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# Introduction

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Mobile cranes are usually one of the most important, productive, and expensive pieces of equipment used on deep foundation installation projects.

Crane operations typically bear the greatest potential for disaster, perhaps more than any other activity on a construction project.

# Introduction

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Please note that this presentation is one of many possible interpretations of the new OSHA crane standards. In addition, it only addresses changes made to the federal OSHA standards and may not address any individual state OSHA plan requirements, which may differ. Please consult your state and local requirements as well as the federal requirements before you make changes to your business operations.

# Overview

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Crane accidents are often the most costly of construction accidents when measured either in dollars or worse...

*... LIVES !*



This is a primary reason why OSHA has set into place a new set of safety standards regarding the use of cranes in the United States.

# Crane-Related Deaths in Construction

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From 1992-2006

- 632 crane-related construction worker deaths, from 611 crane incidents
- 17 multiple deaths incidents resulting in 38 deaths

*Source: U.S. Bureau of Labor Statistics Census of Fatal Occupational Injuries Researched by the CPWR (The Center for Construction Research and Training)*

# Crane-Related Deaths in Construction

1992-2006

Cause of Death	Number of Deaths	Percentage
Overhead power line electrocutions	157	25%
Struck by crane loads	132	21%
Struck by crane or crane parts	125	20%
Crane collapses	89	14%
Falls	56	9%
Caught in/between	30	5%
Other causes	43	7%
Total	632	100% (rounded)

# History Of Crane Standards In The US

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- 1916 – ASME Code of Safety Standards for Cranes  
(American Society of Mechanical Engineers)
- Between WW I & WWII - US Army & Navy created Military Crane Safety Standards
- 1943 – ANSI B 30.2 Safety Codes for Cranes, Derricks, and Hoists  
(American National Standards Institute)
- 1968 - PCSA Standard #2 Mobile Power Crane and Excavator & Hydraulic Crane Standards (Power Crane and Shovel Association)
- 1968 - ANSI B30.5, Safety Code for Crawler, Locomotive and Truck Cranes

# History Of Crane Standards In The US

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“Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that this Act may be cited as the Occupational Safety and Health Act of 1970.” Public Law 91-596 - December 29, 1970

This Act shall take effect one hundred and twenty days after the date of its enactment.(April 28, 1971)

# History Of Crane Standards In The US

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OSHA's federal crane and derrick standard for construction has been virtually unchanged since 1971.

In late 1998 the 15 member Advisory Committee on Construction Safety & Health (ACCSH) formed a “Crane Work Group”.

In late 2000, the Crane Work Group recommends to ACCSH for OSHA to form a Negotiated Rulemaking Committee.

In a July 2002 notice of intent to create a negotiated rulemaking committee, OSHA acknowledged that industry consensus standards had been updated and crane technology had changed considerably over three decades.

# History Of Crane Standards In The US

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On June 12, 2003, OSHA announced its decision to establish a Crane and Derrick Negotiated Rulemaking Advisory Committee (C-DAC) under the Negotiated Rulemaking Act (NRA), the Occupational Safety and Health Act (OSH Act) and the Federal Advisory Committee Act (FACA).

The Committee would be composed of no more than 25 members including OSHA representatives and a facilitator with an appropriate balance of interests for negotiated rulemaking. Between July 30, 2003 – July 9, 2004, OSHA held eleven C-DAC meetings.

At 3:15 p.m. EDT on July 9th 2004, C-DAC reached final consensus on all issues.

# ADSC Participation in Rulemaking

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1998 – 2000

Member of the “Crane Work Group”

2003-2004

Provided testimony to C-DAC to prevent Drill Rigs from inclusion in the definition of a crane, ground conditions, allow boatswain’s chair usage, and power unit mounting on rear of crane.

2009

Provided testimony to OSHA at Public Hearings, endorsing the new proposed rule, as written, including mandatory drug testing similar to DOT testing.

# Why Is A New Standard Needed?

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- OSHA 1910.180 and 1926.550 are 39 years old
- There have been only minor revisions since original publication
- There were some oversights in the original
- There have been many technological advances for crane equipment in the last four decades
- The new standard gets away from SHOULD and includes more SHALL statements
- Focusing on competent persons and giving more defined descriptions of personnel's responsibilities
- Use of multiple ANSI/ASME standards and creating their own (some are more stringent)

# Where Is The Proposed Rule?

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[http://www.osha.gov/doc/proposedrule/Cranes\\_Derricks\\_Proposed\\_Rule.html](http://www.osha.gov/doc/proposedrule/Cranes_Derricks_Proposed_Rule.html)

This is the 1100+ page document describing OSHA's rationale for each section of the proposed rule. The actual standard is the last 100+ pages.

# Comparison Of Standards

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- OSHA 1910.180 – 17 pages
- OSHA 1926.550 – 15 pages
- ASME B30.5 – 46 pages
- New Subpart N – 119+ pages



# Comparison Of Standards

## Operator Qualifications

1910.180 – nothing

1926.550 – nothing

1926.1400 – 8 pages



# Comparison Of Standards

## Floating Cranes

1910.180 – nothing

1926.550 – 1 page

1926.1400 – 9 pages



# Comparison Of Standards

## Crane Signaling

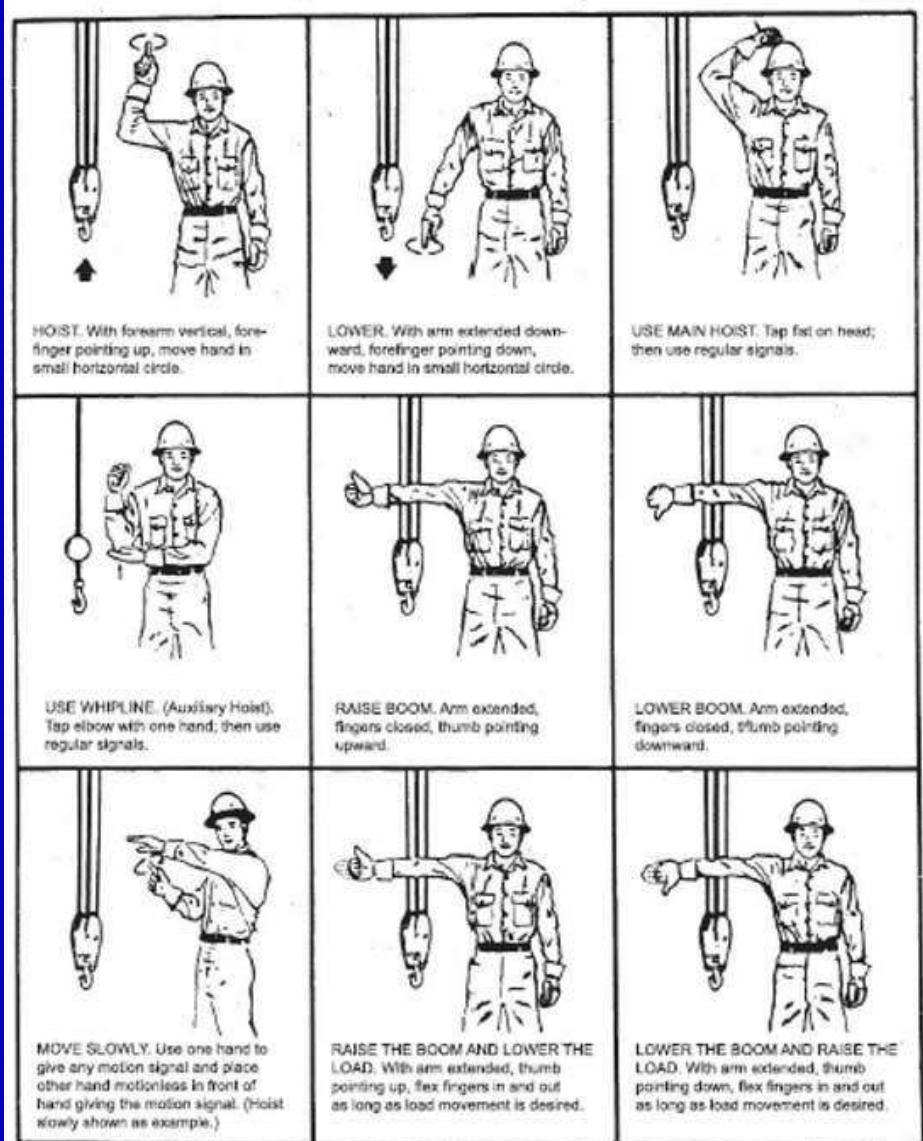
1910.180 – nothing

1926.550 – nothing

1926.1400 – 3 pages

Use of standard signals is mandatory... (special conditions apply)

Signalers must be qualified



# Comparison Of Standards

## Wire Rope

1910.180 – nothing

1926.550 – nothing

1926.1400 – 3 pages



# Comparison Of Standards

## Ground Conditions

1910.180 – nothing

1926.550 – nothing

1926.1400 – 1 page



# Comparison Of Standards

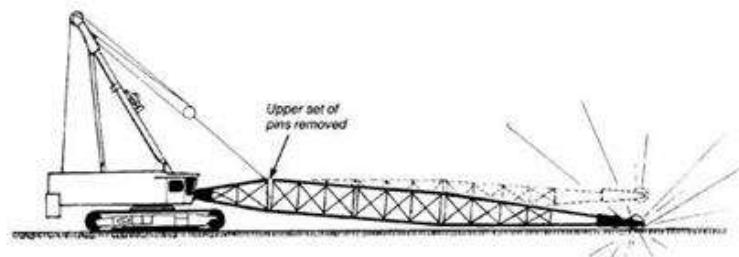
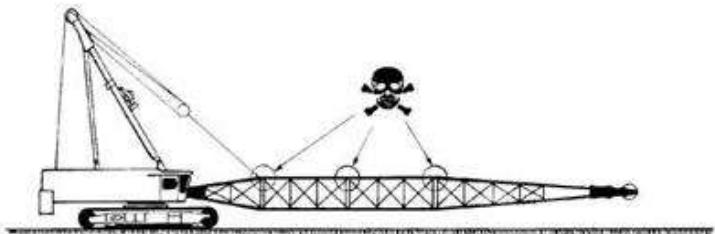
## Assembly & Disassembly

1910.180 – nothing

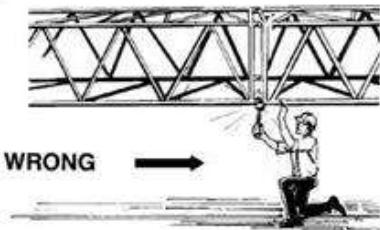
1926.550 – nothing

1926.1400 – 6 pages

- Until the boom is solidly supported on its blocking never touch the top pins ahead of the pendants. The boom will drop.



Caution: Never walk, work, lean or place any part of your body under the boom when it is being assembled, dismantled, shortened or lengthened. If necessary, use a long bar to knock the far side pins out.



# Comparison Of Standards

## Power Lines

1910.180 – nothing

1926.550 –  $\frac{1}{4}$  page

1926.1400 – 11 pages



# Comparison Of Standards

## Inspections

1910.180 – 4 pages

1926.550 – nothing

1926.1400 – 11 pages



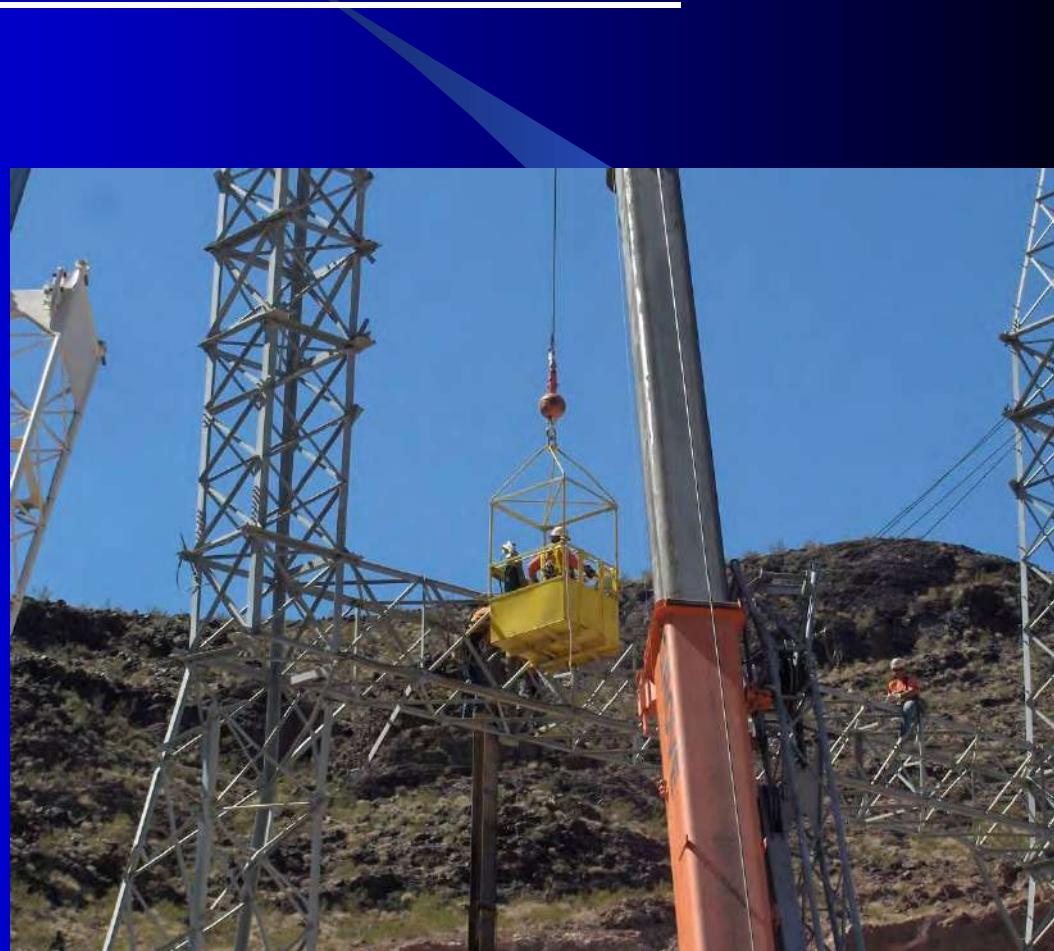
# Comparison Of Standards

## Personnel Platforms & Boatswain's Chair

1910.180 – nothing

1926.550 – 8 pages

1926.1400 – 12 pages



# What's New?

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- Inspection Criteria
- Fall Protection
- Signal Person Qualification
- Power Line Safety
- Ground Conditions
- Authority To Stop Operations
- Operational Aids
- Operator Certifications

# What Cranes Are Included?

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## Types Of Cranes We Use:

- Crawler Mount Lattice Boom
- Carrier Mount Lattice Boom
- Crawler Mount Telescopic Boom
- Carrier Mount Telescopic Boom
- Rough Terrain Telescopic Boom

# Lattice Boom Crawler

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# Carrier Mount Lattice Boom

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# Crawler Mount Telescopic Boom

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# Carrier Mount Telescopic Boom

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# Rough Terrain Telescopic Boom

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# Other Types Of Cranes



Pedestal Mount and Conventional Tower Cranes

# Other Types Of Cranes

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Cranes On Rails



# Other Types Of Cranes

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Carry-deck Cranes



Locomotive Cranes



# Other Types Of Cranes

## Cranes On Barges



Floating Cranes

# Other Types Of Cranes

## Derricks



# Other Types Of Cranes

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Pedestal Crane



Side Boom Tractor

# Is This A Crane?

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YES!

The new standard defines this type of dedicated or self-contained hydraulic pile driver as a crane.

This is primarily because of its limited lifting capabilities, which are regulated by their *load charts*.

# Is This A Crane?

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YES!

This *is* a Crane with a  
drill attachment  
suspended from, and  
attached to, the crane.

# What Is Not Defined As A Crane

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- Forklifts
- Track Loaders
- Excavators (Track Hoe/Backhoe)
- Concrete Pump Trucks w/boom
- Power Shovels
- Digger Derricks
- Tow Trucks
- Vehicle Mounted Work Platforms
- Self-propelled Elevating Work Platforms
- Stacker Cranes
- Mechanic's Trucks With Hoisting Devices
- Come-A-Longs and Chain Falls
- Gin Poles For Communication Tower Work
- Tree Trimming and tree removal work
- Anchor handling with a vessel or barge using an affixed A-frame
- Roustabouts

# Is This A Crane?



NO!

This is a dedicated or self-contained drill rig or in OSHA speak – “Dedicated Drilling Rig” used for the installation of drilled shafts, drilled piers or caissons.

While it may have some very limited lifting capacities, it is NOT a crane.

*See exclusion #11 under section 1400 - Scope*

# What Do We Do With Our Cranes?

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- Load and Unload Materials & Equipment
- Drive & Extract Piling
- Drill CFA Piling
- Drill Shafts (Caissons)
- Set & Extract Casing
- Set Reinforcing Cages
- Pour Concrete (Bucket or Tremie Pipe)
- Others???

# Cranes Used to Drill Shafts & Piles

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# Cranes Used To Drive Casing & Piling



# Cranes Used to Set Rebar Cages

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# New Definitions for Employees

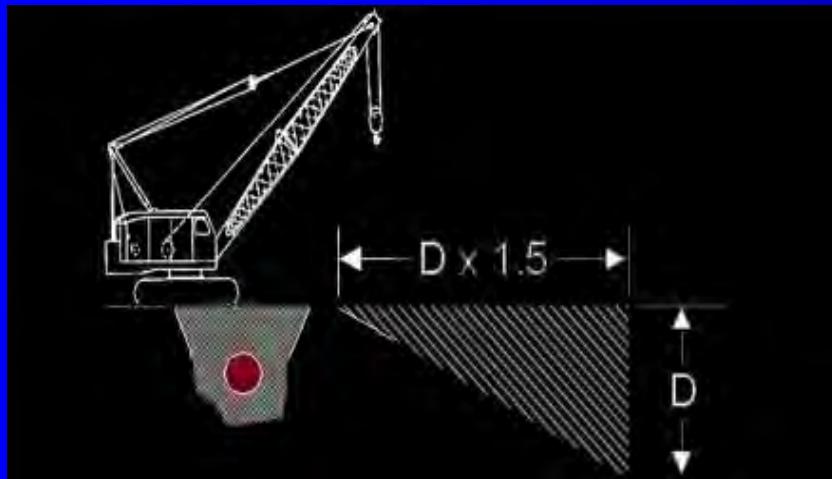
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- A/D Supervisor
- Appointed Person
- Competent Person
- Dedicated Spotter
- Operator
- Qualified Evaluator
- Qualified Person
- Qualified Rigger



# Ground Conditions (Before)

Most often, the deep foundation contractor is one of the first to arrive to a jobsite. Typically, the site needs some “improvement”.



If underground utilities, vaults, poor soil conditions are not identified before we get onsite, or dealt with once we arrive, bad things can happen to cranes.

# Ground Conditions (Now)

The controlling entity shall:

Ensure that ground preparations necessary to meet the requirements in paragraph (b) of this section are provided.



(b) The equipment shall not be assembled or used unless ground conditions are firm, drained (except for marshes / wetlands), and graded to a sufficient extent so that, in conjunction (if necessary) with the use of supporting materials, the equipment manufacturer's specifications for adequate support and degree of level of the equipment are met.

Locate all hazards that are identified in all available documents and inform the crane user of them.

# Ground Conditions (Now)

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## Controlling Entity:

A prime contractor, general contractor, construction manager or any other legal entity which has the overall responsibility for the construction of the project - its planning, quality and completion.

# Crane Assembly / Disassembly

- Lengthy Procedures For Crane Assembly/Disassembly
- Requirements For Supervision Knowledge and Authority
- Crew Training And Instructions
- No Person Under The Boom During Pin Removal
- Proper Outrigger Blocking Is Mandatory



# Crane Assembly / Disassembly



No part of crane, line or load may be able to reach within 20 feet of a power line during setup.

Exceptions: de-energized and grounded power lines – or - use of a dedicated spotter – or - proximity alarms.

Assembly/disassembly below power lines is prohibited, unless line is de-energized and grounded.

# Power Lines In Crane Operations

- You must identify work zone and either mark boundaries, use range limiting devices or range control warnings
- You must determine if any part of crane, line or load could get within:
  - 20 feet of a power line 350kV or less
  - 50 foot for all lines over 350kV
- If yes, you must either:
  - De-energize and ground
  - Maintain 20 or 50 foot clearance
  - Use Table A and conduct a planning meeting with crew



# Power Line Minimum Clearances

Table A

<b>Voltage (kV)</b>	<b>Minimum Clearance Distance (feet)</b>
Up to 50	10
50 to 200	15
200 to 350	20
350 to 500	25
500 to 750	35
750 to 1000	45
Over 1000	As established by the line owner

# Power Lines In Crane Operations

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Some special requirements for working below power lines include training of operators and crew on:

- Procedures to follow after power line contact
- Danger of a potential energized zone
- Operator's emergency procedures
- Safest means to evacuate equipment
- Need for crew to avoid approach
- Safe clearance from power lines



# Power Lines In Crane Operations

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- All power lines are presumed to be **energized** unless confirmed to be de-energized by the utility owner/operator **AND** visibly grounded at the worksite.
- All power lines presumed to be un-insulated.
- Shall understand limitations of insulating links, proximity alarms and range control devices, if used.
- Dedicated spotters shall be trained.
- There must be at least one electrocution hazard warning sticker conspicuously placed in the cab of the crane.

# Crane Inspections

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- After Modification
- After Repair Or Adjustment
- Post Assembly
- Each Shift
- Monthly
- Annual Comprehensive



# Crane Inspections

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- Monthly Inspections
  - Documented
  - Kept on file for three months
- Annual Inspection
  - Documented
  - Detail inspection criteria
  - Functional testing
  - Kept on file for 12 months or next annual inspection

# Crane Inspections

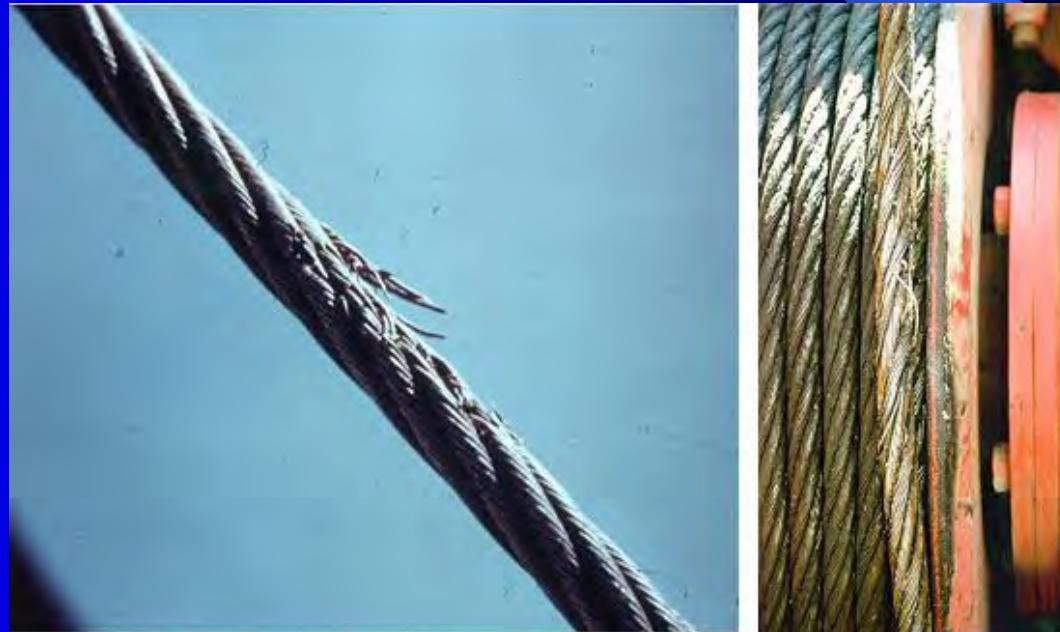
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- Severe Service
  - Shock load, corrosive atmosphere, etc.
  - Inspect exposed items/conditions
  - Document
- Not In Regular Use
  - Idle more than three months
  - Monthly inspection must be performed
  - Document

# Wire Rope Inspection

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- Shift Inspection
- Monthly Inspection
- Annual Inspection



# Safety Devices

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## Mandatory Equipment

- Crane level indicator
- Boom stops (except hydraulic booms)
- Jib stops
- Locks for foot pedal brakes
- Integral check valves for hydraulic outriggers
- Rail clamps and stops for equipment on rails

# Operational Aids

Required equipment – must be in service except where specified temporary alternative measures are met:

- Boom hoist limiting device
- Luffing jib limiting device
- Anti two-block device (cranes manufactured after 2/28/92) *Exception: lattice booms used for dragline, clam shell, scrap magnet, drop ball, marine operations and pile driving work*

# Operational Aids

- Boom angle or radius indicator
- Jib angle indicator (luffing jibs)
- Boom length indicator (telescopic booms)
- Load weighing devices (load moment indicators, rated capacity indicators or rated capacity limiters – cranes manufactured after 3/29/03)
- Outrigger position indicators (cranes manufactured after 1/1/08)
- Hoist drum rotation indicator (if drum is not visible to operator)

# Fall Protection

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Fall protection above six feet, with exceptions:

- While at a work station or going to and from a work station
- When walking point to point along a horizontal lattice boom that has been lowered to the ground and supported



# Fall Protection

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Fall protection is required above 6 feet during non-assembly/ disassembly work, w/exceptions:

- Employee is at or near the draw-works (when the equipment is running)
- In the cab
- On the deck

# Fall Protection

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Fall protection must be used when working over 15 feet during the assembly/disassembly process, except when the employee is:

- At or near the draw-works
- In the cab, or
- On the deck

# Fall Protection

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Anchorages may be any substantial part of the boom or to any substantial piece on the equipment (using correct fall protection equipment).

A fall arrest system is permitted to be anchored to the crane/derrick's hook or other part of the load line where the following requirements are met:

- A qualified person has determined the set-up and rated capacity meets or exceeds the anchorage requirements
- The operator is aware it is being used for this purpose

# Operator Certification / Qualification

- No physical examinations or mandatory drug testing requirements
- Re-certification / qualification must be completed every five years
- Four acceptable methods of certifying employees

# Operator Certification / Qualification

Option (1) – certification by an accredited crane operator testing organization

- Accredited by a nationally recognized accrediting agency
- Certification is portable
- Valid for five years
- Program must be reviewed by a nationally recognized accrediting agency every three years

# Operator Certification / Qualification

## Option (2) – qualification by an audited employer program

- Developed or approved by an auditor certified by an accredited crane operator testing organization
- Auditor is not an employee of the employer
- Tests should be administered per nationally recognized test administration standards
- Program shall be audited within the first three months, then once every three years
- Qualification is not portable and valid for five years

# Operator Certification / Qualification

## Option (3) – qualification by the US military

- Qualification is not portable
- Valid for the period of time stipulated by the issuing entity

# Operator Certification / Qualification

## Option (4) – licensing by a government entity

- Must meet or exceed requirements of this subpart
- Valid only within the jurisdiction of the government entity
- Valid for time specified by the government entity, but no longer than five years

# Operator Certification / Qualification

## Certification / Qualification Criteria:

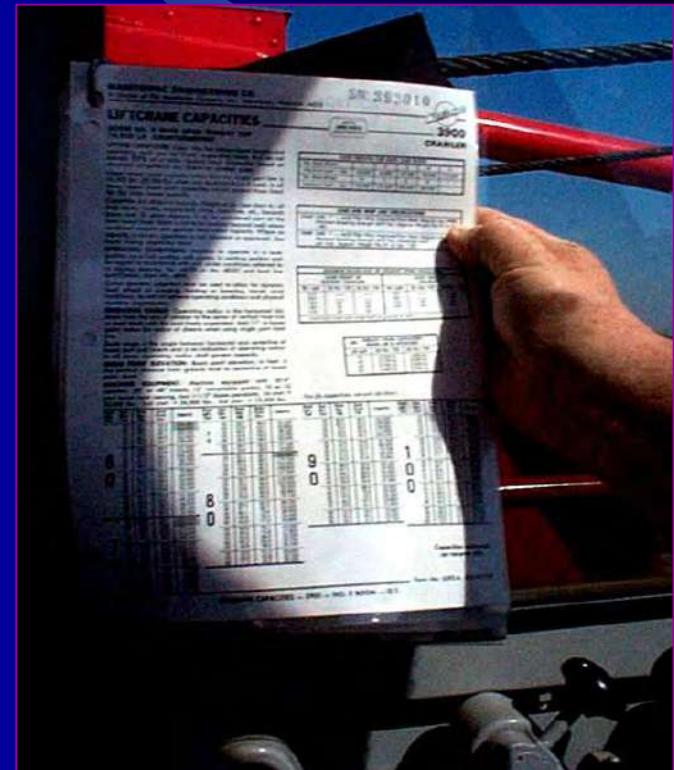
### Written Testing on:

- Controls and operational performance
- Ability to calculate the load/capacity
- Procedures for power line contact
- Site preparation
- Ability to read manuals/charts relevant to the equipment being operated

# Operator Certification / Qualification

## Certification / Qualification Criteria:

- Pass practical examination
- Ability to perform a pre-shift inspection
- Operational and maneuvering skills
- Application of load chart information
- Application of safe shut down and securing procedures



# Operator Certification / Qualification

- Employer must revoke operators certification if they have reason to believe the employee is not qualified to operate.
- All programs shall have provisions for retraining employees.
- The current training records must be on file during the operator's employment.



# Operator Certification / Qualification

Many States, and/or Cities now require operators of essentially all cranes to provide proof of license in addition to certification upon request by an investigator.

An employer may be cited by the governing entity for a violation of the requirements, as well as the revoking of the license from the operator.

# Operator Training

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## Examples Of Training Topics:

- Identification Of Crane Types
- Crane Definitions: Rated Strength, Ultimate Strength, Etc.
- Component Identification
- Crane Application
- Operating Procedures
- Quadrants Of Operation & Their Adverse Effects: "Over Side", "Over Rear" Or "360°"
- Preparing For A Lift
- Describe How To Pre-plan A Crane Lift
- ANSI Signal Chart
- The Principles Of Leverage And Stability
- The Concepts Of Structural Competence Or Strength Of Materials
- Understanding Load Charts
- Wire Rope - Construction, Types, Inspection
- How To Change Boom Sections (Lattice Boom Cranes)
- Pick And Carry Operations
- Perform Crane Inspections
- Be Able To Answer Questions Pertaining To The Crane Or Its Attachments
- Know What Required Maintenance Must Be Performed

# Operator Certification / Qualification

There will be a four year phase-in process for the employer to get their operators to obtain certification.

New operator training will be allowed under the continuous supervision of a certified operator with some minor exceptions.

# Authority to Stop Operations

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Whenever there is a concern for safety, the crane operator shall have the authority to stop and refuse to handle loads until a qualified person has determined that safety has been assured.

# Signal-Person Qualification

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## Training Requirements

- Know and understand signals to be used, as well as all forms of signals (i.e., voice, hand, radio, etc.)
- Be competent in the application of the type of signals to be used
- Have basic understanding of crane operation and limitations, including the crane dynamics involved in swinging and stopping loads and boom deflection from hoisting loads
- Must be able to effectively communicate to crane operator (i.e., English-English, Spanish-Spanish, etc.)

*A qualified evaluator must conduct the training*

# Wire Rope Inspection

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- Competent person to conduct visual inspections before each shift, monthly and annually
- Categorize deficiencies in:
  - Category I
  - Category II
  - Category III



# Wire Rope Inspection

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**Shift Inspection** – Before each shift

**Monthly Inspection** – All wire ropes, including running ropes (Documented)

**Annual Inspection** – At least every 12 months, unless not feasible due to set-up. More detailed, including wire rope that is normally hidden during daily/monthly inspections, etc. (Documented)

# Wire Rope – Category I

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- (A) Significant distortion of the wire rope structure such as kinking, crushing, un-stranding, bird caging, signs of core failure, or steel core protrusion between the outer strands.
- (B) Significant corrosion.
- (C) Electric arc (from a source other than power lines) or heat damage.
- (D) Improperly applied end connections.
- (E) Significantly corroded, cracked, bent, or worn end connections (such as from severe service).

# Wire Rope – Category I

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If a Category-1 deficiency is identified, an immediate determination shall be made by the qualified person as to:

- Replacement of the wire rope, or
- If the deficiency is localized, the wire rope may be severed at the bad spot and may be continued to be used.

# Wire Rope – Category II

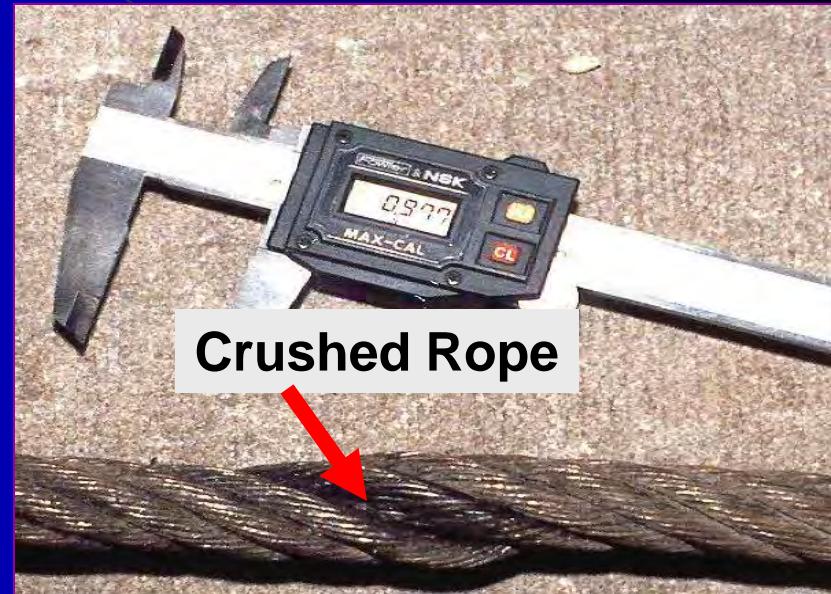
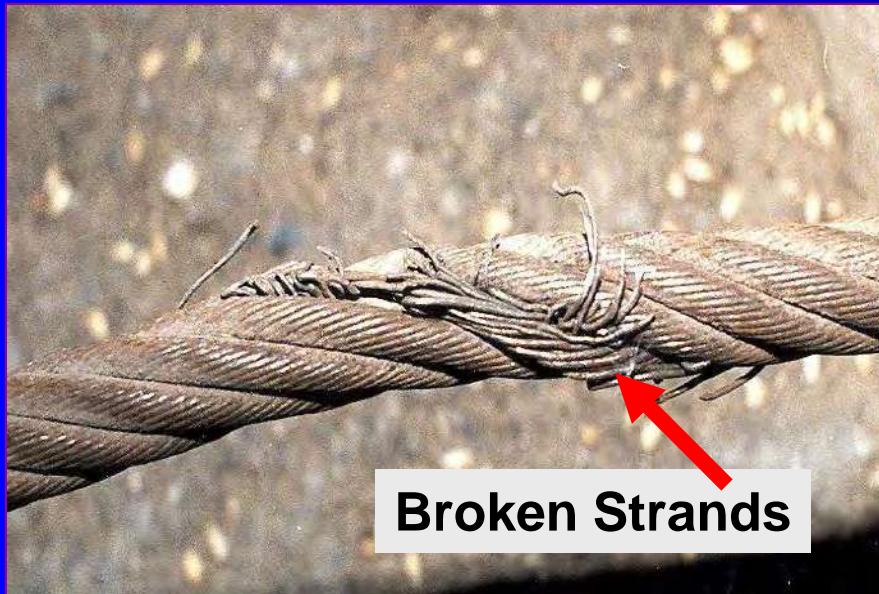
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Deficiencies in this category are:

Visible broken wires, as follows:

1. In running wire ropes: six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay.
2. In rotation resistant ropes: two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in 30 rope diameters.

# Wire Rope Inspection

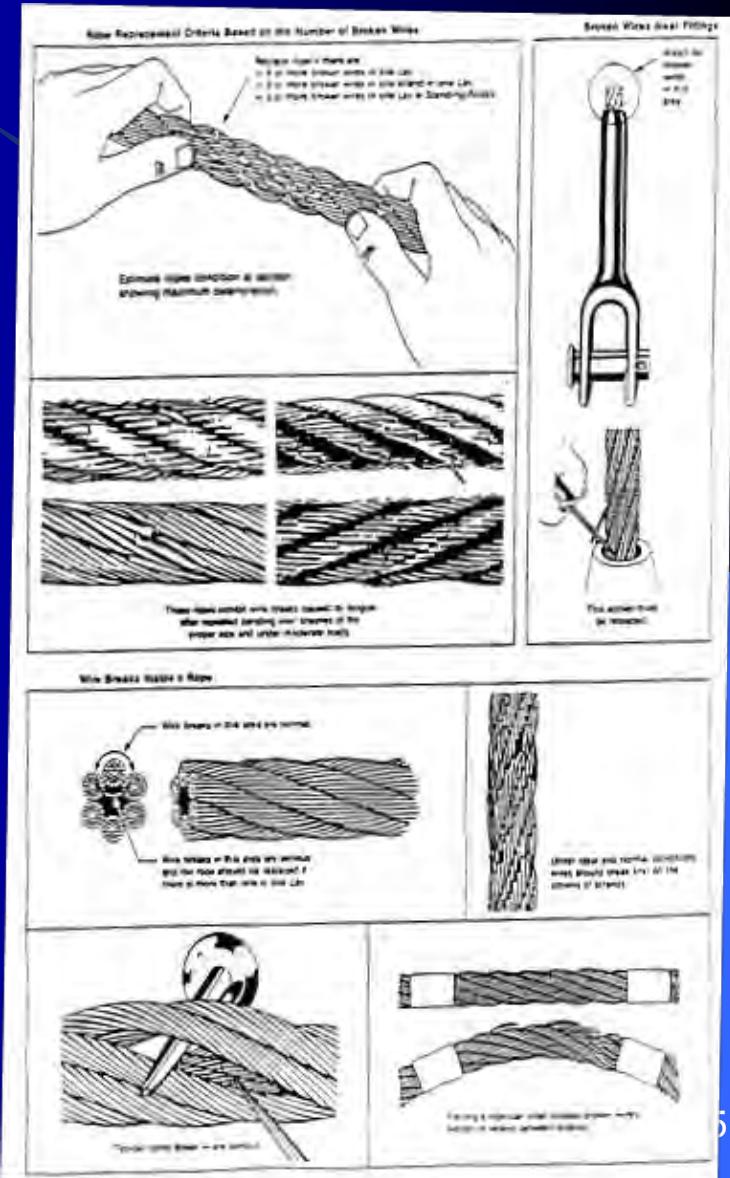


**Damaged wire rope must be taken out of service**

# Wire Rope – Category II

(3) In pendants or standing wire rope:

More than two broken wires in one rope lay located in rope beyond end connections and / or one or more broken wire in a rope lay located at an end connection.



# Wire Rope – Category II

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If a category II deficiency is identified an immediate determination shall be made by the qualified person as to:

Based on manufacturer recommendations, either remove or monitor the wire rope for continued deterioration

# Wire Rope – Category II

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- The qualified person determines when to replace the wire rope (no more than 30 days after the deficiency is identified).
- A qualified person assesses the deficiency in light of the load and other conditions of use and determines it is safe for continued use.
- A qualified person establishes the parameters of use.
- All workers who conduct shift inspections are notified.
- The qualified person's findings and procedures are documented.

# Wire Rope – Category III

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Category III deficiencies are:

- Electrical contact to power line
- Core protrusion or other distortion indicating core failure in rotation resistant wire rope
- Broken strand

# Wire Rope – Category III

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If a category III deficiency is identified, operations involving use of the wire rope shall be prohibited until:

Wire rope is replaced (ALWAYS with power line contact).

Deficiency is localized and problem corrected.

# Multiple Crane Lifts

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A multiple-crane lift must be planned with the following requirements:

- Plan must be developed by a competent, qualified person
- Plan must be designed to ensure that the requirements of the Subpart are met
- Lift must be supervised by a competent and qualified person



# Mobile Cranes On Water

- Lifting a load that is already on the barge can cause the barge to list when the crane swings or changes the boom angle, changing the equilibrium between the weight of the crane and the weight of the load.
- The listing of the barge will also cause the suspended load to swing (increase the radius). The crane operator must expect and compensate for this swinging motion.
- Mobile cranes on barges must use the “on water” load charts and “shall be positively secured”



# Working On The Water

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## Floating Cranes/Derricks & Land Cranes/Derricks on Barges – Additional Requirements:

- Inspections
- Working with a diver
- Design requirements of the barge, pontoon, vessel or other means of flotation
- Defines maximum list and trim

# Hoisting Personnel

(1) When using equipment to hoist employees, the employees shall be in a platform that meets the requirements of paragraph (e).

**Exceptions:** *A personnel platform is not required for hoisting employees:*

- Into and out of drill shafts that are up to and including 8 feet in diameter (*see paragraph (0) for requirements for hoisting these workers*).
- In pile driving operations (*see paragraph (p) for requirements for hoisting these workers*).
- Solely for the transfer to or from a marine worksite in a marine hoisted personnel transfer device.

# Hoisting Personnel

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## For Drilled Shaft Entry:

- A signal person shall be stationed at the shaft opening.
- The employee shall be hoisted in a slow, controlled decent and ascent.
- The employee shall use personal fall protection equipment, including a full body harness, attached independent of the crane/derrick.
- The fall protection equipment shall meet the applicable requirements in 1926.502.
- The boatswain's chair itself (excluding the personal fall arrest system anchorages), shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load.

# Mandatory Training

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- Overhead power lines
- Signal persons
- Competent/qualified persons
- Operators
- Crush/pinch points
- Tag-out



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