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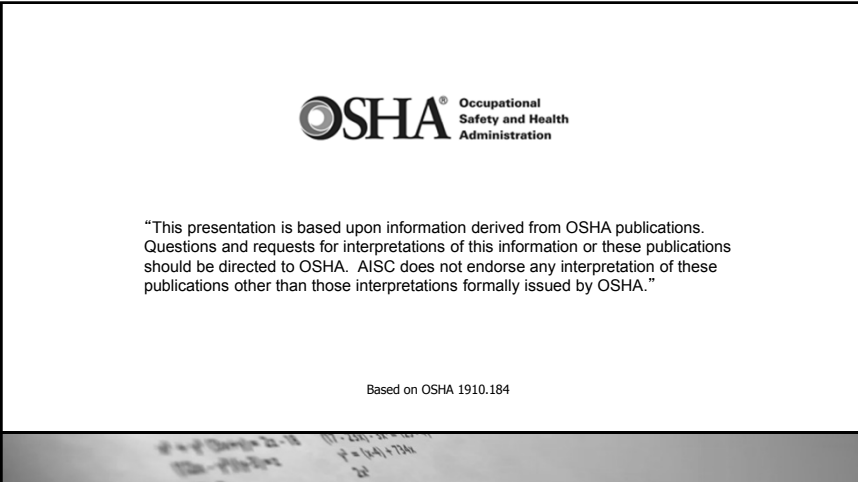
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Rigging Safety

Bryan McClure CPLP
L.P.R. Construction Co





OSHA® Occupational Safety and Health Administration

“This presentation is based upon information derived from OSHA publications. Questions and requests for interpretations of this information or these publications should be directed to OSHA. AISC does not endorse any interpretation of these publications other than those interpretations formally issued by OSHA.”

Based on OSHA 1910.184

Objectives

Phase 1

Phase 2

Phase 3


Phase 4

Participants will:

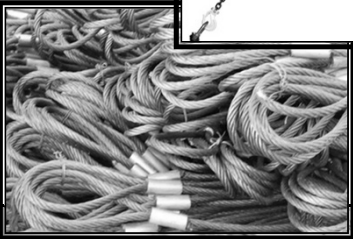

- Understand the most commonly used rigging material & hitch types
- Understand capacity differences in the most commonly used rigging hitch types
- Understand what sling stress is
- Be able to determine the amount of sling stress placed into a sling

5

Slings




- Synthetic slings
- Alloy steel chain slings
- Wire rope slings

6

Alloy Steel Chains 1910.184(e)



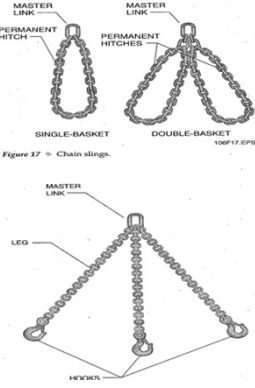

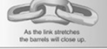








Figure 17 - Chain slings.

7

Alloy Steel Chains 1910.184(e)(3)(i)

- Annual inspections by a competent person are required
- Employer shall make and maintain a record of the most recent month in which each alloy steel chain sling was thoroughly inspected

<p>HEAT DAMAGE AND CRACK</p> 	<p>OVERLOAD DAMAGE</p> <p>As the link stretches the barrels will close up.</p> 
<p>IMPACT DAMAGE BENT LINKS</p> <p>Link barrels have bent from being engaged around a load with sharp corners.</p> 	<p>TWISTED LINKS</p> <p>Links twisted from knocking or placing a twist into the chain prior to load stress.</p> 
<p>CUTS, CHIPS, AND GOUGES</p> <p>Link bent from impact.</p> 	<p>EXCESSIVE WEAR</p> 
<p>RUST AND CORROSION</p> <p>Links wear at the bearing surfaces.</p> 	

8

Wire Rope 1910.184f(5)(i)

Ten randomly distributed broken wires in one rope lay, or five broken wires in one strand in one rope lay.

Diagram labels: CORE, STRAND WIRE (ONE LAY), CENTER WIRE, LAY OF THE ROPE, ROPE, Lay length.

9

Wire Rope 1910.184f(5)(i)

- Kinking
- Crushing
- Bird Caging
- Heat Damage

Diagram labels: BROKEN WIRES, KINKING, BIRDCAGING, CRUSHING, CORROSION.

10

Synthetic Slings 1910.184(i)(1)

Marked or coded to show the rated capacities

Diagram labels: 6000, 5100, 15,000.

11

Synthetic Slings 1910.184(i)(9)

Removal from Service if any of the following are present:


- Burns
- Snags, tears punctures or cuts
- Broken/worn stitches

Diagram labels: (G) CUT, (H) CUT WITH WARNING THREADS SHOWING, (I) PUNCTURE, (J) BROKEN SPLICE OR STITCHING, (K) SNAG SHOWING RED THREAD, (L) TENSILE DAMAGE.

12

Synthetic Slings

Always use softeners when rigging around sharp edges



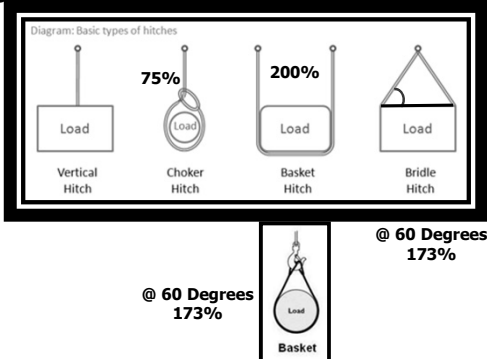
13

Hitch Types

Diagram: Basic types of hitches

- Vertical Hitch: Load
- Choker Hitch: 75% Load
- Basket Hitch: 200% Load
- Bridle Hitch: Load

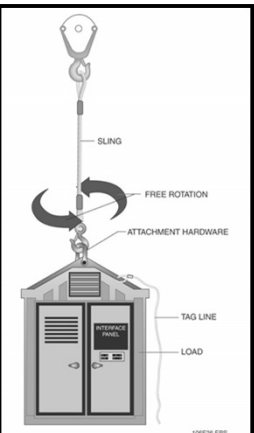
@ 60 Degrees: 173%
 @ 60 Degrees: 173%



14

Vertical Hitch

Forms a 90 degree angle between the hitch and the load.

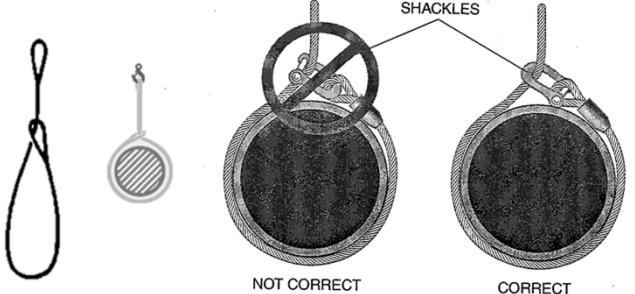


15

Choker Hitch

SHACKLES

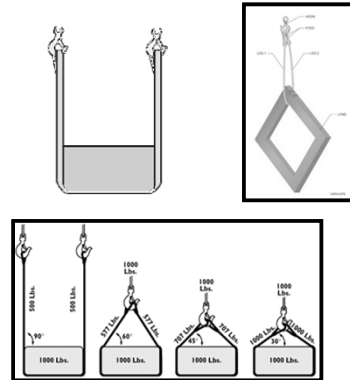
NOT CORRECT CORRECT



16

Basket Hitch

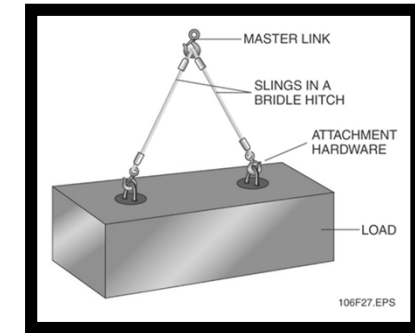
A basket hitch with both legs at 90 degrees effectively doubles the capacity of the sling



17

Bridle Hitch

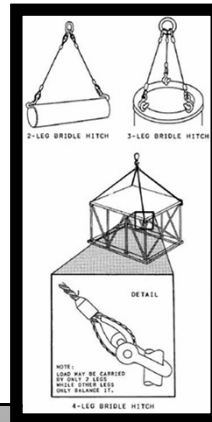
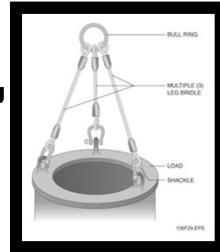
The bridle hitch consists of two or more vertical hitches attached to the same hook, master link, or bull ring.



18

Multiple Leg Bridle Hitch

A multiple leg bridle hitch is always considered to have only two of the legs supporting the majority of the load and the rest of the legs balancing it.



19

Sling Stress

Sling Stress

The total amount of force exerted on a sling. This includes forces added as a result of sling angle. Sling stress applies to all types of slings.


Sling Angle

The angle of an attached sling when pulled in relation to the load

20

Sling Stress


Two buckets of water weighing
40 LBS



21

Sling Stress


@ 30 degrees from horizontal =
80 LBS



21

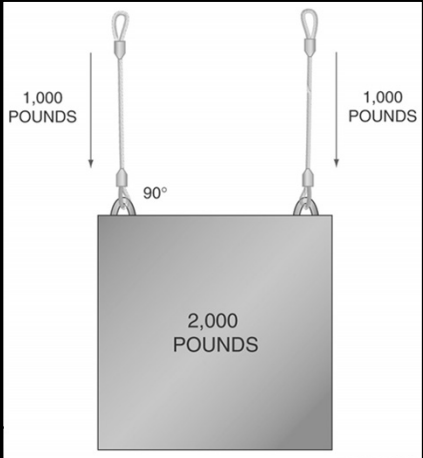
Sling Stress

@ 5 degrees from horizontal =
240 LBS



21

Sling Stress



1,000 POUNDS

1,000 POUNDS

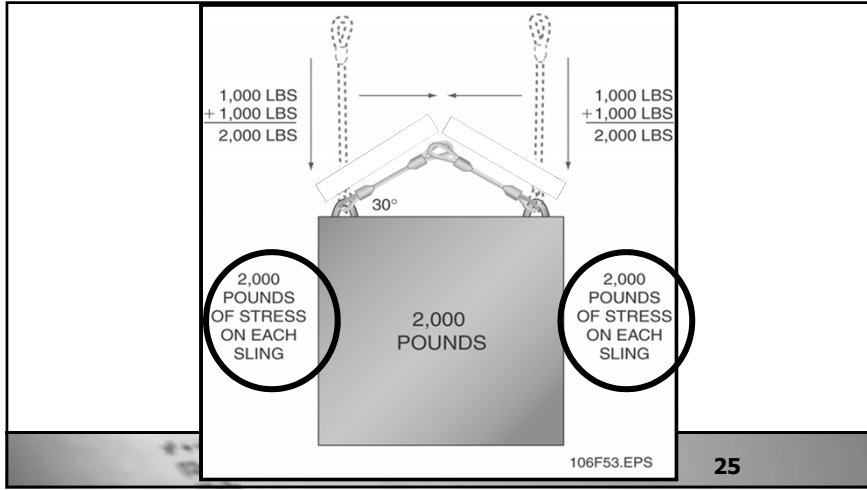
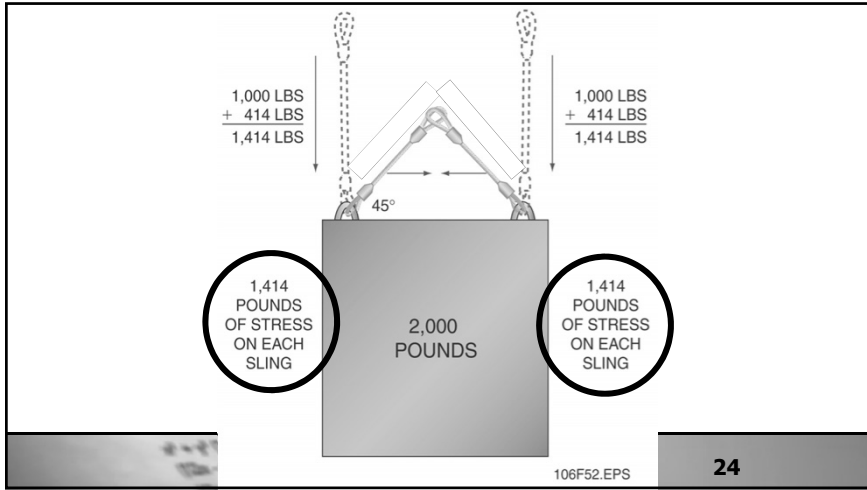
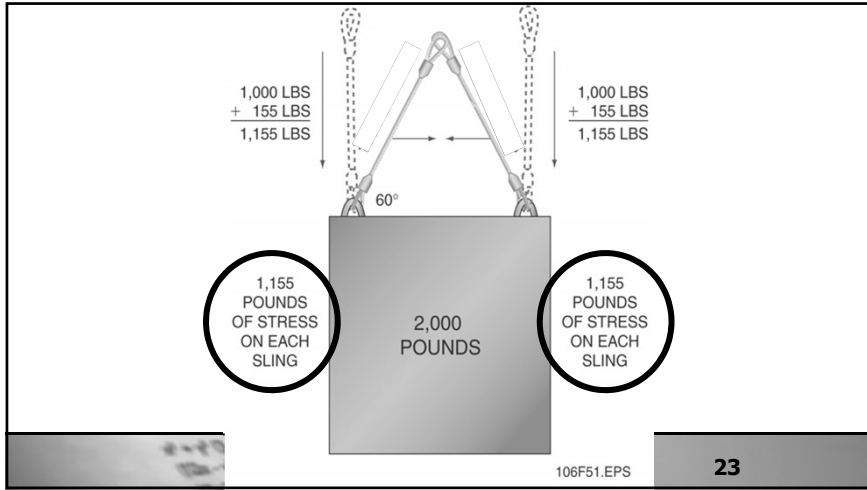
90°

2,000 POUNDS

106F50.EPS

22





How to determine sling tension

Load Factors & Weight Distribution

Tension in s = $\frac{\text{length } s}{\text{length } h} \times \text{share of load wt.}$ $\frac{s}{h}$ = Load Factor

Given: length s = 10' and length h = 8' What is tension in s?

Solution: Tension in s = $\frac{10}{8} \times 5,000$ $T_s = 1.25 \times 5,000$ $T_s = 6,250\#$

How much tension in chain come-a-long A?

Tension in A = $\frac{6}{3} \times 4,000$ Tension in A = 8,000 #

Share of Load Wt. @ A	Share of Load Wt. @ B	Legend
$R_1 + R_2 = TS$	$R_1 + R_2 = TS$	R_1 = Run, Side 1
$R_2 = P$	$R_1 = P$	R_2 = Run, Side 2
$TS = P$	$TS = P$	TS = Total Span
$P \times W$ = Share of Load Wt @ A	$P \times W$ = Share of Load Wt @ B	P = Percentage
		W = Weight of Load

106F54.EPS **26**

Activity

Determine sling Tension

Length of sling = 30 feet
 Height from load = 25 feet
 Total load weight = 100,000 lbs

What is the sling tension in each sling?

Tension in s = $\frac{\text{length } s}{\text{length } h} \times \text{share of load wt.}$ $\frac{s}{h} = \text{Load Factor}$

Given: length s = 10' and length h = 8' What is tension in s?

Solution: Tension in s = $\frac{10}{8} \times 5,000$ $T_s = 1.25 \times 5,000$ $T_s = 6,250\#$

27

D/d Ratio For Wire Rope Slings

28

Questions? More Information?

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29

Safety Resources

- AISC Safety Website – www.aisc.org/safety
- Sample Safety Program Elements
- Safety Awards Program
- Sample Safety Forms
- Top 10 OSHA Citations
- OSHA Interpretations
- Safety Product Reviews
- Safety Details or 'Tool Box Talks'
- Daily Safety Focus
- And more

30

Thank You

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There's always a solution in steel.

