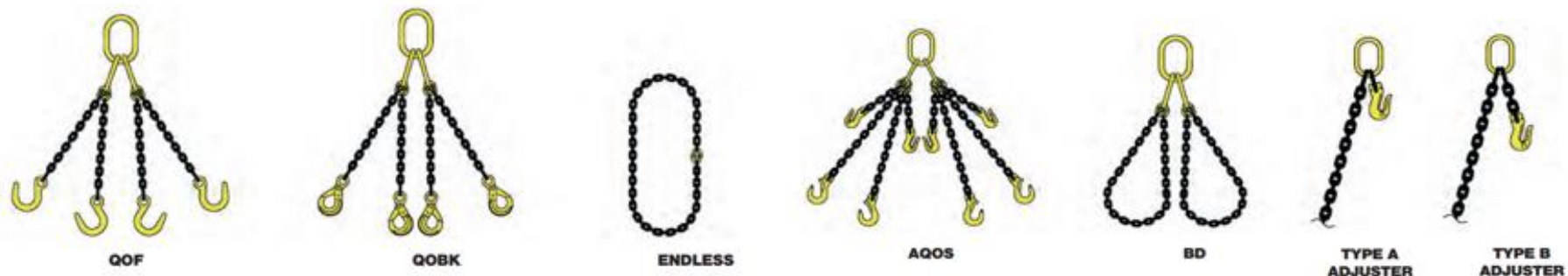
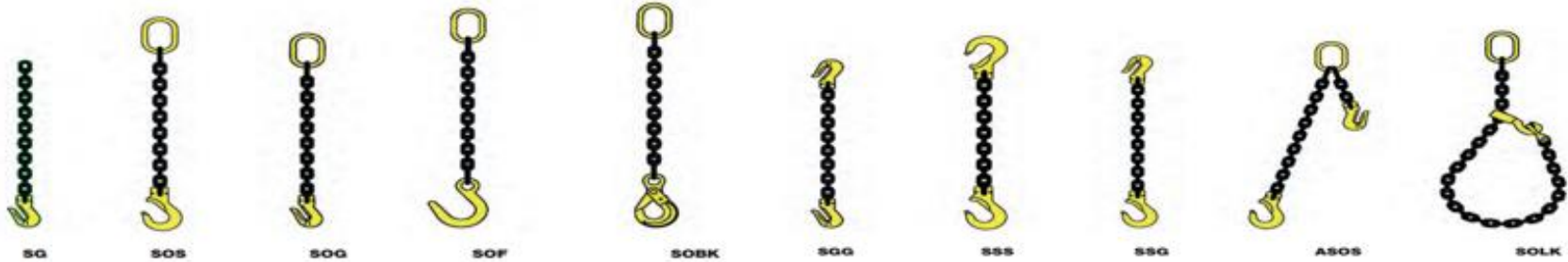
- Flexible
- Impact resistant
- Repairable
- Durable
- Minimum Elongation

DISADVANTAGES

- Heavy
- Initial cost

CHAIN SLING SELECTION





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 preformed 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



INSPECT ALL

Inspection
MICHEL'S PIPELINE CONSTRUCTION
PIPELINE DIVISION
LAKEVILLE, MN 55044-8229



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**

General

- | | |
|--|-----------------|
| ● 1. General Condition | (P) Pass |
| ● 2. Tag / Identification | (F) Fail |
| ■ <i>Missing identification tag.</i> | |

Alloy Chain Overview

- | | | |
|---|----------------------------|----|
| 3. Master Link(s) | (NA) Not Applicable | |
| ● 4. Fitting(s) | (F) Fail | P4 |
| ● 5. Chain | (P) Pass | |
| ● 6. End Connection(s) - Hook(s) | (F) Fail | P6 |
| ■ <i>Flat spot</i> | | |
| 7. Repairable | No | |



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

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

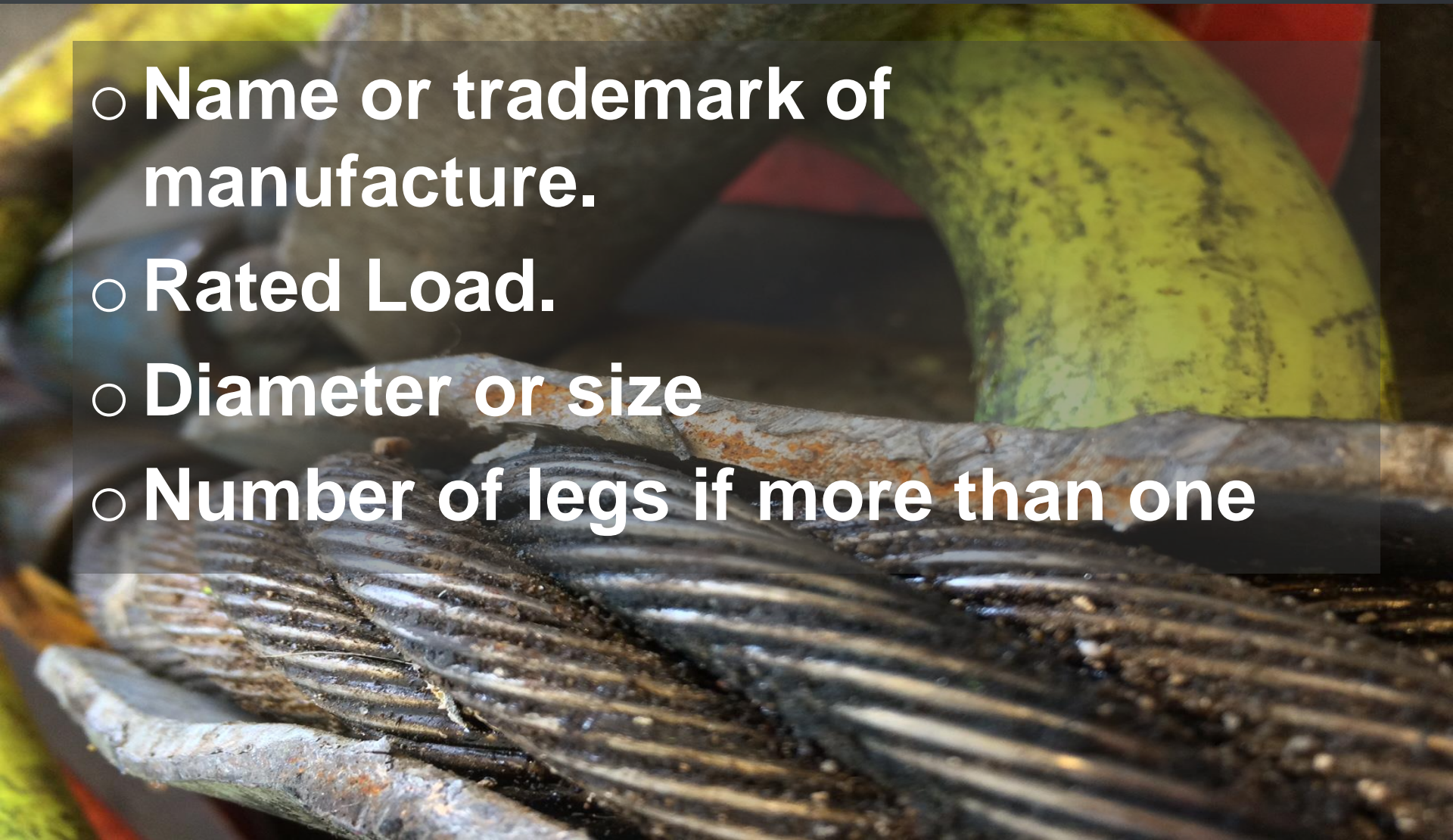
WIRE ROPE TYPES AND SLING CONFIGURATIONS

- 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



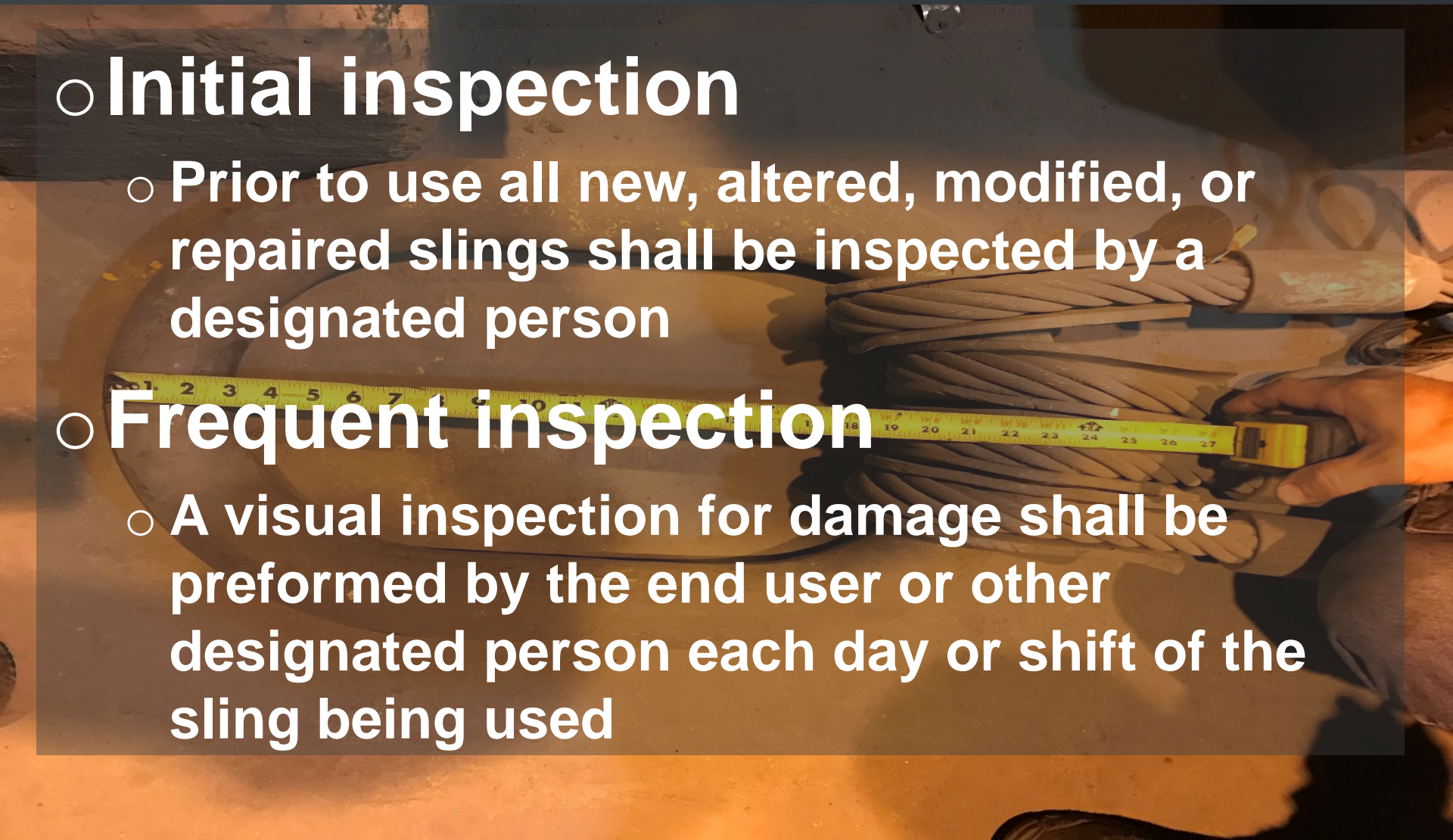
Inspections

- 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

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 WEB-SLINGS

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



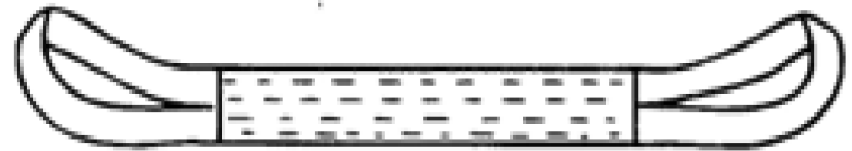
Type 3 — Flat Eye and Eye Sling



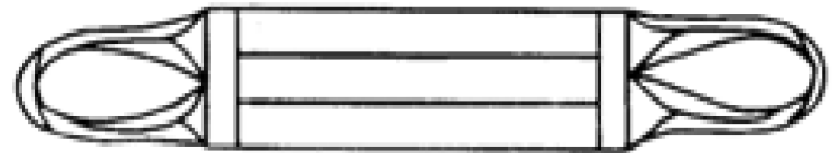
Type 4 — Twisted or Turned



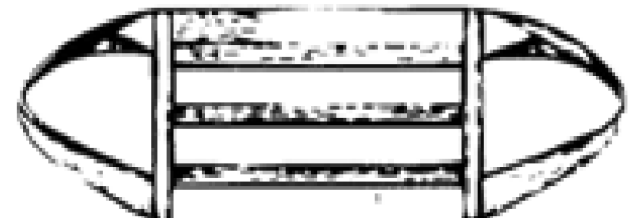
Type 5 — Endless Sling



Type 6 — Reversed Eye



Type 8 — Wide Body Basket



Part Number System

EE2-904x12

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 a object or at temperatures in excess of 194 degrees or below -40 degrees

○ Chemically active environments

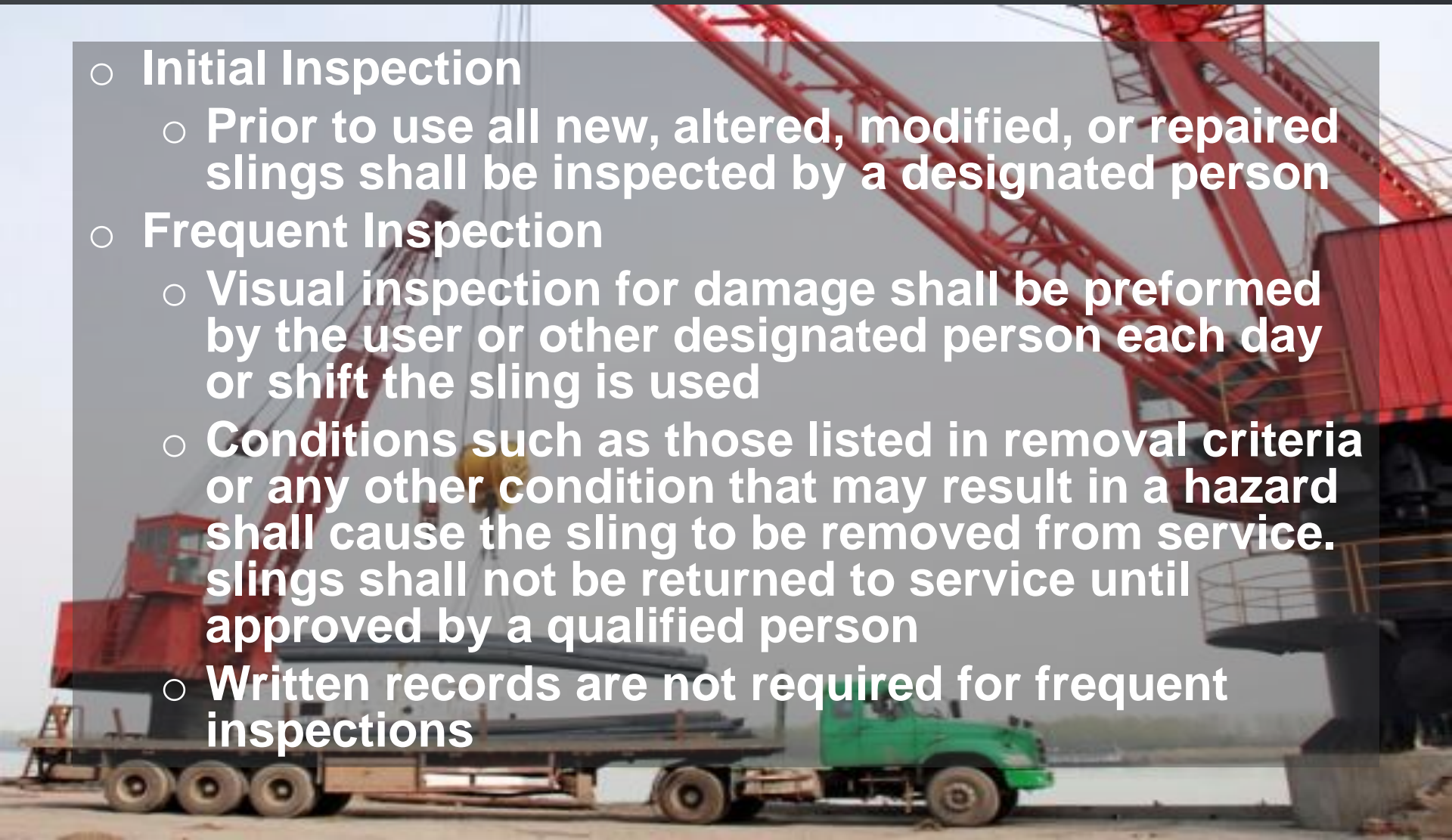
- The strength of synthetic webbing slings can be degraded by chemically active environments. This includes exposure to chemicals in the form of solids, liquids, gases, vapors, or fumes. The sling manufacturer or qualified person should be consulted before slings are used in chemically active environments

○ 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 preformed 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



TOTAL  TOOL



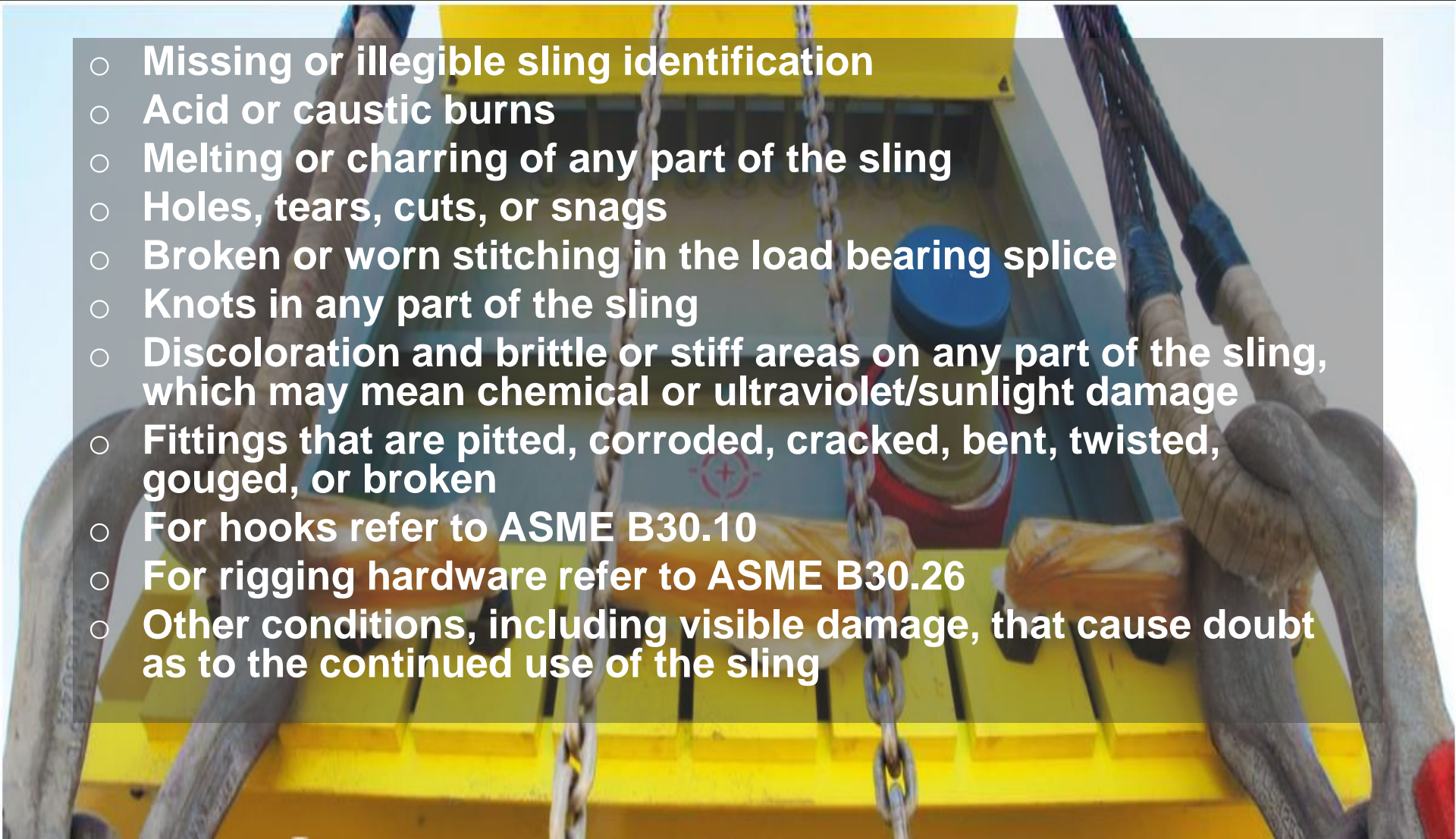
Periodic Inspection

○ Periodic inspection

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 - 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

Proof Test Standard

A photograph of a wire rope sling being tested on a machine in a factory setting. The machine has a large, curved, mesh-covered component. The background shows industrial equipment and yellow safety railings.

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



Round Slings

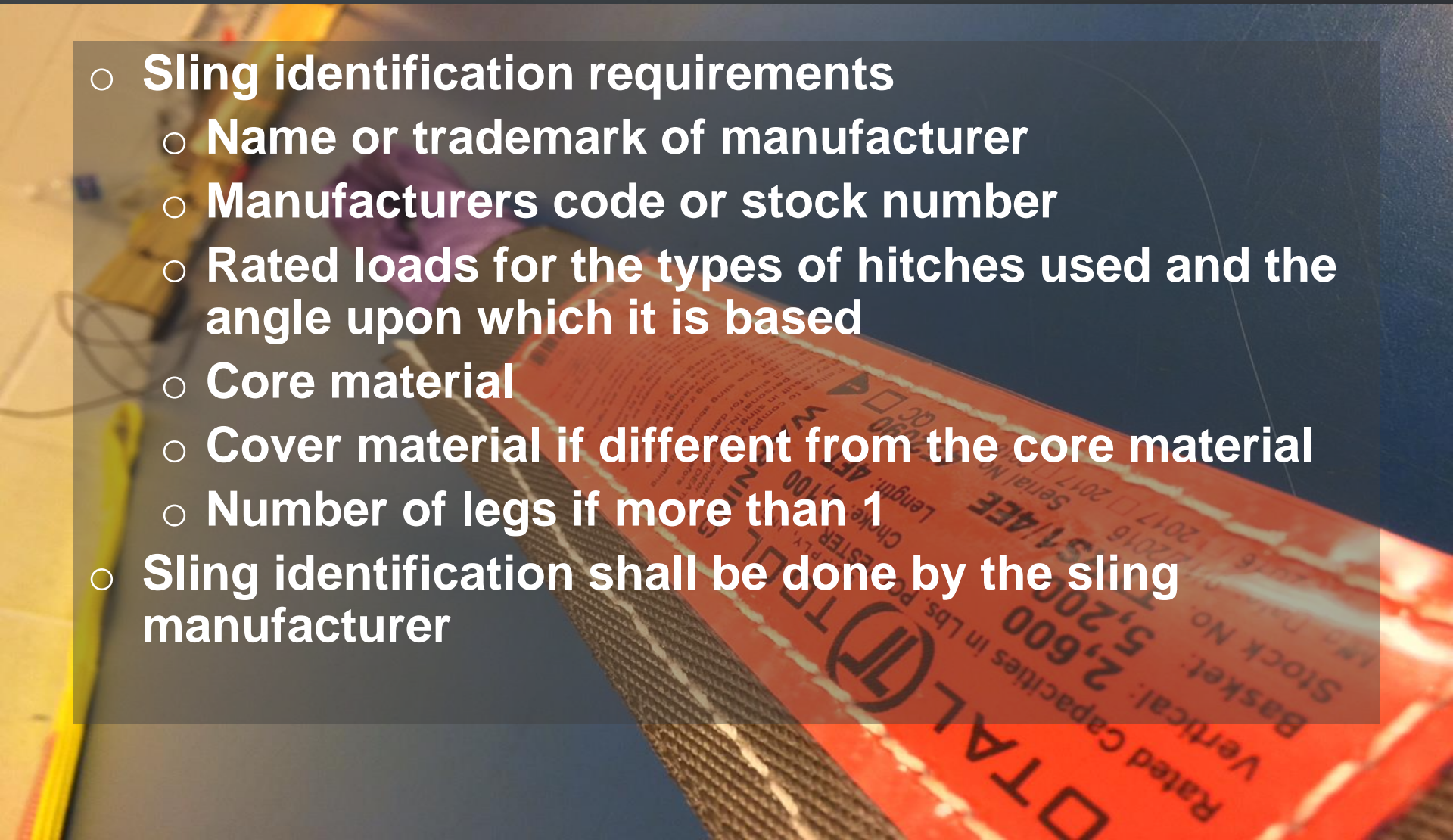
Synthetic Round Slings

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 a 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
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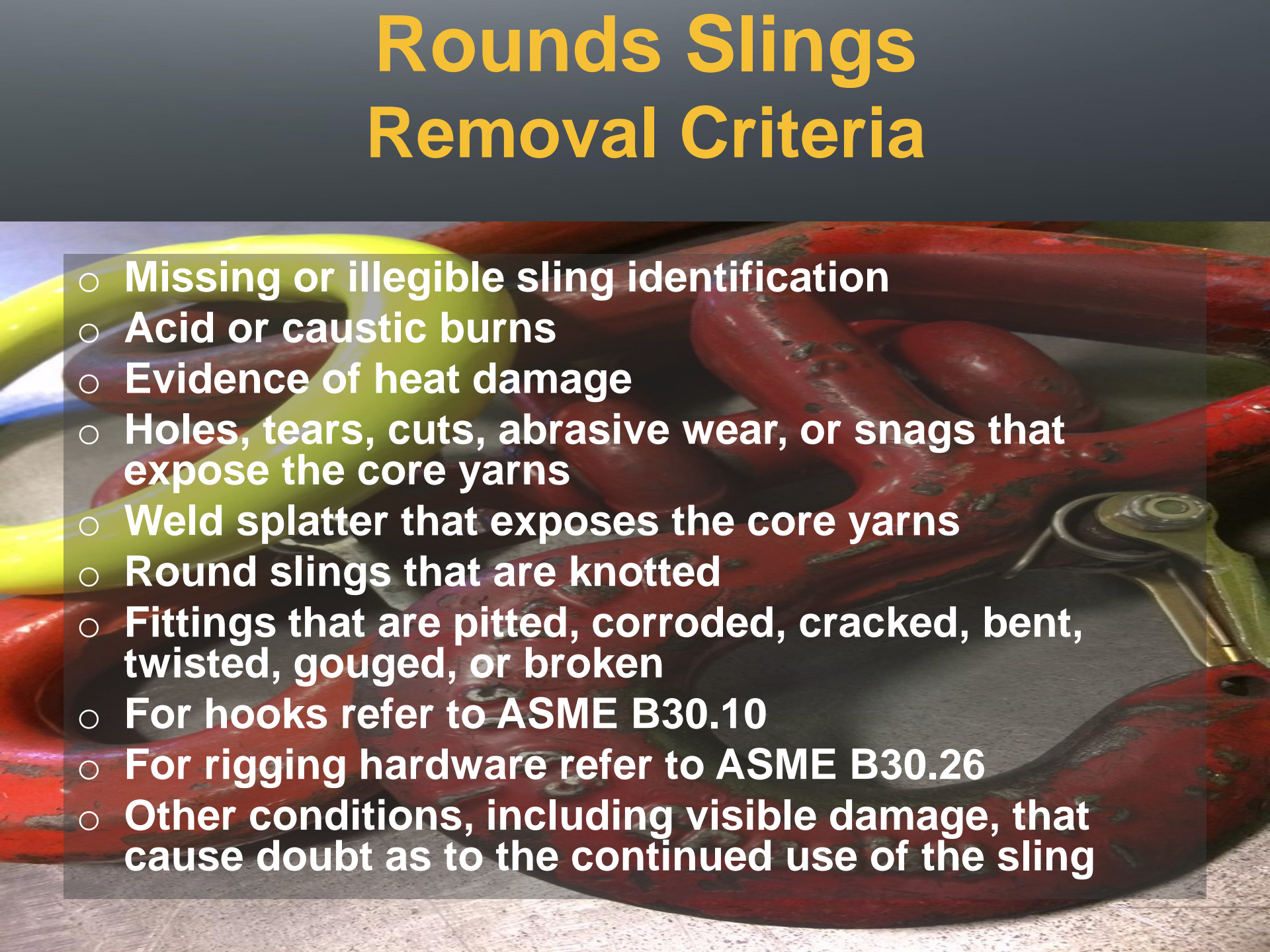
Round Slings

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.
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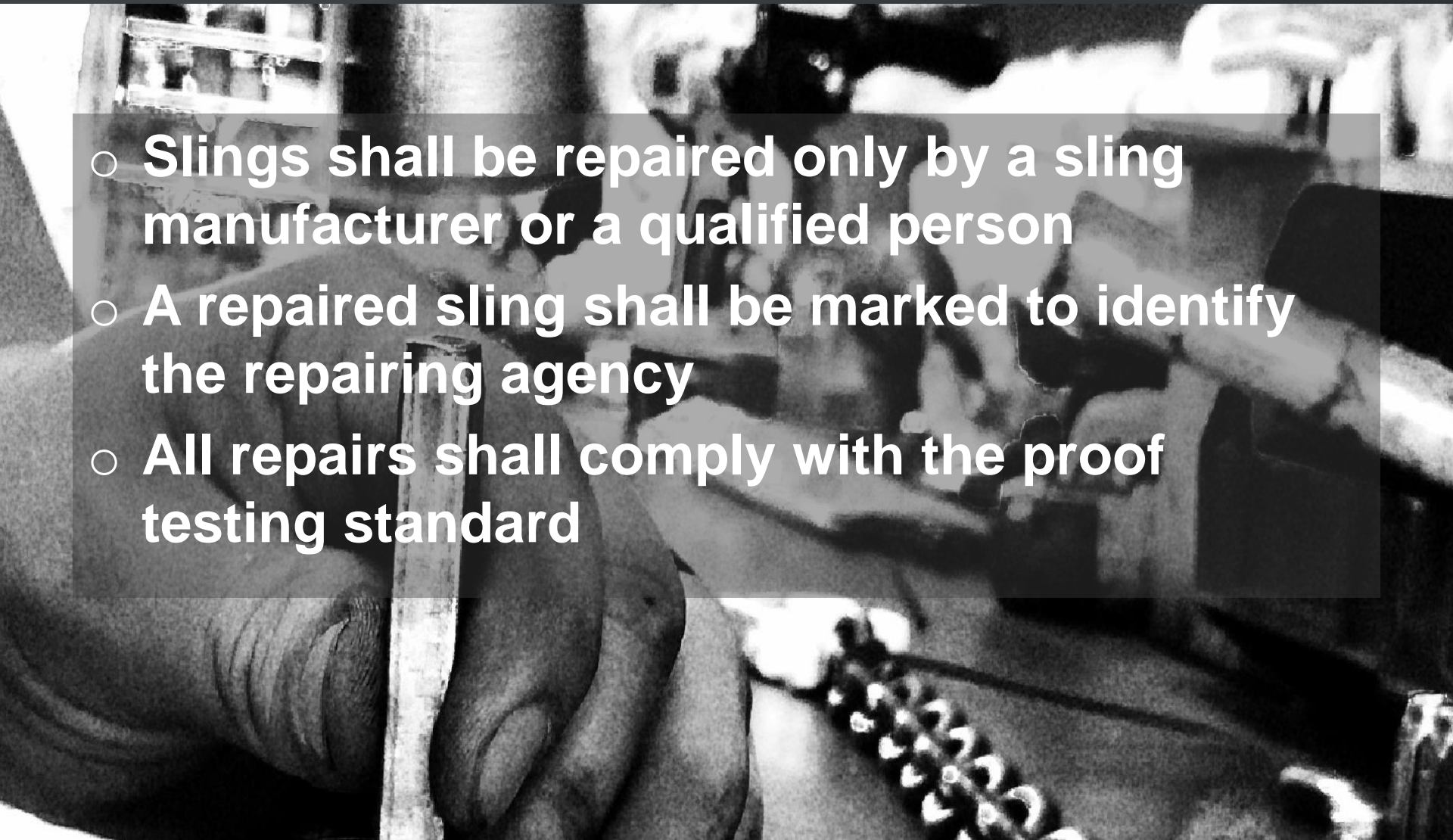
Rounds Slings

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



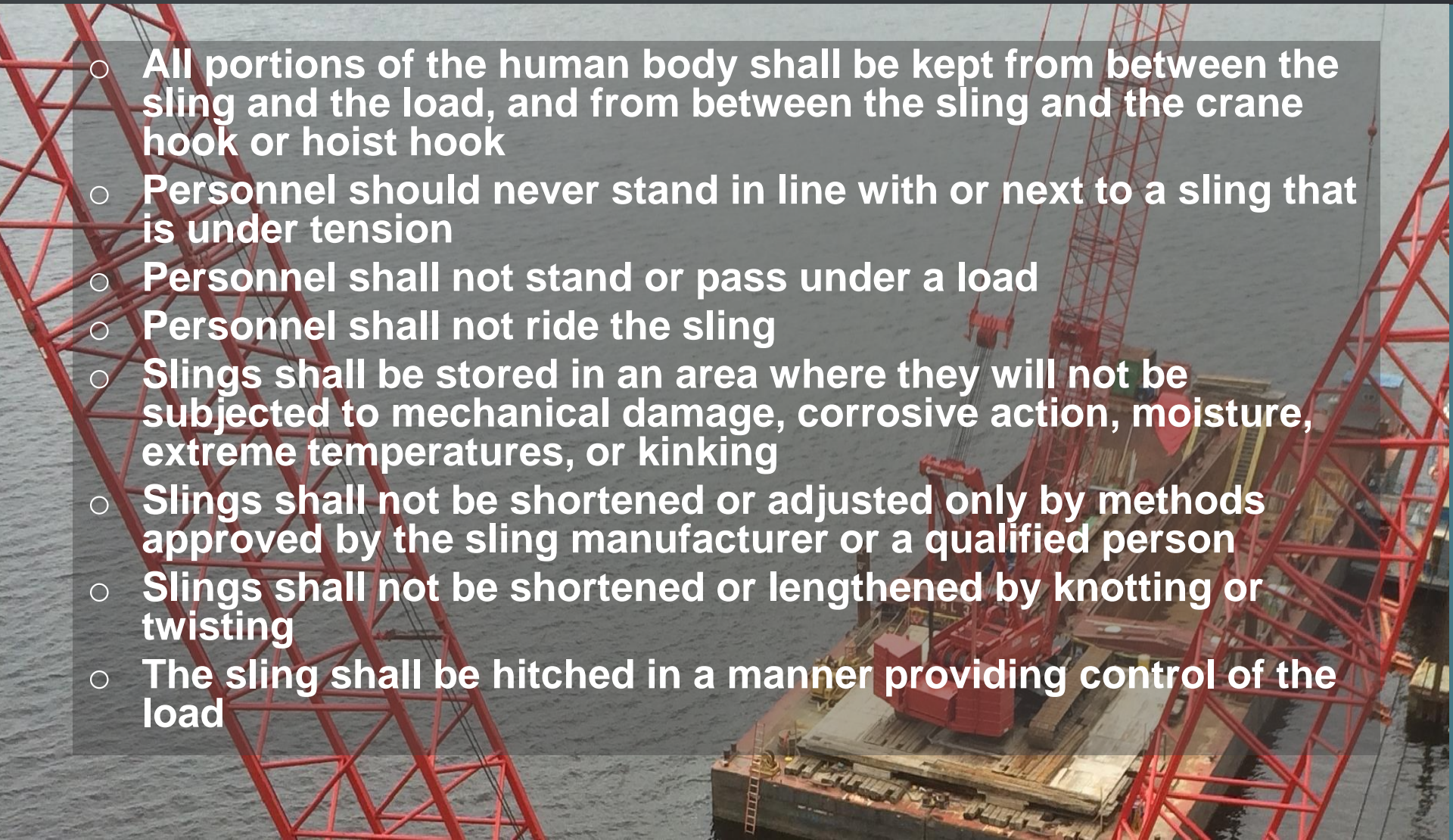
Proof Test Standard

A photograph of a wire rope sling being tested in a factory setting. The sling is suspended from a large metal structure, and a yellow safety net is visible in the background. The text is overlaid on the image.

Prior to initial use, all wire rope slings, chain slings, synthetic slings, ect. 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!**