RIGGING SAFETY

UNSAFE RIGGING COULD BECOME THE WEAKEST LINK!!
Section 15
RIGGING SAFETY

RIGGING EQUIPMENT SHALL BE INSPECTED BY A COMPETENT PERSON BEFORE USE ON EACH SHIFT AND AS NECESSARY DURING ITS USE TO ENSURE THAT IT IS SAFE.

QUALIFIED RIGGING LIFT SUPERVISOR and QUALIFIED RIGGER

1) Be at least 18 years of age
2) Be able to communicate with crane operator, lift supervisor, flagman and affected employees on site
3) Have basic knowledge and understanding of equipment-operating characteristics, capabilities, and limitations

QUALIFIED RIGGERS AND LIFT SUPERVISORS MUST DEMONSTRATE KNOWLEDGE AND PROFICIENCY TO APPROPRIATE MANAGEMENT PERSONNEL IN THE FOLLOWING;

1) Personnel roles and responsibilities
2) Site preparation
3) Rigging equipment and materials
4) Safe Operating procedures
QUALIFIED RIGGERS AND LIFT SUPERVISORS MUST DEMONSTRATE KNOWLEDGE AND PROFICIENCY TO APPROPRIATE MANAGEMENT PERSONNEL IN THE FOLLOWING:

5) Principles of safe rigging
6) Environmental hazards (overhead interferences)
7) Rigging the load, handling the load, common causes of crane-related accidents
MULTIPLE LIFT RIGGING (MLR)

1) A multiple lift is considered a critical lift and requires a written critical lift plan per Section 16.H

2) For the purpose of erecting/placing structural steel ONLY and must follow Section 15.C and 29 CFR 1926.753 Subpart R

3) Must follow the following criteria
   a. MLR assembly used
   b. maximum of five members are hoisted per lift
   c. Only beams and similar structural members are lifted
   d. All employees engaged in MLR are trained
   e. All loads are rigger by a qualified rigger
   f. Manufacturer specifications allow MLR
   g. Components designed capacity with a 5:1 safety factor for all components
MULTIPLE LIFT RIGGING (MLR) cont.

h. The total load doesn’t exceed the rigging capacity

MULTIPLE LIFT RIGGING SHALL BE RIGGED WITH MEMBERS:

1) ATTACHED AT THEIR CENTER OF GRAVITY
2) Rigged from the top down
3) Rigged at least 7 feet apart
4) Members shall be set from the bottom up
5) Controlled load lowering shall be used whenever the load is over the connectors (people!!)
RIGGING SAFETY

RIGGING EQUIPMENT SHALL BE INSPECTED BY A COMPETENT PERSON BEFORE USE ON EACH SHIFT AND AS NECESSARY DURING ITS USE TO ENSURE THAT IT IS SAFE.

RIGGING EQUIPMENT, WHEN NOT IN USE, SHALL BE REMOVED FROM THE IMMEDIATE WORK AREA AND PROPERLY STORED AND MAINTAINED IN A SAFE CONDITION.

WHEN HOISTING LOADS, A POSITIVE LATCHING DEVICE SHALL BE USED TO SECURE THE LOAD AND RIGGING.
RIGGING GEAR

FIBER ROPE, CHAIN, WIRE ROPE & WIRE ROPE CLIPS

SLINGS: ROPE SLINGS, WEB SLINGS, WIRE ROPE SLINGS, BRAIDED SLINGS & CHAIN SLINGS.

HOOKS, SHACKLES, RINGS/LINKS, TURNBUCKLES, EYE-BOLTS

BELOW THE HOOK DEVICES
### TABLE 16-2

**Wire Rope Removal and Replacement Criteria**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Equipment</th>
<th># of Broken Wires in Running Ropes</th>
<th># of Broken Wires in Standing Ropes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>In one rope lay</td>
<td>In one strand</td>
</tr>
<tr>
<td>ASME/B30.2</td>
<td>Overhead &amp; gantry cranes</td>
<td>12**</td>
<td>4</td>
</tr>
<tr>
<td>ASME/B30.4</td>
<td>Portal, tower, &amp; pillar cranes</td>
<td>6**</td>
<td>2</td>
</tr>
<tr>
<td>ASME/B30.5</td>
<td>Mobile &amp; locomotive cranes</td>
<td>6**</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Rotation-resistant ropes</td>
<td>2 randomly distributed broken wires in 6 rope dia. or 4 randomly distributed broken wires in 30 rope dia.</td>
<td>2</td>
</tr>
<tr>
<td>ASME/B30.6</td>
<td>Derricks</td>
<td>6**</td>
<td>3</td>
</tr>
<tr>
<td>ASME/B30.7</td>
<td>Base-mount drum hoists</td>
<td>6**</td>
<td>2</td>
</tr>
<tr>
<td>ASME/B30.8</td>
<td>Floating cranes and derricks</td>
<td>6**</td>
<td>2</td>
</tr>
<tr>
<td>ASME/B30.16</td>
<td>Overhead hoists</td>
<td>12**</td>
<td>4</td>
</tr>
<tr>
<td>ANSI/A10.4</td>
<td>Personnel hoists</td>
<td>6**</td>
<td>2</td>
</tr>
<tr>
<td>ANSI/A10.5</td>
<td>Material hoists</td>
<td>6**</td>
<td>Not Specified</td>
</tr>
</tbody>
</table>
RIGGING GEAR

WIRE ROPE  CHAIN  MESH  ROPE  WEB  ROUNDSLINGS
STEEL  SYNTHETIC

SLINGS
END LINK  SLING LINK  WELDLESS RING  SWIVEL HOIST

RINGS
EYE BOLT  TURNBUCKLE  SHACKLE

OTHER THINGS
FIBER ROPE

TAG LINES

Control loads be lifted by crane

Excessive length could cause
A safety problem

Max. Length about 10 Feet.

Work around power lines
Use non-conductive tag lines

See Pages 3-6
Can You Name this Violation?

Positive latching device, i.e., self-closing safety latches, hook with spring-loaded gate, and alloy anchor type shackle with a bolt, nut and retaining pin.

Violation here!
LIFTING ANGLES

90° (STRAIGHT UP & DOWN) FROM THE LOAD...THE FULL CHAIN CAPACITY CAN BE LIFTED.

THE GREATER THE ANGLE FROM VERTICAL AWAY FROM THE CENTER OF THE LOAD...THE LESS THE LIFTING CAPACITY OF THE CHAIN (See Pg. #14)

NOTE: SLING ANGLE APPLIES TO ALL TYPE SLINGS!

Slings are not to be used at angles less than 30° from the horizontal!
WIRE ROPE

LIFTING SLINGS

STANDING LINES ON CRANES

RUNNING LINES ON CRANES

HORIZONTAL LIFE LINES

Pages 15-31
WIRE ROPE

See Appendix Q
For Definition.
WIRE ROPE

TYPICAL WIRE ROPE
(6 X 19)
1st # is number of strands
2nd # is number of wires per strand

CENTER CORE
FIBER
OR
METAL

See Page #17 for classifications & types
WIRE ROPE TYPES

MOST COMMON
RIGHT REGULAR LAY...Wires wind in one direction & strands in the opposite direction.

Less likely to kink & untwist, easier to handle And more resistant to crushing.
WIRE ROPE TYPES

WHY IT IS IMPORTANT TO UNDERSTAND ABOUT TYPES OF WIRE ROPE?

CRANE MANUFACTURERS MANUAL WILL STIPULATE THE SIZE & TYPE OF WIRE ROPE TO USED FOR EACH OF THE CRANE HOISTS.
WRONG TYPE OF WIRE ROPE USED ON THIS CRANE HOIST
INSPECTING WIRE ROPE

CRANES

RUNNING LINES

6 Broken Wires
In one rope lay

3 Broken Wires
In one strand

OR

STANDING LINES

3 Broken Wires
In one rope lay

2 Broken Wires
at end connection
WHAT IS ONE ROPE LAY?

THE LENGTH OF WIRE ROPE THAT ONE STRAND TAKES TO MAKE ONE COMPLETE REVOLUTION AROUND THE CORE OF THE WIRE ROPE (See Pg 18)
Crushed Wires

Broken Wires

DAMAGE FROM HEAT AND CORROSION
(Electrical contact with wire rope)

(See page 26 & 27)
INSPECTING WIRE ROPE

Bird Cage

Kinked
WIRE ROPE SLINGS

FIVE BASIC TYPES

- SOCKET (POURED) 100%
- WEDGE SOCKET 75%-90%
- MECHANICAL (above) 90%-95%
- HAND TUCKED 80%-90%
- WIRE ROPE CLIPS 80%

Look on Page #25
COE says “Wire rope slings shall have affixed a durable permanent ID tag with the diameter, rated load, & lifting capacity in the vertical, chocker, and basket configuration. Also the date the sling was placed in service.
TYPES OF SLING HITCHES

Choker
Basket
Straight
Bridle
VERTICAL HITCH: Full rated lifting capacity of the sling may be used. (Watch Rotation!)

CHOKER HITCH: Reduced lifting capacity of single sling is 75% of full rating of sling, dual slings capacity rating based on lifting angle of the slings (See page # 30 )

BASKET HITCH: Distributes the weight of the load evenly between two slings. Both eyes of each sling are placed on lifting hook, load in “in the cradle”. ( See Page # 31 )
Straight Sling

The total weight of the load is supported by a single leg. The working load limit of the sling must exceed the load.
Choker Sling
Basket Sling
Spreader Beams

- Spreader beams can be used with a double vertical hitch to handle long loads
- Reduces load tipping
- Each leg will carry one-half the total load
- Spreader beams must be manufactured for that purpose and have a rated capacity indicated
D/d RATIO

A wire rope around
An object of equal Diameter (1/1 d/d)
Will have a breaking Strength reduced 50%

A 4/1 ratio decreases
The strength to 25%

A 20/1 ratio has a
0% loss in strength.
See page # 31
Most common type called a “Crosby Clamp”

3 Main Parts
SADDLE
“U” Bolt
Nuts
NEVER SADDLE A DEAD HORSE!!!
PROPER USE OF THE WIRE ROPE CLIP

PAGE 21 OF SAFETY RESOURCE BOOK FOR APPLYING WIRE ROPE CLIPS

WEDGE SOCKETS

PAGES 23 & 24 OF SAFETY RESOURCE BOOK
WEDGE SOCKETS

The new Crosby TERMINATOR™ wedge socket secures the dead-end of a wire rope with a new longer wedge and a Crosby "Red-U-Bolt" wire rope clip. This combination eliminates the need for extra piece of wire rope on tail.

New wedge fits existing Crosby sockets (Becketts).

No other wedge socket offers this unique approach to termination while maintaining a minimum efficiency rating of 80%, based on the catalog strength of XXIP grade wire rope. Available to fit wire rope from 3/8" to 1 1/8". The TERMINATOR™... The last wedge socket you’ll ever need.

For more information contact your local authorized Crosby Distributor.
SYNTHETIC WEB SLINGS

SYNTHETIC ROPE SLINGS

TWO MAJOR TYPES
SYNTHETIC SLING CAPACITY

TAG TO ID THE

Name or trademark of the manufacturer

Rated capacity for the type of hitch

Not to exceed rated Capacity
RATED CAPACITY IS DETERMINED BY THE TAG AND COLOR CODE OF THE OUTER JACKET

REPLACE WHEN RED STRIPE WHITE CORE YARNS ARE VISIBLE

See Pages 41 & 42
ROUND SLING CONSTRUCTION

SEE PAGE 42 FOR SLING CAPACITY COLOR CODES
DISADVANTAGES SYNTHETIC SLINGS

HEAT SOURCES

ACIDS

CAUSTIC

CUT TEAR EASY
INSPECTING SYNTHETIC SLINGS

ACID BURNS
MELTING MARKS
CUTS, HOLES
TEARS, SNAGS
RED WARNING
EXCESSIVE WEAR
NO SWL TAG
UNREADABLE TAG
END ATTACHMENTS
RIGGING HARDWARE

WIRE ROPE CLIPS
HOOKS
SHACKLES
RINGS
LINKS
TURNBUCKLES
EYE BOLTS
TYPES OF HOOKS

HOIST HOOKS
CHAIN GRAB HOOKS
SLING CHOCKER HOOKS
CHAIN SLIP HOOKS
EYE HOOKS

See pages 44 through 54
INSPECTING HOOKS

WEAR OR CRACKS

DEFORMATION OF HOOK

THROAT OPENING 15% MORE

*BENT MORE THAN 10° OUT OF PLANE

SAFETY LATCH OR MOUSE

•Page # 45 for deformed hook photo and COE Appendix “F” page F-5
Example of Bad Hook

Max twist
10°

Avoid:
- Side load
- Back load
- Tip load
LIFTING WITH HOOKS

Only foundry hooks are designed for tip loading

Hook/Load Angles

A. Balanced 100%
B. 1/4 off center 86%
C. 1/2 off center 80%
D. 3/4 off center 70%
E. Point loading 40%
SHACKLES

6 MAJOR TYPES

Screw Pin Anchor
Round Pin Anchor
Safety Anchor
Screw Pin Chain
Round Pin Chain
Safety Chain

Screw Pin Anchor
SHACKLES

Stock Diameter Determines Size

Safety Type for high vibration operations i.e. pile driving
SHACKLE RIGGING SAFETY TIPS

Avoid placing running line over the pin.

Never replace shackle pin with a bolt

A hook on the shackle should be placed
On the stock (round) part of the shackle

Look on Page 47!!!
SHACKLE INSPECTION RESULTS

• Unknown SWL (Shackle not marked)
• Different sizes used in one arrangement.
• Bolts used for pins.
• Shackles welded to spreader bar
• Bent/out of shape
• Shop fabricated shackle pins
TURNBUCKLES

3 TYPES, HOOK, ROUND, CLEVIS END

Maximum distortion allowed 5% End or 10% of Hook distortion.

Go See Pages 52 & 53
EYE BOLTS

NON-SHOULDER

SHOULDER

Slowly I turned to Page # 54
EYE BOLT SAFETY TIPS

Angle of Lift is Critical

Max 5° for Non-shoulder Avoid angular Loading
HOME MADE LIFTING DEVICE
What’s wrong with this?
BELOW THE HOOK LIFTING DEVICES

PRESSURE GRIPPING LIFTERS – INDENTATION-TYPE

AUTOMATIC SLAB TONG (FOUR-POINT)

PRESSURE GRIPPING LIFTERS – FRICTION-TYPE

AUTOMATIC INGOT TONG (TWO-POINT)

PLATE CLAMPS
BELOW THE HOOK
LIFTING DEVICES

LOAD INDICATING DEVICES

ANALOG

DIGITAL

LEVER OPERATED

HAND CHAIN OPERATED

MANUAL HOISTS

PORTABLE GANTRY

FLOOR CRANE

MISCELLANEOUS CRANES
LOAD RATING OF THE DEVICE
Especially In Line items i.e. Come-a-long

SPREADER BARS LIFT RATING?

DEFORMATIONS/USED CORRECTLY

What does Manufacture Data say?
OTHER RIGGING CONSIDERATIONS

CRIBBING

BLOCK & TACKLE

JACKING/BLOCKING
WHAT IS THE WEIGHT OF THE LOAD TO MOVE?

Manufacturer’s literature
Labels on machine or equipment
Bill of lading from shipping company
Weigh bill from trucking company
Scientific data sheets
Commercial/government scales
Standards of weights and measures
Field measurements & calculations
Estimate & lift (LMI reading)
http://portal.navfac.navy.mil/ncc
DSN: 387-3803
FAX: (757) 967-3808
COMM: (757) 967 3803