

Overview

Purpose

The purpose of this Safety Regulation is to provide the instructions for general safety, inspection, and storage for rigging.

Scope

This Safety Regulation applies to any person who performs rigging activities, including crane, overhead hoist, A-frame, air/steam tugger lifts) at the Salt Lake City (SLC) Refinery and Terminals.

In This Safety Regulation

This Safety Regulation contains the topics listed below.

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Personnel Training

Personnel Training Requirements

The table below provides the personnel training requirements for rigging.
If you want to see how this works, see this video:

<https://www.youtube.com/watch?v=Xtq48uqBeNA>

Personnel	Training Requirement
<ul style="list-style-type: none">• Crane/ Lift Operator, and• Personnel who perform rigging	Must be trained in <ul style="list-style-type: none">• basic safe rigging• inspection• storage procedures, and• this Safety Regulation.
Qualified Riggers	Must have hands-on training in <ul style="list-style-type: none">• basic rigging techniques• equipment inspection• jib installation• ball installation, and• proper application of wire rope clips.

Roles and Responsibilities

List of Roles and Responsibilities

The table below lists the roles and responsibilities for rigging.

Role	Responsibility
Crew Supervisor	Ensures that each lift is planned, requirements are communicated, and safe rigging procedures are followed.
Crane/Lift Operator	Ensures that the crane/lift device is in safe working condition, the load is properly rigged, and weights do not exceed the rated load of rigging equipment.
Rigger	Follow safe rigging procedures.
All Persons Involved in the Lift	Stops the lift if it becomes unsafe.

Rigging Equipment

Introduction

This topic contains information on rigging equipment, including

- the durable identification of slings
- rating capacity of sling attachments
- eyebolts
- custom designed rigging accessories, and
- damaged or defective slings, hooks, and other attachments.



Durable Identification of Slings

Affix durable identification to all slings giving the

- sling size
- rated capacity, and
- sling reach (length).

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Rigging Equipment, Continued

Durable Identification of Slings, continued

IMPORTANT: If the identification is damaged to the extent that it cannot be read or is missing, take the sling out of service until the identification is replaced.

Rated Capacity of Sling Attachments

The rated capacity of all sling attachments (such as hooks, rings, coupling links) must be at least equal to that of the sling to which they are affixed.

Eyebolts

Eyebolts must be

- a one-piece manufactured device, not welded or constructed by the SLC Refinery, and
 - have a known load rating.
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Preliminary observations

Before archiving the FEA, take the following rules into consideration:

- Only systems that are used in the fatigue calculations are allowed in the project archive.
 - The name of the systems in the workbench should be meaningful or, when available, according to the applicable calculation guideline.
 - The name of the systems in Mechanical should be equal to the name of the system in the Workbench.
 - The following result plots should be included: von Mises / Max Principal
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Custom Designed Rigging Accessories

All custom designed rigging accessories (such as, pump removal A-frames, spreader bars, bundle pulling rods, plates, and so on) must be

- engineered
 - proof tested to 125% of its rated load prior to use
 - approved, and
 - marked to indicate the safe working loads.
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Rigging Equipment, Continued

**Damaged or
Defective Slings,
Hooks, and
Other
Attachments**

If a sling, sling fastener, hook, or other type of attachment is damaged or defective

- immediately remove it from service
 - report it to the Supervisor
 - tag it as “Do Not Use,” and
 - have it repaired or destroyed.
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Inspecting Rigging

Daily Visual Inspections

Prior to use each day, visually inspect all slings, fastenings, and attachments for damage or defects.

Annual Inspections

Thoroughly inspect slings, chain falls, and fasteners on an annual basis using “Exhibit 1: Rigging Inspection Guidelines” later in this document.

IMPORTANT: Document all annual inspections.

Additional Inspections

Perform additional inspections where service conditions warrant (for example, corrosive service).

Preparing for and Performing the Lift

Introduction This topic contains information on preparing for and performing the lift, including

- the prohibition of shock loading
 - avoiding the use of basket hitches
 - preparing lift plans for air tuggers
 - environmental considerations for slings
 - determining the load capacity
 - barricading the area
 - using safety lines
 - the safety precautions for slings, and
 - the safety precautions for personnel.
-

Prohibition of Shock Loading Shock loading is prohibited.

Avoiding the Use of Basket Hitches Avoid using a basket hitch.
Exception: If one is required, balance load in the hitch to prevent slippage.

Preparing Lift Plans for Air Tuggers If an air tugger is needed to pull a bundle, prepare a lift plan that includes the

- load weight
- lift angles
- rated capacity for structural members used to secure the tugger and lift blocks as painted on the housing (**Exception:** If the rated capacity is unknown, anticipate that the tugger will be load tested at 125% of the anticipated lift.)
- anticipated rigging loads, and
- recommended rigging for a safe pull.

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Preparing for and Performing the Lift, Continued

Environmental Considerations for Slings The table below provides the environmental factors to take into consideration prior to performing a lift.

Type of Sling	Environmental Consideration						
Metal Mesh Slings	Reduce the working load limit in accordance with the sling manufacturer's recommendations for operations outside the temperature ranges in the table below.						
	<table border="1"> <thead> <tr> <th>Type of Sling</th> <th>Temperature Range</th> </tr> </thead> <tbody> <tr> <td>Slings not impregnated with elastomers</td> <td>-20°F to 550°F</td> </tr> <tr> <td>Slings impregnated with PVC or neoprene</td> <td>0°F to 200°F</td> </tr> </tbody> </table>	Type of Sling	Temperature Range	Slings not impregnated with elastomers	-20°F to 550°F	Slings impregnated with PVC or neoprene	0°F to 200°F
	Type of Sling	Temperature Range					
Slings not impregnated with elastomers	-20°F to 550°F						
Slings impregnated with PVC or neoprene	0°F to 200°F						
Synthetic Fiber Rope Slings	Reduce the working load in accordance with the sling manufacturer's recommendations for operations outside of -20°F to 180°F.						
Nylon Web Slings	Do not use where fumes, vapors, sprays, mists, or liquids of acids or caustic are present.						
Polyester and Polypropylene Web Slings	<ul style="list-style-type: none"> Do not use either type of web sling where fumes, vapors, sprays, mists, or liquids of caustics could result in damage to the sling. Do not use polypropylene web slings in temperatures that exceed 200°F. 						
Web Sling With Aluminum Fittings	Do not use where fumes, vapors, sprays, mists, or liquids of caustics could result in damage to the fittings.						
Synthetic Web Slings of Polyester & Nylon	Do not use in temperatures that exceed 180°F.						
Wire Rope Sling or Choker	<p>Do not use if there is a possibility of the sling or choker becoming the path-to-ground during electric arc welding on a load suspended by a wire rope sling or choker.</p> <p>Note: A synthetic sling should be used during the above activity so long as the synthetic sling is not heated beyond the manufacturer's approved temperature range.</p>						

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Preparing for and Performing the Lift, Continued

Determining Load Capacity

To determine the load capacity, identify the

- load weight and center of gravity
 - boom/lift angle
 - swing radius, and
 - sling angle.
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Barricading the Area

Prior to the lift, barricade the lift area and crane tail swing.

Using Safety Lines

When pulling bundles, use a safety line where feasible to absorb the shock if any component should fail.

Safety Precautions for Slings

When setting up rigging

- do not load the sling in excess of its rated capacity
 - securely attach slings to their loads
 - do not shorten the sling with knots, bolts, or other makeshift devices, and
 - pad or otherwise protect the sling from the sharp edges of the load.
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Safety Precautions for Personnel

Below are the safety precautions personnel must take when preparing for and performing lifts.

- Do not enter any lift area that has been barricaded unless authorized to do so.
 - Keep clear of loads that are about to be lifted and those that are suspended.
 - Do not place hands or fingers between the sling and its load while the sling is being tightened around the load.
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Removing and Storing Rigging

Removing and Storing Rigging

After each job

- remove rigging, with the exception of some trolleys and permanently fixed chain blocks (**IMPORTANT:** Never pull a sling from under a load when the load is resting on the sling.)
 - if applicable, oil it, and
 - properly store it to prevent damage or deterioration.
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Exhibit 1: Rigging Inspection Guidelines

NOTE: In all cases, follow manufacturer specifications for rigging inspection. The following is provided as a general guide.

Type of Rigging	Qualifying Conditions to Immediately Remove From Service
Metal Mesh	<ul style="list-style-type: none"> • Broken weld or broken brazed joint along the sling edge • Reduction in wire diameter of 25% due to abrasion or 15% due to corrosion • Lack of flexibility due to distortion of the fabric • Distortion of the female handle so that the dept of the slot is increased more than 10% • Distortion of either handle so that the width of the eye is decreased more than 10% • A 15% reduction of the original cross-sectional area of metal at any point around the handle eye • Distortion of either handle out of its plane
Synthetic Rope Slings	<ul style="list-style-type: none"> • Abnormal wear beyond the wear indicator or that allowed by the manufacturer • Powdered fiber between strands • Broken or cut fibers beyond the wear indicator or that allowed by the manufacturer • Discoloration or rotting • Distortion of sling hardware beyond that allowed by the manufacturer
Synthetic Webbing Slings	<ul style="list-style-type: none"> • Acid or caustic burns • Melting or charring of any part of the sling surface • Snags, punctures, tears, or cuts • Broken or worn stitches beyond the wear indicator or that allowed by the manufacturer • Fitting distortion beyond that allowed by the manufacturer
Wire Rope Slings	<ul style="list-style-type: none"> • If in any length of 8 wire rope diameters, the total number of visible broken wires exceeds 10% of the total number of wires • Wear or scraping of 1/3 the original diameter of outside individual wires • Severe kinking, crushing, or other damage resulting in distortion of the rope structure (for example, bird caging) • Any evidence of heat damage • End attachments which are cracked, deformed, or worn beyond that allowed by the manufacturer • Hooks that are cracked, have a throat opening which is 15% or greater at its narrowest point, twisted 10 degrees or greater from the plane of the unbent hook
Hoisting Chains	<ul style="list-style-type: none"> • Wear beyond that allowed by the manufacturer • Twist beyond that allowed by the manufacturer • Distortion beyond that allowed by the manufacturer • Cracked links, nicks, gouges

Terms and Definitions

A-Frame A certified lifting device with two A-shaped end pieces and a horizontal beam used to pull pumps and other related equipment at the SLC Refinery.

Alloy Chain Chrome alloy chain approved for lifting.

Note: Other grades of chain are *not* approved for lifts.

Air Tugger Mechanical hoist that uses air or steam to power the drum hoist.

Angle of Loading The inclination of the leg of a sling measured from the horizontal or vertical plane, which varies the tension of the sling.

Note: The stress on a sling can be greater than the load it is picking, depending on the angle of the sling in relation to the load. The closer the pick point gets to the load, the greater the leg angle, which increases the stress on each leg of the sling.

Example: Loading on a sling leg that is

- 30 degrees from the vertical (60 degrees from the horizontal) is 0.865 of vertical
 - 45 degrees from the vertical (or horizontal) is 0.7 of vertical;
 - 60 degrees from the vertical (30 degrees from the horizontal) is 0.5 of vertical).
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Basket Hitch 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.

Braided Wire Rope A wire rope formed by plaiting component wires.

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Terms and Definitions, Continued

Bridle Wire Rope Sling

A wire rope sling composed of multiple wire rope legs with the top ends gathered in a fitting that is attached to the lifting hook.

Chain, Lift

Chain, except for chain hoists, is not approved as a choker or sling for lifts.

Metal Meshed Sling

A webbed sling composed of multiple steel spirals welded or brazed to cross rods.

Rated Capacity or Working Load Limit

The maximum working load in pounds permitted by the manufacturer.

Synthetic Sling

Rope or webbed sling that is made of synthetic materials, such as nylon or polyethylene.

Tackle

An assembly of ropes and sheaves arranged for hoisting and pulling.

Use Rated Capacity Chart

Manufacturers chart used to determine the proper sling length, type and construction, diameter, and rigging angle for a lift.

Note: When the manufacturers chart is not available, refer to Title 29 Code of Federal Regulations (CFR), Section 1926.251, Table H.

Wire Rope

Stranded rope made of various grades of steel helically wound together.

Review and Revision History

History of Reviews

The table below provides the review history for this Safety Regulation.

Revision	Date	Reviewer	Outcome
1.0	12/08/2003	---	Document revised.
2.0	02/12/2004	---	Document revised.

History of Revisions

The table below provides the revision history for this Safety Regulation.

Revision	Date	Change Author	Reason for Change
1.0	04/05/1994	---	Original Issue
2.0	12/08/2003	---	---
3.0	02/12/2004	---	---
4.0	03/01/2015	W. Walter	Reformatted using the Information Mapping methodology.
