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#803 Introduction to safe rigging practices

Rob Siemens

Wednesday, March 30, 2011
11:15 a.m. to 12:15 p.m.

Ohio Bureau of Workers Compensation



Rigging Safety...

Enhancing knowledge saves lives

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Presented by:  888.829.9099

Many industries use Rigging

- Regardless of what industry your in, you will encounter some form of rigging.
 - Lifting
 - Pulling
 - Cargo Securement
- What saves lives is knowing your equipment and understanding the proper use.

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Rigging in Construction

- Today we hear of many accidents...
 - Most due human error

Unacceptable... behavior

Example of how Injuries occur...



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Construction Safety importance

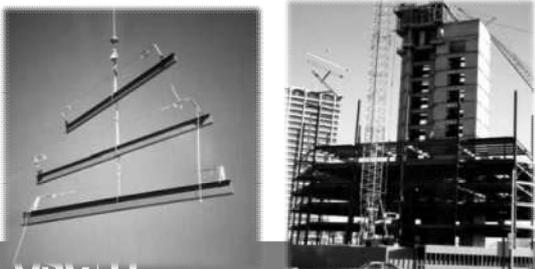
- Many don't realize the importance of rigging safety until its to late...
 - Accidents resulting in death cause everyone to reconsider their position on safety.
 - The purpose of this conference is to ensure those who go to work, return home safely and alive.

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Rigging Procedures in Construction

- Christmas Treeing



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Steel Connector



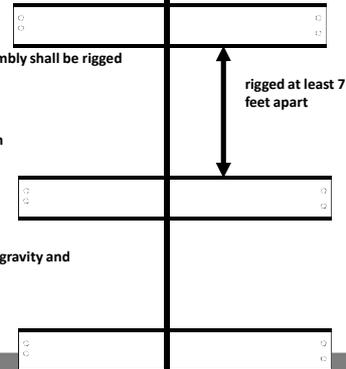
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(4) The multiple lift rigging assembly shall be rigged with the members:

rigged from the top down

attached at their center of gravity and maintained level



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Understand your Equipment

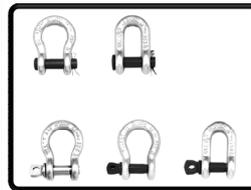
Regardless of your industry, you must:

- Know the types of equipment needed in the field.
- Know the proper names for the equipment.
- Understand how to properly use them.
- Understand how to read the capacity

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Commonly mistaken equipment

Shackles versus Clevises can be a deadly mistake.



Utility Clevis Screw Pin Clevis Twist Clevis Straight Clevis

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Capacities

NYLON WEB SLING CHART

Web Width (Inches)	MAXIMUM SAFE WORKING LOADS—POUNDS (SAFETY FACTOR = 5) (Eye & Eye, Twisted Eye, Triangle Fittings, Choker Fittings)				
	Single Vertical Hitch	Single Choker Hitch	Single Basket Hitch (Vertical Leg)	2-Leg Basket Hitch with Legs Inclined	
	60°	45°	30°		
1	1,800	1,200	3,200	2,270	1,800
2	3,200	2,400	6,400	4,500	3,200
3	4,800	3,600	9,600	6,800	4,800
4	6,400	4,800	12,800	11,300	6,400
5	8,000	6,000	16,000	13,800	8,000
6	9,600	7,200	19,200	16,300	9,600
7	11,200	8,400	22,400	18,800	11,200
8	12,800	9,600	25,600	21,300	12,800
9	14,400	10,800	28,800	23,800	14,400
10	16,000	12,000	32,000	26,300	16,000
11	17,600	13,200	35,200	28,800	17,600
12	19,200	14,400	38,400	31,300	19,200

If used with Choker Hitch multiply above values by 75%.

For Double Basket Hitch multiply above values by 2.

Note: For Safe Working Loads of Endless or Grouted Slings, Multiply Above Values by 3.

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Capacities

WIRE ROPE SLING CHART

Rope Diameter (Inches)	MAXIMUM SAFE WORKING LOADS—POUNDS (Safety Factor = 5)				
	Single Vertical Hitch	Single Choker Hitch	Single Basket Hitch (Vertical Leg)	2-Leg Basket Hitch & Single Basket Hitch with Legs Inclined	
	60°	45°	30°		
1/4"	650	480	1,300	1,100	900
3/8"	1,150	850	2,300	2,000	1,600
1/2"	1,750	1,300	3,500	3,000	2,500
5/8"	2,500	1,900	5,100	4,400	3,700
3/4"	3,400	2,500	6,800	6,000	5,200
7/8"	4,500	3,300	9,000	8,100	7,000
1"	5,700	4,200	11,400	10,000	8,700
1 1/8"	7,100	5,300	14,200	12,500	10,800
1 1/4"	8,600	6,400	17,200	15,200	13,200
1 1/2"	10,200	7,600	20,400	18,100	15,700
1 3/4"	11,900	8,900	23,800	20,900	18,200
1 7/8"	13,700	10,300	27,400	24,000	20,800
2"	15,600	11,800	31,200	27,300	23,500
2 1/4"	19,700	14,800	39,400	34,300	29,500
2 1/2"	22,000	16,500	44,000	38,400	32,800
2 3/4"	24,500	18,400	48,000	42,000	36,000
3"	27,200	20,500	52,400	45,800	39,400
3 1/4"	30,100	22,800	57,200	50,000	43,000
3 1/2"	33,200	25,300	62,400	54,500	46,800
3 3/4"	36,500	28,000	68,000	59,400	50,800
4"	40,000	30,900	74,000	64,600	55,000
4 1/4"	43,700	34,000	80,400	70,200	60,000
4 1/2"	47,600	37,300	87,200	76,200	65,000
4 3/4"	51,700	40,800	94,400	82,500	70,000
5"	56,000	44,500	102,000	89,200	76,000
5 1/4"	60,500	48,400	110,000	96,400	82,000
5 1/2"	65,200	52,500	118,400	104,000	88,000
5 3/4"	70,100	56,800	127,200	112,000	94,000
6"	75,200	61,300	136,400	120,400	100,000
6 1/4"	80,500	66,000	146,000	129,200	107,000
6 1/2"	86,000	70,900	156,000	138,400	114,000
6 3/4"	91,700	76,000	166,400	148,000	121,000
7"	97,600	81,300	177,200	158,000	128,000
7 1/4"	103,700	86,800	188,400	168,400	135,000
7 1/2"	110,000	92,500	200,000	179,200	142,000
7 3/4"	116,500	98,400	212,000	190,400	150,000
8"	123,200	104,500	224,400	202,000	158,000

Note: Table values are for slings with eyes and thimbles in both ends, Flemish Softened Eyes and mechanical chokers.

Hard locked spliced eyes — reduce loads according to table 1.11, page 47.

Eyes formed by cable clips — reduce loads by 20%.

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Visit our booth

Should you have questions that we have not been able to answer, look for Royal Arc's booth and we can discuss your individual rigging applications.

Thank you!

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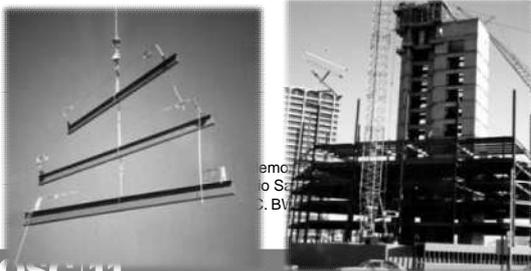
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Royal Arc Presents...
Signalmen
Hand Signals & Verbal Commands
Bob Siemens
OSHA Authorized Instructor #:EKU00275
OSHA
Royal Arc Industrial Services

Rigging Procedures in Construction

▪ Christmas Treeing



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History

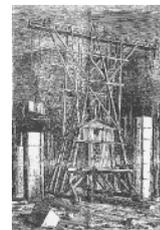
- 1914-1918 mobile cranes begin to appear
- 1916 first crane standard ASME
- 1920-1925 meetings and discussions on crane safety ASME
- The Safety Code for Cranes Derricks & Hoists ASA B30.2-1943
- Jointly ASME and the U.S. Navy reorganized as an American National Standards Committee in 1962 with 39 members and 27 organizations

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ROYAL ARC

Quick History

- Tower Cranes are newer than mobile cranes, but still 100 years old
- Less than 5% of crane accidents involve tower cranes. Most accidents occur on mobile equipment.
- Most are designed in Europe (Germany, France, Italy, Spain), and now China



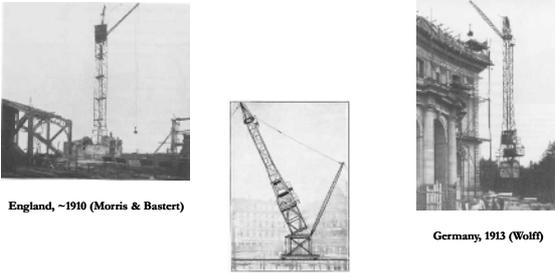
France, 1867

Cologne, 1819



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ROYAL ARC



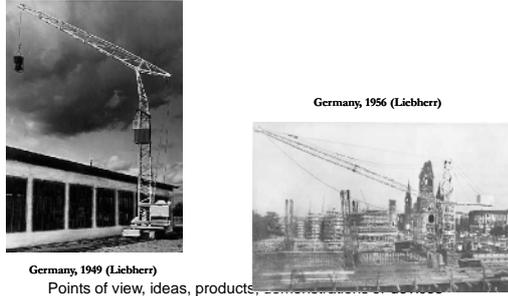
England, ~1910 (Morris & Bastero)

Germany, 1910 (Wolff)

Germany, 1913 (Wolff)

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ROYAL ARC



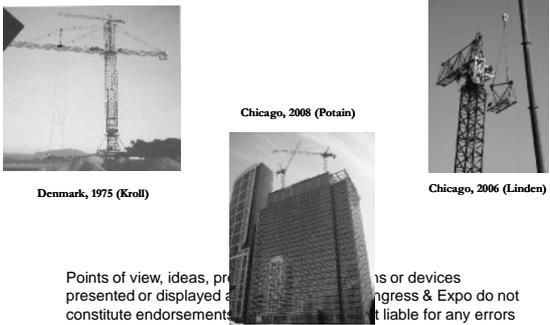
Germany, 1949 (Liebherr)

Germany, 1956 (Liebherr)

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Denmark, 1975 (Kroll)

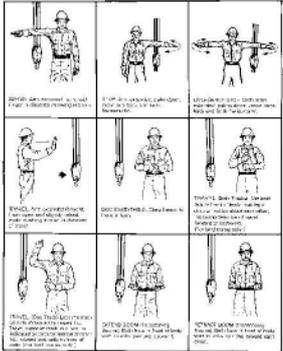
Chicago, 2008 (Potain)

Chicago, 2006 (Linden)

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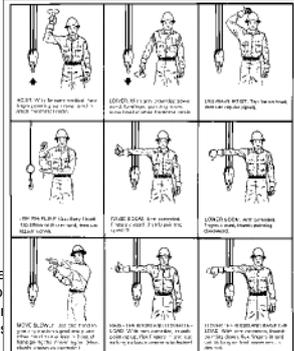
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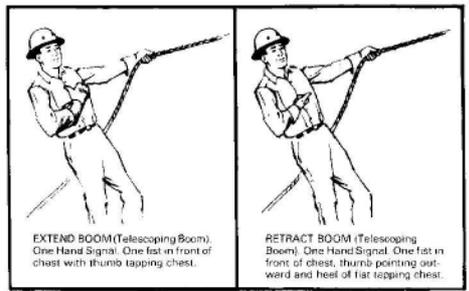
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ROYAL ARC



EXTEND BOOM (Telescoping Boom). One Hand Signal: One fist in front of chest with thumb tapping chest.

RETRACT BOOM (Telescoping Boom). One Hand Signal: One fist in front of chest, thumb pointing outward and heel of fist tapping chest.

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ROYAL ARC

ANSI A10.42-2000

5.2.1 Communication

Riggers shall be capable of understanding spoken and written English and should understand the language in use at the location.

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Title 8 CCR §5001.

(a) A signal person shall be provided when the point of operation is not in full and direct view of the operator unless a signaling or control device is provided for safe direction of the operator.

(b) Only qualified persons shall be permitted to give signals.

(c) A uniform signal system shall be used on all operations and if hand signals are used, they shall be clearly understood by the operator.

(d) Signal systems other than manual shall be protected against unauthorized use, breakage, weather or obstruction which will interfere with safe operation. In the event of any known malfunction, an alternate signal system shall be used or all motion shall be stopped.

(e) There shall be conspicuously posted in the vicinity of the hoisting operations, a legible chart depicting and explaining the system of signals used.

NOTE: Authority cited: Section 142.3, Labor Code. Reference: Section 142.3, Labor Code.

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ASME B30.5 2004

5-3.3.3 Signal Person Qualifications. Prior to signaling crane operations, all signal persons shall be tested by a designated person and demonstrate their qualifications in the following areas:

- (a) Basic understanding of crane operation and limitations.
- (b) Standard hand signals described in para. 5-3.3.4 whenever hand signals are used.
- (c) Standard voice signal procedures described in para. 5-3.3.5 whenever voice signals are used.

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ASME B30.5 2004

- (a) Telephones, radios, or equivalent, if used, shall be tested before lifting operations begin. If the system is battery powered, extra batteries should be available at the jobsite.
- (b) Prior to commencing a lift, the operator and signal person shall contact and identify each other.
- (c) All directions given to the crane operator by the signal person shall be given from the operator's direction perspective, e.g. swing right.
- (d) Each series of voice signals shall contain three elements stated in the following order:
 1. Function direction
 2. Distance and/or speed
 3. Function stop

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Verbal Crane Signals (Tower Cranes)

Hoist		Trolley		Swing	
Fast	Up Up	Fast	Trolley Out	Fast	Swing Right
	Up		Easy Trolley	Easy	Easy Swing
Stop	Up High	Stop	Trolley	Stop	Swing
Fast	Down Down	Fast	Trolley In	Fast	Swing Left
	Down		Easy Trolley	Easy	Easy Swing
Stop	Down High	Stop	Trolley	Stop	Swing
Travel (optional)		Hooking / Unhooking From A Load		Up To Choke	
Fast	Travel Forward			Down To Cut Loose	
Stop	Easy Travel				
	Travel				
Fast	Travel Backward				
Stop	Easy Travel				
	Travel				

Adjustments in Speed can be made with one word commands.
Faster or Slower

do not
y errors

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Verbal Crane Signals (Conventional Cranes)

Hoist		Boom		Swing	
Fast	Up	Fast	Boom Up	Fast	Swing Right
Up	Easy	Easy	Easy Boom	Easy	Easy Swing
Stop	High	Stop	Stop	Stop	Stop
Fast	Down	Fast	Boom Down	Fast	Swing Left
Down	Easy	Easy	Easy Boom	Easy	Easy Swing
Stop	High	Stop	Stop	Stop	Stop

Travel		Hooking / Unhooking From A Load	
Fast	Travel Forward	Up To Choke	
Easy	Easy Travel	Down To Cut Loose	
Stop	Travel		
Travel		Hooking / Unhooking From A Load	
Fast	Travel Backward	Up To Choke	
Easy	Easy Travel	Down To Cut Loose	
Stop	Travel		

Adjustments in Speed can be made with one word commands.
Faster or Slower

do not errors

ASME B30.5 2004

Note: Examples of Signals

- Swing right 50 feet, 25 feet, 15 feet, 10 feet, 5 feet, 2 feet, swing stop
- Load down 100 feet, 50 feet, 40 feet, 30 feet, ...2 feet, load stop
- Load up slow, slow, slow, load stop

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ANSI A10.42-2000

4.1 General Requirements

When an operation is determined to be critical, a competent person shall be appointed who has overall responsibility for the critical rigging operation.

Commentary: The employer or enforcing authority may require various levels of review due to the complexity of tasks. The Person in Charge (PIC), Competent Person, qualified rigger, and employer representative may be the same person.

4.2 Signaling

Only designated signalers shall give signals to an operator (see Appendix A). However, the operator shall obey an emergency STOP signal at all times, no matter who gives the signal.

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ANSI A10.42-2000

5.1 General

Personnel who are designated to operate rigging tools and equipment or perform work covered by this standard shall be qualified and trained to the level of proficiency consistent with assigned tasks. The employer or other entity responsible for supervising the lifting, hoisting, or movement of a load shall assess the knowledge, skills, and abilities of individuals designated as qualified riggers.

5.2.1 Communication

Riggers shall be capable of understanding spoken and written English and should understand the language in use at the location.

5.2.2 Calculation Skills

Have sufficient skills to calculate loads, load weights, safe capacities, and apply other safe rigging principles and procedures.

5.2.3 Skills

Demonstrate the ability to utilize rigging materials and principles.

5.2.4 General Requirements

A qualified rigger shall be capable of safely performing rigging operations.

5.3.1 General

Riggers shall be trained on the methods, methods, equipment, techniques, communication, and other items as is necessary for safe performance of their specific tasks.

5.3.1.1

Without limiting the generality of paragraph 5.3.1, tasks for which qualified riggers may be trained on include (but are not limited to): preparing a load for safe movement, assisting in movement or directing the movement of the load, safe utilization of various hoisting and load movement equipment, or selecting components used to assist cranes, hoists, or other equipment to achieve mechanical advantage for the purpose of moving loads. A rigger may also assist in the setup, erection, movement, placement, and dismantling of cranes and other equipment.

5.3.1.2

If previous training is limited or absent, a rigger for a task, the rigger shall not accept the task and management, (the Person in Charge or Competent Person) shall not assign the task until the rigger is suitably trained.

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ANSI A10.42-2000

5.3.1.4

New or different equipment, methods, situations, techniques, procedures, standards, materials, and unique loads may require special or specified training during planning stages prior to rigging or moving the loads.

5.3.2

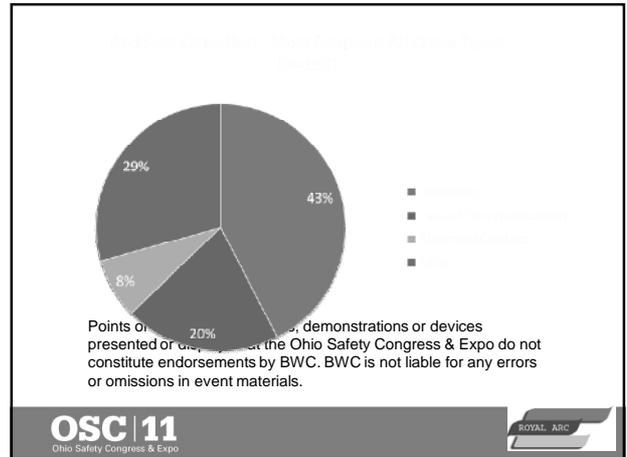
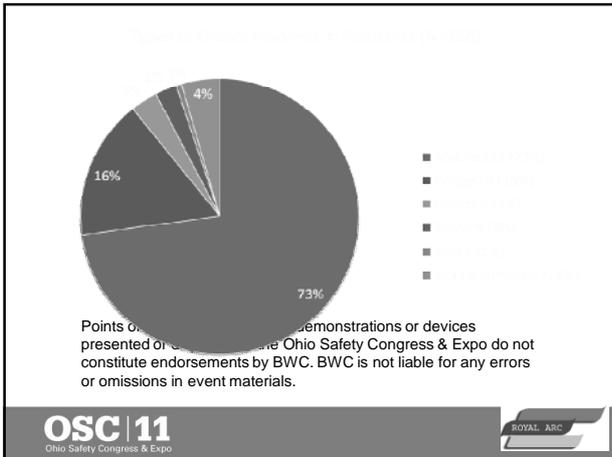
Qualified Riggers shall have completed training in the safe application, use, and limitations of the following, if applicable to the person's specific tasks:

- Anchor Points and deadends
- Synthetic ropes for rigging
- Wire rope
- Chains
- Reeving
- Scallops
- Spreader bars and equalizing beams
- Synthetic slings
- Lifting points
- Davits
- Toggles
- Toggles and winches (manual and power)
- Bars and levers
- Come-alongs
- Fiber rope for rigging jacks, jacking systems, and rams
- Formulas and attachments
- Wire rope slings
- Rigging telescopes
- Hooks and similar attachment devices
- Shackles
- Eye bolts
- Tumbuckles

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B. Instability, Lack of Communication and Other Causal Factors

- 1. Instability**
Instability accidents for mobile cranes generally resulted in either the crane tipping over, or the load falling off the hook or slings. Instability accidents were further broken down into separate categories.
- 2. Lack of Communication**
Lack of communication was another major cause of accidents because the point of operation is usually some distance from the crane's operator station or not in full and direct view of the operator in operations involving mobile cranes. Seventy-five percent of accidents caused by both "lack of communication" and "electrical contact" involved mobile cranes.
- 3. Lack of Training**
Although "Lack of Training" did not rank very high as a primary cause, it would have been ranked within the top three if a secondary cause were listed.

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