

Cranes and Derricks Safety II



This course is the second in a series of two courses. It is intended to help businesses comply with OSHA's standard 29 CFR 1926 Subpart CC, Cranes & Derricks in Construction. It is designed to address the most common compliance issues that employers will face and to determine all of the steps that must be taken to comply with the standard.

This page intentionally blank

OSHAcademy Course 821 Study Guide

Crane and Derrick Safety II

Copyright © 2017 Geigle Safety Group, Inc.

No portion of this text may be reprinted for other than personal use. Any commercial use of this document is strictly forbidden.

Contact OSHAcademy to arrange for use as a training document.

This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 821.

Read each module, answer the quiz questions, and submit the quiz questions online through the course webpage. You can print the post-quiz response screen which will contain the correct answers to the questions.

The final exam will consist of questions developed from the course content and module quizzes.

We hope you enjoy the course and if you have any questions, feel free to email or call.

OSHAcademy

15220 NW Greenbrier Parkway, Suite 230

Beaverton, Oregon 97006

www.oshatrain.org

instructor@oshatrain.org

+1 (888) 668-9079

Disclaimer

This document does not constitute legal advice. Consult with your own company counsel for advice on compliance with all applicable state and federal regulations. Neither Geigle Safety Group, Inc., nor any of its employees, subcontractors, consultants, committees, or other assignees make any warranty or representation, either express or implied, with respect to the accuracy, completeness, or usefulness of the information contained herein, or assume any liability or responsibility for any use, or the results of such use, of any information or process disclosed in this publication. GEIGLE SAFETY GROUP, INC., DISCLAIMS ALL OTHER WARRANTIES EXPRESS OR IMPLIED INCLUDING, WITHOUT LIMITATION, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Taking actions suggested in this document does not guarantee that an employer, employee, operator or contractor will be in compliance with applicable regulations. Ultimately every company is responsible for determining the applicability of the information in this document to its own operations. Each employer's safety management system will be different. Mapping safety and environmental management policies, procedures, or operations using this document does not guarantee compliance regulatory requirements.

Revised: March 21, 2018

This page intentionally blank

Contents

Course Introduction	1
Standard Compliance	1
Who should take this course?	1
How do I use this course?	1
Module 1: Operation	2
Compliance with Rated Capacity	2
Other Manufacturer Procedures	3
Operator Attention	3
Operator Responsibility While the Load is Suspended	3
Tagging Out-of-Service Equipment and Functions	4
Precautions During Startup	4
Bad Weather Precautions	4
Sideload Prohibited	4
Brake Test	4
Protection Against Rope Detachment	5
Traveling with a Load	5
Authority to Stop Operation	5
Module 1 Quiz	6
Module 2: Signals and Fall Protection	8
Signals	8
When a Signal Person is Needed	8
Types of Signals	8
Hand Signals	9

Hand Signals Chart	10
Voice Signals	12
Audible Signals	12
New Signals	13
Fall Protection	13
Real Life Accident.....	14
Boom Walkways.....	14
Steps, Handholds, Ladders, Grabrails, Guardrails, and Railings	15
Anchorage	15
Module 2 Quiz.....	16
Module 3: Staying Clear of Hazards.....	18
Work Area Control	18
Keeping Clear of the Load	18
Safe Hoisting Routes	18
Stationary Suspended Load	19
Hooking, Unhooking, or Guiding the Load.....	19
Receiving a Load.....	19
Tilt-up or Tilt-down Operation.....	19
Free Fall Generally Prohibited	20
Free Fall Specifically Prohibited	20
Backup Protection	21
Preventing Uncontrolled Retraction	21
Free Fall of the Load Line is Prohibited.....	21
Module 3 Quiz.....	23

Module 4: Qualification and Certification	25
Getting Certified or Qualified	25
Certification Validity	26
Limitations.....	26
Leading Cranes and Operator	27
Hiring Crane Operators	27
Certification Exams	27
Hands-on Training for the Operator	28
Signal Person Qualifications.....	30
Qualifications of Maintenance & Repair Employees	31
Training	31
Training Requirements Specified Elsewhere	32
Additional Training Requirements.....	32
Training Administration	32
Module 4 Quiz.....	33
Module 5: Hoisting Personnel.....	35
Hoisting Personnel is Generally Prohibited	35
Use of Personnel Platform	35
Personnel Platform Criteria	35
Hoisting Equipment	37
Trial Lift and Inspection.....	38
Proof Testing	39
Work Practices	39
Pre-Lift Meeting	41

Hoisting Personnel near Power Lines	41
Module 5 Quiz	42
Module 6: Multiple Crane/Derrick Operations	44
Multiple Crane/Derrick Lifts.....	44
Design, Construction and Testing	44
Rated Capacity and Related Information Requirements	45
Miscellaneous Requirements.....	46
Equipment Modifications	46
Manufacturer Review and Approval.....	47
Manufacturer Review Unavailable	47
Module 6 Quiz	48
Module 7: Tower Cranes and Derricks.....	50
Tower Cranes	50
Additional Requirements for Erecting, Climbing, and Dismantling	50
Particular Caution Required When Using Synthetic Slings	51
Safety Devices	52
Operational Aids	53
Inspections	54
Derricks	54
Operator Qualifications	54
Load Charts	54
Construction.....	55
Swingers and Hoists	55
Operational Aids	56

Post-Assembly Approval and Testing.....	56
Load Testing Repaired or Modified Derricks	58
Power Failure Procedures	58
Jumping	58
Module 7 Quiz	59
Module 8: Specialized Cranes and Equipment	61
Floating Cranes/Derricks and Land Cranes/Derricks on Barges	61
Inspections	61
Safety Devices	61
Working with a Diver	62
Land Cranes/Derricks on Floatation Devices	62
Equipment Designed for Use on Floatation Devices	62
Overhead & Gantry Cranes	62
Dedicated Pile Drivers.....	63
Sideboom Cranes	63
Equipment with a Rated Hoisting/Lifting Capacity of 2,000 Pounds or Less	64
Module 8 Quiz	65
Glossary.....	67
Endnotes	77

This page intentionally blank

Course Introduction

Welcome to course 821, Crane and Derrick Safety Part II. **Please be sure to take course 820, Crane and Derrick Safety Part I before taking this course.**



This course is intended to help businesses comply with OSHA's standard 29 CFR 1926 Subpart CC – Cranes & Derricks in Construction.

It is designed to address the most common compliance issues that employers will face and to determine all of the steps that must be taken to comply with the standard.

Standard Compliance

Employers who use cranes and derricks in construction work must comply with the standard. In addition, other employers on construction sites where cranes and derricks are used are responsible for violations that expose their employees to hazards and, therefore, need to know the requirements of the standard that may affect their employees. Crane lessors who provide operators and/or maintenance personnel with the equipment also have duties under the standard. See the section of this course entitled "Employer Responsibilities" for additional information on the compliance responsibilities of different employers.

Who should take this course?

Employers who have compliance responsibilities under the standard should take this course. In addition, crane operators and other workers who work with or near cranes on construction sites can find information in this course that will make them aware of the hazards that cranes present to them and their co-workers and the steps that employers must take to protect against those hazards.

How do I use this course?

This course is divided into modules that correspond to the sections of the standard. The course focuses on the standard's provisions that address the most serious hazards and the compliance issues that employers will face most frequently. Some issues that arise less frequently are addressed briefly or not at all. In some places, the course refers the reader to sections of the standard for more detailed information about particular topics.

When this course uses the word "you," it is referring to an employer who operates a crane on a construction site unless the context indicates otherwise. However, as noted above, other employers may also have responsibilities under the standard.

Module 1: Operation

This section contains a number of requirements that are designed to prevent dangerous conditions during crane operations.

Compliance with Rated Capacity

One of the most serious hazards that cranes present is collapse of the equipment caused by exceeding the crane's rated capacity. The term "rated capacity" is defined in section 1401, and that definition reads:

Rated capacity means the maximum working load permitted by the manufacturer under specified working conditions. Such working conditions typically include a specific combination of factors such as equipment configuration, radii, boom length, and other parameters of use.

The combination of factors that enter into rated capacity is set forth in a load chart that must be on the equipment. In general, the load chart states the weight of the load that the crane can lift at different boom radii. The longer the radius at which the lift occurs, the smaller amount of weight the crane can lift.

You must not operate a crane in excess of its rated capacity. Some crane users believe they can safely exceed the rated capacity because the manufacturer includes a safety factor in the load chart. However, any safety factor included by the manufacturer is not intended to be treated as excess capacity. It is included because a variety of variable worksite conditions, such as swinging of the load caused by wind or other factors, can reduce the capacity of the crane from that which exists under ideal conditions.

To comply with the rated capacity, the weight of the load must be known. Before beginning a lift, you must determine the load weight by using a reliable means.



Collapse of equipment caused by exceeding the crane's rated capacity.

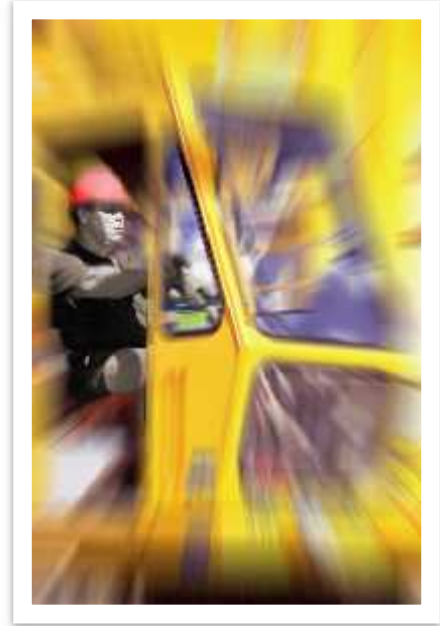
Other Manufacturer Procedures

In addition to complying with the rated capacity, you must comply with all other manufacturer procedures applicable to the operation of the equipment. If the manufacturer's procedures are unavailable, you must comply with procedures that you develop. Procedures for the operational controls must be developed by a qualified person. Procedures related to the capacity of the equipment must be developed and signed by a registered professional engineer familiar with the equipment.

All procedures applicable to the operation of the equipment, including rated capacities (load charts), recommended operating speeds, special hazard warnings, instructions, and operator's manual, must be readily available in the cab at all times for use by the operator.

Operator Attention

The operator must not engage in any practice or activity that diverts their attention while engaged in operating the equipment, such as the use of a cell phone (except when used for signal communications).



The operator must not engage in any practice or activity that diverts their attention while engaged in operating the equipment.

Operator Responsibility While the Load is Suspended

The operator must not leave the controls while the load is suspended except where ALL of the following criteria are met:

-) The operator remains adjacent to the equipment and is not engaged in any other duties.
-) The load is to be held suspended for a period of time exceeding normal lifting operations.
-) The competent person determines that it is safe to do so and implements measures necessary to restrain the boom hoist and telescoping, load, swing, and outrigger or stabilizer functions.
-) Barricades or caution lines and notices are erected to prevent all employees from entering the fall zone. No employees are permitted in the fall zone.

The four criteria immediately above do not apply to working gear (such as slings, spreader bars, ladders, and welding machines) where the weight of the working gear is negligible relative to the lifting capacity of the equipment as positioned, and the working gear is suspended over an area other than an entrance or exit.

Tagging Out-of-Service Equipment and Functions

When the equipment is out of service, a tag must be placed in the cab stating that the equipment is out of service and is not to be used. Where a function is out of service, a tag must be placed in a conspicuous position stating that the function is out of service and is not to be used. The equipment or function may not be used until the tag is removed by an authorized person.



Precautions During Startup

Before starting the engine, the operator must verify that all controls are in the proper starting position and that all personnel are in the clear.

Bad Weather Precautions

When a local storm warning has been issued, the competent person must determine whether it is necessary to implement manufacturer recommendations for securing the equipment. The competent person must adjust the equipment and/or operations to address the effect of wind, ice, and snow on equipment stability and rated capacity.

Sideload Prohibited

The equipment must not be used to drag or pull loads sideways.

Brake Test

The operator must test the brakes each time a load that is 90% or more of the maximum line pull is handled by lifting the load a few inches and applying the brakes. In duty cycle and repetitive lifts where each lift is 90% or more of the maximum line pull, this requirement applies to the first lift but not to successive lifts.



Neither the load nor the boom must be lowered below the point where less than two full wraps of rope remain on their respective drums.

Protection Against Rope Detachment

To prevent rope from becoming detached from a drum, neither the load nor the boom must be lowered below the point where less than two full wraps of rope remain on their respective drums.

Traveling with a Load

Traveling with a load is prohibited if the practice is prohibited by the manufacturer. Where it is not prohibited, you must take precautions to prevent hazardous movement of the load and avoid excessive movement of the load that could overload the crane.

Authority to Stop Operation

This section provides that, whenever there is a concern about safety, the operator must have the authority to stop and refuse to handle loads until a qualified person has determined that safety has been assured.

Module 1 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

1. _____ means the maximum working load permitted by the manufacturer under specified working conditions.
 - a. Load limit
 - b. Rated capacity
 - c. Permissive working limit
 - d. Acceptable load limit
2. Factors determining rated capacity include which of the following?
 - a. Equipment inspection
 - b. Elevated barriers
 - c. Boom length
 - d. Ground conditions
3. The crane operator may use a cell phone for signal communications.
 - a. True
 - b. False
4. Which of the following is not one of the criteria that must be met before the crane operator can leave the controls while the load is suspended?
 - a. The operator remains adjacent to equipment.
 - b. The operator is not engaged in other duties.
 - c. A competent person determines it is safe to do so.
 - d. Only trained employees should enter the fall zone.

- 5. The operator must test the brakes each time a load that is _____ is handled by lifting the load a few inches and applying the brakes.**
- a. 90% or more of maximum pull
 - b. 70% of rated capacity
 - c. certified within limits by a competent person
 - d. irregular in shape or size

Module 2: Signals and Fall Protection

Signals

A crane operator often needs a second set of eyes—a signal person—to be able to operate safely. The sections below state when a signal person must be provided and the types of signals that are allowed. The qualifications the signal person must possess are specified in section 1428 (Signal person qualifications).

When a Signal Person is Needed

A signal person must be provided:

-) when the point of operation, meaning the path the load travels or the area where the load is placed, is not in full view of the operator
-) when the equipment is traveling and the operator's view in the direction of travel is obstructed
-) when, due to site-specific safety concerns, either the operator or the person handling the load determines that it is necessary

During operations requiring signals, the ability to transmit signals between the operator and signal person must be maintained. If that ability is interrupted at any time, the operator must safely stop operations until signal transmission is reestablished and a proper signal is given and understood.

Only one person may give signals to a crane/derrick at a time, though any person may give an emergency stop signal.

Types of Signals

Hand, voice, audible, or new signals are allowed. The type of signals used and means of transmitting the signals to the operator (such as direct line of sight, video, radio, etc.), must be appropriate for the site conditions. All directions given to the operator by the signal person must be given from the operator's perspective.



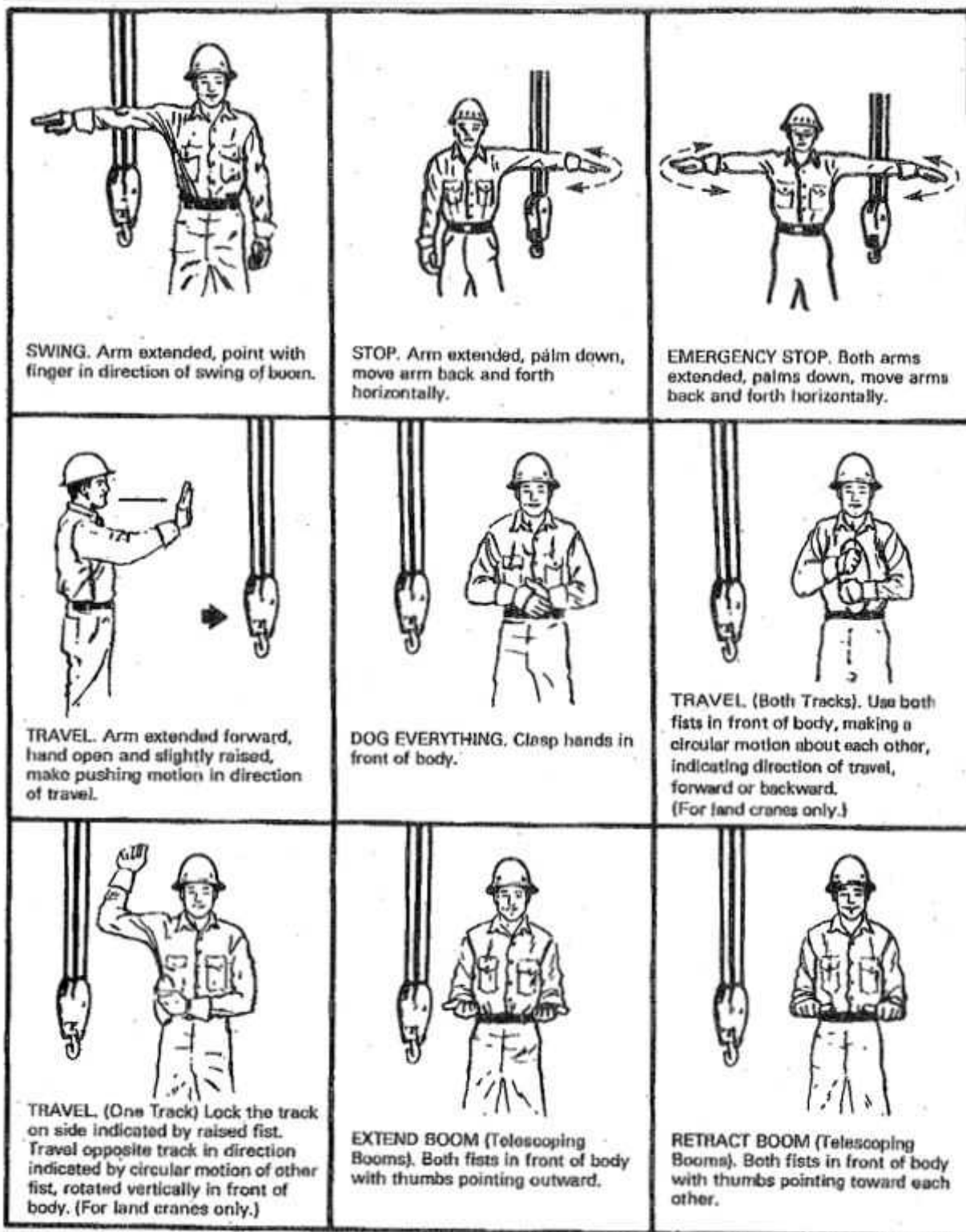
A crane operator often needs a signal person, to be able to operate safely.

Hand Signals

When using hand signals, the Standard Method must be used. **Exception:** Where an operation or use of an attachment is not covered in the Standard Method or the use of the Standard Method is otherwise infeasible, non-standard hand signals may be used. When using non-standard hand signals, the signal person, operator, and lift director (where there is one) must contact each other prior to the operation and agree on the non-standard hand signals that will be used. Hand signal charts must be either posted on the equipment or conspicuously posted in the vicinity of the hoisting operation.

Hand Signals Chart

 HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circle.	 LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circle.	 USE MAIN HOIST. Tap fist on head; then use regular signals.
 USE WHIPLINE (Auxiliary Hoist). Tap elbow with one hand; then use regular signals.	 RAISE BOOM. Arm extended, fingers closed, thumb pointing upward.	 LOWER BOOM. Arm extended, fingers closed, thumb pointing downward.
 MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as example.)	 RAISE THE BOOM AND LOWER THE LOAD. With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.	 LOWER THE BOOM AND RAISE THE LOAD. With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.



Voice Signals

These are signals given by oral communication, with or without amplification or electronic transmission. If this type of signal is used, the operator, signal person, and lift director (if there is one) must, before beginning operations, contact each other and agree on the voice signals that will be used.

Each voice signal must contain the following three elements, given in the following order:

1. function (such as hoist, boom, etc.) and direction
2. distance and/or speed
3. function stop

In most cases where voice signals are given, some type of electronic transmission and reception will be used. When this is the case:

-) The device(s) used to transmit signals must be tested on site before beginning operations to ensure that the signal transmission is effective, clear, and reliable.
-) Signal transmission must be through a dedicated channel, except:
 - o Multiple cranes/derricks and one or more signal persons may share a dedicated channel for the purpose of coordinating operations.
 - o Where a crane is being operated on or adjacent to railroad tracks, and the actions of the crane operator need to be coordinated with the movement of other equipment or trains on the same or adjacent tracks.
-) The operator's reception of signals must be by a hands-free system.

Audible Signals

These are signals made by a distinct sound or series of sounds, such as sounds made by a bell, horn, or whistle. As with other types of signals, the signal person and operator must clearly understand the meaning of the signals being used.

New Signals

The standard allows room for development of new signal technology by permitting signals other than hand, voice, or audible signals to be used where the employer demonstrates one of the following:

-)] The new signals provide at least equally effective communication as voice, audible, or Standard Method hand signals.
-)] The new signals comply with a national consensus standard that provides at least equally effective communication as voice, audible, or Standard Method hand signals.

Fall Protection

Falls from dangerous heights can occur when employees work on boom sections during assembly/disassembly, when employees are gaining access to and from their work stations, or at other times when employees are working at elevations, such as tower crane walkways. The provisions of this section are designed to protect employees who work on elevated parts of equipment from falling.

Work at elevation: For non-assembly/disassembly work, the employer must provide and ensure the use of fall protection equipment for employees who are on a walking/working surface with an unprotected side or edge more than **6 feet** above a lower level as follows:

-)] when moving point-to-point
-)] on non-lattice booms (whether horizontal or not horizontal)
-)] on lattice booms that are not horizontal
-)] on horizontal lattice booms where the fall distance is 15 feet or more
-)] while at a work station on any part of the equipment (including the boom, of any type), except when the employee is at or near draw-works (when the equipment is running), in the cab, or on the deck

Assembly/Disassembly: For assembly/disassembly work, the employer must provide and ensure the use of fall protection equipment for employees who are on a walking/working surface with an unprotected side or edge more than **15 feet** above a lower level, except when the employee is at or near draw-works (when the equipment is running), in the cab, or on the deck.

For erecting, climbing, and dismantling work, the employer must provide and ensure the use of fall protection equipment for employees who are on a walking/working surface with an unprotected side or edge more than **15 feet** above a lower level.

OSHA's general fall protection standard for construction work, 29 CFR 1926 subpart M, only applies to work on cranes when this section explicitly refers to a provision in that subpart.

Real Life Accident

On July 29, 2005, Employee #1 was operating a Rubber Tired Grove Crane. The crane was used to hoist purlins onto the walls of a steel building. While on the ground, a hook was attached to the purlin and it was lifted into place using a tagline. After the purlin was placed, the hook was detached and lowered to the ground. During the operation, the tagline became entangled. Employee #1 was instructed to untangle the tagline. The crane hook was lowered and he climbed onto the hoist cable without fall protection. With one foot in the sling, he held the hoist cable above the hook block with both hands. Then he was hoisted 29.5 ft. into the air. As he attempted to untie the tagline from the purlin, he let go of the cable, causing the sling to swing sideways. The movement of the swing resulted in his loss of balance. He fell to the ground, landing on his back and head. He was flown by helicopter to a medical center where he remained in a coma until his death thirteen days later.

Boom Walkways

When lattice boom cranes are assembled and disassembled, it is sometimes necessary for employees to walk and work on the boom sections to install and remove pins or for other purposes. To provide them with a safer surface on which to walk and work, certain booms manufactured after November 8, 2011 must have built-in walkways. The booms that must be equipped with walkways are those more than **six feet** from cord centerline to cord centerline. The walkways must be at least **12 inches** wide and need not be protected by guardrails, railings, or other permanent fall protection attachments.



Some booms have built in walkways.

Steps, Handholds, Ladders, Grabrails, Guardrails, and Railings

If the equipment was originally equipped with these devices, you must maintain them in good condition. However, the standard does not require existing equipment to be retrofitted with these devices.

Equipment manufactured after November 8, 2011 must be equipped to provide safe access and egress between the ground and the operator work station(s), including the forward and rear positions, by the provision of these types of devices. Walking/stepping surfaces, except for crawler treads, must have slip-resistant features/properties (such as diamond plate metal, strategically placed grip tape, expanded metal, or slip-resistant paint).

Anchorage

Fall protection must be anchored to a substantial part of the equipment that would meet the criteria in 29 CFR 1926 subpart M. A personal fall arrest system may be anchored to the crane/derrick's hook (or other part of the load line) where all of the following requirements are met:

-)] A qualified person has determined that the set-up and rated capacity of the crane/derrick (including the hook, load line, and rigging) meets or exceeds the requirements in 29 CFR 1926 subpart M.
-)] The equipment operator must be at the work site and informed that the equipment is being used for this purpose.
-)] No load is suspended from the load line when the personal fall arrest system is anchored to the crane/derrick's hook (or any other part of the load line).



Equipment must be equipped to provide safe access and egress between the ground and the operator work station(s).

Module 2 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. A signal person is required in which of the following situations?**
 - a. The point of operation is not in full view of the operator
 - b. The operator's view is unobstructed while equipment is traveling
 - c. The rigger determines it is necessary
 - d. The load is in view, but exceeds rated capacity

- 2. When using voice signals, the operator, _____, and lift director (if there is one) must, before beginning operations, contact each other and agree on the voice signals that will be used.**
 - a. general contractor
 - b. A/D director
 - c. signal person
 - d. rigger

- 3. During crane operations, new signals must provide communications that are at least equally effective as _____.**
 - a. written signals
 - b. inaudible signals
 - c. Standard Method hand signals
 - d. electronic signals

- 4. During erecting, climbing, and dismantling work, as the employer you must provide and ensure the use of fall protection equipment for your employees who are on a walking/working surface with an unprotected side or edge more than _____ feet above a lower level.**
 - a. 4
 - b. 6
 - c. 10
 - d. 15

- 5. Equipment manufactured after November 8, 2011 must be equipped to provide safe access and egress between the ____.**
- a. trolley and lower load block
 - b. turntable and operator cab(s)
 - c. boom and jib
 - d. ground and the operator work station(s)

Module 3: Staying Clear of Hazards

Work Area Control

This section is designed to protect employees who work near a crane from being struck or crushed by the crane's rotating superstructure. To prevent employees from entering an area where they could be struck/crushed, you must:

-) Train each employee assigned to work on or near the equipment in how to recognize struck-by and pinch/crush hazard areas posed by the rotating superstructure.
-) Erect and maintain control lines, warning lines, railings, or similar barriers to mark the boundaries of the hazard areas. **Exception:** When you can demonstrate that it is neither feasible to erect such barriers on the ground nor on the equipment, the hazard areas must be clearly marked by a combination of warning signs (such as "Danger – Swing/Crush Zone") and high visibility markings on the equipment that identify the hazard areas. In addition, you must train each employee to understand what these markings signify.

Before an employee goes to a location in the hazard area that is out of view of the operator, the employee (or someone instructed by the employee) must ensure that the operator is informed that he/she is going to that location. Where the operator knows that an employee went to such a location, the operator must not rotate the superstructure until the operator is informed in accord with a pre-arranged system of communication that the employee is in a safe position.

Keeping Clear of the Load

This section seeks to protect employees against being struck by a moving or falling load.

Safe Hoisting Routes

Where available, hoisting routes that minimize the exposure of employees to hoisted loads must be used, to the extent consistent with public safety.



You must protect your employees from being struck by a moving or falling load.

Stationary Suspended Load

While the operator is not moving a suspended load, no employee may be within the fall zone, except for employees:

-) engaged in hooking, unhooking, or guiding the load
-) engaged in the initial attachment of the load to a component or structure
-) operating a concrete hopper or concrete bucket



Only necessary employees may be within the fall zone.

Hooking, Unhooking, or Guiding the Load

When employees in the fall zone are engaged in hooking, unhooking, or guiding the load, or are connecting a load to a component or structure, all of the following criteria must be met:

-) The materials being hoisted must be rigged to prevent unintentional displacement.
-) Hooks with self-closing latches or their equivalent must be used. **Exception:** "J" hooks may be used for setting wooden trusses so that a worker need not go onto the truss to open the hook.
-) The materials must be rigged by a qualified rigger.

Receiving a Load

Only employees needed to receive a load are permitted to be within the fall zone when a load is being landed.

Tilt-up or Tilt-down Operation

During a tilt-up or tilt-down operation:

-) No employee may be directly under the load.
-) Only employees essential to the operation are permitted in the fall zone (but not directly under the load). Such employees include those who must be in the fall zone to course the load, monitor the load's movement, or attach and/or detach the load.

Free Fall Generally Prohibited

Some older cranes are designed with a "live boom," where the rate of lowering the boom can only be controlled by a brake. Failure of the brake can lead to free fall of the boom and a risk of death or serious injury to workers near the crane. This standard prohibits the use of equipment with a live boom unless:

-) the equipment was manufactured before October 31, 1984
-) the equipment is a floating crane/derrick or a land crane/derrick on a vessel/flotation device

Free Fall Specifically Prohibited

Even in the two situations where the equipment may have a live boom, the equipment must not be used in the following circumstances:

-) An employee is in the fall zone of the boom or load.
-) An employee is being hoisted.
-) The load or boom is directly over a power line, or over any part of the area extending the [Table A](#) of § 1926.1408 clearance distance to each side of the power line; or any part of the area extending the Table A clearance distance to each side of the power line is within the radius of vertical travel of the boom or the load.
-) The load is over a shaft, except where there are no employees in the shaft.
-) The load is over a cofferdam, except where there are no employees in the fall zone of the boom or the load.
-) Lifting operations are taking place in a refinery or tank farm.



Live booms cannot be used if there are any employees in the fall zone of the boom or load.

Backup Protection

In the situations listed above where the use of equipment with a live boom is prohibited, the boom hoist must have a secondary mechanism or device designed to prevent the boom from falling in the event the primary system used to hold or regulate the boom hoist fails, as follows:

-) Friction drums must have:
 - o a friction clutch and, in addition, a braking device to allow for controlled boom lowering
 - o a secondary braking or locking device, which is manually or automatically engaged, to backup the primary brake while the boom is held (such as a secondary friction brake or a ratchet and pawl device)
-) Hydraulic drums must have an integrally mounted holding device or internal static brake to prevent boom hoist movement in the event of hydraulic failure.
-) Neither clutches nor hydraulic motors may be considered as brake or locking devices for purposes of this subpart.
-) Hydraulic boom cylinders must have an integrally mounted holding device.

Preventing Uncontrolled Retraction

Hydraulic telescoping booms must have an integrally mounted holding device to prevent the boom from retracting in the event of hydraulic failure.

Free Fall of the Load Line is Prohibited

In each of the following circumstances, controlled load lowering is required and free fall of the load line hoist is prohibited:

-) An employee is directly under the load.
-) An employee is being hoisted.
-) The load is directly over a power line, or over any part of the area extending the [Table A](#) of § 1926.1408 clearance distance to each side of the power line; or any part of the area extending the Table A of § 1926.1408 clearance distance to each side of the power line is within the radius of vertical travel of the load.

-) The load is over a shaft.
-) The load is over a cofferdam, except where there are no employees in the fall zone of the load.



Free fall of the load line hoist is prohibited.

Module 3 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Who must ensure the operator is informed an employee is going to the hazard area which is out of view of the operator?**
 - a. The employee (or someone instructed by the employee)
 - b. The owner (or someone instructed by the owner)
 - c. The site supervisor (or someone instructed by the site supervisor)
 - d. The controlling entity (or someone instructed by the controlling entity)

- 2. Only _____ are permitted to be within the fall zone when a load is being landed.**
 - a. employees hooking/unhooking
 - b. employees needed to receive a load
 - c. designated riggers
 - d. authorized employees

- 3. During tilt-up or tilt-down crane operations, essential employees may be in the fall zone (but not directly under the load) to engage in which of the following activities?**
 - a. Essential construction duties, such as welding the frame
 - b. Monitoring workers performing essential construction duties
 - c. Attaching and/or detaching the load
 - d. Evaluating those engaged in working the load

- 4. In crane operations, which of the following circumstances require controlled load lowering?**
 - a. An employee is not under the load
 - b. An employee is being hoisted
 - c. The load is not over a shaft
 - d. The load is over a cofferdam and no employees are in the fall zone

- 5. In crane operations, free fall of the load line hoist is prohibited in which of the following circumstances?**
- a. An employee is near a power line
 - b. No employees are in the fall zone of the load
 - c. The load is directly under a power line
 - d. An employee is being hoisted

Module 4: Qualification and Certification

[CFR 29 1926.1427](#) contains new requirements designed to ensure that crane operators have the knowledge and skills they need to operate safely.

After November 10, 2017, operators of most equipment covered by the standard must be qualified or certified by, or under the scrutiny of, a third party other than the operator's employer. An exception is provided for operators-in-training, who may operate equipment with certain limitations until they can become qualified or certified.

A few types of equipment are **not** covered by this requirement:

-) derricks
-) sideboom cranes
-) equipment with a rated hoisting/lifting capacity of 2,000 pounds or less

Getting Certified or Qualified

There are four qualification or certification options for crane operators.

A crane operator may become “**certified**” through the first option.

Option 1 - Certification after passing both a written and practical test administered by an **accredited testing organization**. Certification is valid for 5 years.

A crane operator may become “**qualified**” through the following three other options:

Option 2 - Qualification after passing a written and practical test by an **audited employer program**. Qualification is valid for 5 years.

Option 3 - Qualification by the **U.S. Military** (limited to employees of the Department of Defense or members of the Armed Forces). The qualification is valid for the period of time stipulated by the issuing authority.

Option 4 - Licensing by a **government entity**. If the crane operator is working in a jurisdiction that requires a state or local crane license and the licensing process meets



Crane operators of most equipment must be qualified or certified by a third party other than the operator's employer.

the requirements of this standard, the operator must obtain such a license. Licensing is valid for the period of time stipulated by the licensing department/office, but no longer than 5 years.

Certification Validity

A valid certification can only be issued by an "accredited crane operator testing organization." To qualify for this title, the testing organization must be accredited by a "nationally recognized accrediting agency." During the rulemaking, OSHA identified two organizations qualified as "nationally recognized accrediting agencies:" the National Commission for Certifying Agencies (NCCA) and the American National Standards Institute (ANSI). These organizations have accredited several testing organizations, and their websites identify the organizations they have accredited. A testing organization's accreditation must be reviewed at least every three years.

A certification is valid for 5 years. After 5 years, it must be renewed to make sure that the operator's knowledge and skills are up-to-date.

Limitations

An operator is qualified to operate a particular piece of equipment if the operator is certified for that type and capacity of equipment or for higher-capacity equipment of that type. For example, an operator certified for a 100-ton hydraulic crane may operate a 50-ton hydraulic crane but not a 200-ton hydraulic crane.

If no accredited testing agency offers certification examinations for a particular type and/or capacity of equipment, an operator is considered to be qualified to operate that equipment if the operator has been certified for the type/capacity that is most similar to that equipment and for which a certification examination is available.

The operator's certificate must state the type/capacity of equipment for which the operator is certified.

Limitations: *An operator certified for a 100-ton hydraulic crane may operate a 50-ton hydraulic crane but not a 200-ton hydraulic crane.*

Leading Cranes and Operator

Employers leading cranes and operators are responsible for ensuring that the operator is certified. The rule does not specify how you must do that. Personally, examining the operator's certificate may be advisable. If there is any question as to whether the operator's certification is valid, you should contact the testing organization that issued the certification.

Hiring Crane Operators

When hiring crane operators certified for the equipment by an accredited testing organization, the operator's certification is portable. However, as stated above, the certification is valid for only 5 years, after which it must be renewed. A qualification by an audited employer program or by the U.S. military, on the other hand, is not portable.

Certification Exams

The certification exam covers certain topics relevant to safe crane operation but does not require any particular type of training. An experienced operator may have the necessary knowledge and skills without further training.

The certification exam consists of both a written and a practical test. Among other topics, the written test covers the following:

1. the controls and operational/performance characteristics of the equipment
2. use of, and the ability to calculate (manually or with a calculator), load/capacity information on a variety of configurations of the equipment
3. procedures for preventing and responding to power line contact
4. the ground conditions needed to support the equipment and load



The certification exam consists of both a written and a practical test.

The practical test is conducted with the operator at the controls of the equipment. It requires the operator to demonstrate, among other things, operational and maneuvering skills, the ability to apply load chart information, and the ability to safely shut down and secure the equipment.

The examination may be administered in any language the operator candidate understands. It may be administered verbally as long as the operator can demonstrate that he/she is literate in the language of the exam and demonstrates the ability to use the type of written manufacturer procedures applicable to the class/type of equipment for which the candidate is seeking certification. The operator's certificate must note the language in which the exam was given, and the employee may only operate a crane that is furnished with materials required by the standard that are written in the language of the certification.

Hands-on Training for the Operator

The operator-in-training may operate a crane during training as long as the conditions below are satisfied.

-) The employer must provide each operator-in-training with sufficient training prior to operating the equipment. This will enable the operator-in-training to operate the equipment safely.
-) The tasks performed by the operator-in-training while operating the equipment must be within the operator-in-training's ability.
-) While operating the equipment, the operator-in-training must be continuously monitored by an individual ("operator's trainer") who meets all of the following requirements:
 - o The operator's trainer is an employee or agent of the operator-in-training's employer.
 - o The operator's trainer is either a certified operator under this section or has passed the written portion of a certification test and is familiar with the proper use of the equipment's controls.
 - o While monitoring the operator-in-training, the operator's trainer performs no tasks that detract from the trainer's ability to monitor the operator-in-training.
 - o For equipment other than tower cranes, the operator's trainer and the operator-in-training must be in direct line of sight of each other. In addition, they must



The operator's trainer and the operator-in-training must be in direct line of sight of each other.

communicate verbally or by hand signals. For tower cranes, the operator's trainer and the operator-in-training must be in direct communication with each other.

-) The operator-in-training must be monitored by the operator's trainer at all times, except for short breaks where all of the following are met:
 - o The break lasts no longer than 15 minutes and there is no more than one break per hour.
 - o Immediately prior to the break the operator's trainer informs the operator-in-training of the specific tasks that the operator-in-training is to perform and limitations to which he/she must adhere during the operator trainer's break.
 - o The specific tasks that the operator-in-training will perform during the operator trainer's break are within the operator-in-training's abilities.
-) The operator-in-training must not operate the equipment in any of the following circumstances are present:
 - o if any part of the equipment, load line, or load (including rigging and lifting accessories), if operated up to the equipment's maximum working radius in the work zone, could get within 20 feet of a power line that is up to 350 kV, or within 50 feet of a power line that is more than 350 kV
 - o if the equipment is used to hoist personnel
 - o in multiple-equipment lifts
 - o if the equipment is used over a shaft, cofferdam, or in a tank farm
 - o in multiple-lift rigging operations, except where the operator's trainer determines that the operator-in-training's skills are sufficient for this high-skill work



The operator-in-training cannot operate a crane if the crane is used to hoist personnel.

Signal Person Qualifications

Each signal person must:

-) know and understand the type of signals used
(If hand signals are used, the signal person must know and understand the Standard Method for hand signals)
-) be competent in the application of the type of signals used
-) have a basic understanding of equipment operation and limitations, including the crane dynamics involved in swinging and stopping loads and boom deflection from hoisting loads
-) know and understand the relevant requirements of the sections of the standard dealing with signals
-) demonstrate he/she meets these requirements through an oral or written test, and through a practical test



A signal person must meet the qualification requirements.

The employer of the signal person must ensure that the signal person meets these qualification requirements through one of the following qualification options:

Option (1) – Qualified third party evaluator. The signal person has documentation from a qualified third party evaluator (see [section 1401](#) for definition of "Qualified Evaluator (third party)") showing that the signal person meets the qualification requirements.

Option (2) – Employer's qualified evaluator. The employer's qualified evaluator (see section 1401 for definition of "Qualified Evaluator (not a third party)") and determines that the individual meets the qualification requirements.

The employer must make the documentation for whichever option is used available at the site while the signal person is employed by the employer. Such documentation is considered "available" when it is physically present on the site or retrievable via an on-site computer. The documentation must specify each type of signaling (e.g., hand signals, radio signals, etc.) for which the signal person meets the requirements of [paragraph \(c\) of section 1926.1428](#).

If subsequent actions by the signal person indicate that the individual does not meet the qualification requirements, the employer must not allow the individual to continue working as a signal person until retraining is provided and a reassessment is made under one of the two options that confirms the individual meets the qualification requirements.

Qualifications of Maintenance & Repair Employees

Improper crane maintenance and repair can lead to dangerous equipment failure. To ensure that maintenance and repair employees are qualified to perform their assigned tasks, this section requires maintenance and repair personnel to meet the definition of a qualified person with respect to the equipment and maintenance/repair tasks they perform. The definition of "qualified person" is found in [section 1401](#).



If maintenance and repair employees aren't qualified, improper maintenance can lead to equipment failure.

Some maintenance and repair tasks may require the maintenance and repair personnel to operate the equipment to diagnose a problem or check its operation. Such personnel need not be qualified or certified under [section 1427](#) to operate the equipment as long as:

-) the operation is limited to those functions necessary to perform maintenance, inspect the equipment, or verify its performance
-) the personnel either:
 - o operate the equipment under the direct supervision of an operator who meets the qualification/certification requirements of section 1427
 - o are familiar with the operation, limitations, characteristics, and hazards associated with the type of equipment

Training

Other sections of this standard require training in specific topics. Below is a list of the training requirements found in other sections and includes additional training requirements not found elsewhere.

Training Requirements Specified Elsewhere

-) **overhead powerlines** (Sections [1408\(g\)](#) and [1410\(m\)](#))
-) **signal persons** (Section [1428\(c\)](#))
-) **operators** (See [section 1427](#) for the training required for operators during the four-year transitional period for operator qualification/certification, for operators of equipment that does not require qualification/certification, and for operators-in-training).

Additional Training Requirements

Operators – You must train each equipment operator in the manufacturer's emergency procedures for halting unintended equipment movement and in the following practice: whenever moving a boom off a support, first raise the boom a short distance (sufficient to take the load of the boom) to determine if the boom hoist brake needs to be adjusted or repaired.

Competent persons and qualified persons – You must train each competent person and each qualified person in the requirements of this standard that apply to them.

Crush/pinch points – You must train each employee who works with the equipment to keep clear of holes, crush/pinch points, and the hazards addressed in [section 1424](#) (Work area control).

Tag-out – You must train each operator and each additional employee authorized to start/energize equipment or operate equipment controls (such as maintenance and repair employees) in the tag-out and start-up procedures in [sections 1417](#) (f) and (g).

Training Administration

For each employee who must be trained under this standard, you must:

-) Evaluate each employee to confirm that the employee understands the information provided in the training.
-) Provide refresher training in relevant topics for each employee when, based on the conduct of the employee or an evaluation of the employee's knowledge, there is an indication that retraining is necessary.
-) Provide the training at no cost to the employee.

Module 4 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. A crane operator's certification is valid for no longer than _____ years.**
 - a. 3
 - b. 5
 - c. 7
 - d. 10

- 2. Must a candidate for crane operator certification take a training course before taking the exam?**
 - a. Yes
 - b. No
 - c. Yes, but only if a crane operator has less than one year of experience
 - d. Yes, but only if a crane operator has less than three years of experience

- 3. If hand signals are used, the signal person must know and understand the _____ for hand signals.**
 - a. OSHA Approved
 - b. Agreed-upon
 - c. International Standard
 - d. Standard Method

- 4. Each signal person must meet which of the following qualification requirements?**
 - a. Know and use the OSHA approved signals
 - b. Know and understand the type of signals used
 - c. Have a thorough understanding of equipment operation and limitations
 - d. Know and use the International Standard signals

5. Each employee who works with the equipment must be trained to keep clear of _____.

- a. firm ground
- b. crush points
- c. well lit areas
- d. dry surfaces

Module 5: Hoisting Personnel

Hoisting Personnel is Generally Prohibited

Cranes and derricks may not be used to hoist employees, except where the employer demonstrates that the erection, use, and dismantling of conventional means of reaching the work area (such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform, or scaffold) would be more hazardous, or is not possible because of the project's structural design or worksite conditions.

This section contains stringent criteria to assure the safety of personnel who must be hoisted by a crane or derrick. These criteria are fundamentally the same as those in the prior standard.

Use of Personnel Platform

A personnel platform must be used when hoisting employees except when hoisting them:

-) into and out of drill shafts that are 8 feet in diameter or smaller
-) in pile driving operations
-) solely for transfer to or from a marine worksite in a marine-hoisted personnel transfer device
-) in storage tank (steel or concrete), shaft, and chimney operations

Where these exceptions apply, the employee may be hoisted in either a personnel platform or a boatswain's chair. See the standard for rules applicable to these special types of lifts.

Personnel Platform Criteria

The personnel platform must conform to the following:

-) A qualified person familiar with structural design must design the personnel platform and attachment/suspension system used for hoisting personnel.



Under most circumstances a personnel platform must be used when hoisting employees.

-)] The system used to connect the personnel platform to the equipment must allow the platform to remain within 10 degrees of level, regardless of boom angle.
-)] The suspension system must be designed to minimize tipping of the platform due to movement of employees occupying the platform.
-)] The personnel platform itself (excluding the guardrail system and personal fall arrest system anchorages) must be able to support, without failure, its own weight and at least five times the maximum intended load.
-)] All welding of the personnel platform and its components must be performed by a certified welder familiar with the weld grades, types and material specified in the platform design.
-)] The personnel platform must be equipped with a guardrail system which meets OSHA criteria and must be enclosed at least from the toeboard to mid-rail with either solid construction material or expanded metal having openings no greater than ½ inch. Points to which personal fall arrest systems are attached must meet OSHA anchorage requirements.
-)] A grab rail must be installed inside the entire perimeter of the personnel platform except for access gates/doors.
-)] If installed, access gates/doors of all types (including swinging, sliding, folding, or other types) must:
 - o not swing outward (however, if due to the size of the personnel platform, such as a 1-person platform, it is infeasible for the door to swing inward and allow safe entry for the platform occupant, then the access gate/door may swing outward)
 - o be equipped with a device that prevents accidental opening



The personnel platform must be equipped with a guardrail system which meets OSHA criteria.

-)] Headroom must be sufficient to allow employees to stand upright in the platform.
-)] In addition to the use of hard hats, employees must be protected by overhead protection on the personnel platform when employees are exposed to falling objects. The platform overhead protection must not obscure the view of the operator or platform occupants (such as wire mesh that has up to ½ inch openings) unless full protection is necessary.
-)] All edges exposed to employee contact must be smooth enough to prevent injury.
-)] The weight of the platform and its rated capacity must be conspicuously posted on the platform with a plate or other permanent marking.
-)] The personnel platform must not be loaded in excess of its rated capacity.
-)] Personnel platforms must be used only for employees, their tools, and the materials necessary to do their work.
-)] Materials and tools must be secured to prevent displacement and evenly distributed within the platform.
-)] The number of employees occupying the personnel platform must not exceed the maximum number the platform was designed to hold or the number required to perform the work, whichever is less.

Hoisting Equipment

The hoisting equipment must meet the following criteria when hoisting personnel:

-)] The equipment must be uniformly level, within one percent of level grade, and located on footing that a qualified person has determined to be sufficiently firm and stable.
-)] Equipment with outriggers or stabilizers must have them all extended and locked. The amount of extension



When the occupied personnel platform is in a stationary working position, the load and boom brakes and locking features must be engaged.

must be the same for all outriggers and stabilizers and in accord with manufacturer procedures and load charts.

-)] The total load (including the hook, load line and rigging) must not exceed 50 percent of the rated capacity for the radius and configuration of the equipment, except during proof testing.
-)] When the occupied personnel platform is in a stationary working position, the load and boom hoist brakes, swing brakes, and operator actuated secondary braking and locking features (such as pawls or dogs) or automatic secondary brakes must be engaged.
-)] The equipment must be equipped with the safety devices specified in section 1431(d)(5).
-)] Attachments and rigging hardware must meet the criteria specified in section 1431(g).

Trial Lift and Inspection

A trial lift with the unoccupied personnel platform loaded at least to the anticipated liftweight must be made from ground level, or any other location where employees will enter the platform, to each location at which the platform is to be hoisted and positioned.

Where there is more than one location to be reached from a single set-up position, either individual trial lifts for each location, or a single trial lift, in which the platform is moved sequentially to each location, must be performed; the method selected must be the same as the method that will be used to hoist the personnel.

Immediately after the trial lift, a competent person must visually inspect the equipment, base support or ground, and personnel platform to determine whether the trial lift has exposed any defect or problem or produced any adverse effect. Any



This is an example of a trial lift.
Photo courtesy of Lifting Technologies, Inc.

condition found during the trial lift and subsequent inspection that fails to meet a requirement of this standard or otherwise creates a safety hazard must be corrected before hoisting personnel.

Proof Testing

Prior to hoisting employees on the personnel platform, and after any repair or modification, the platform and rigging must be proof tested to 125 percent of the platform's rated capacity. The proof test may be done concurrently with the trial lift. Personnel hoisting must not be conducted until a competent person determines that the platform and rigging have successfully passed the proof test.

Work Practices

The following practices must be used:

- ⌋ Hoisting of the personnel platform must be performed in a slow, controlled, cautious manner, with no sudden movements of the equipment or the platform.
- ⌋ Platform occupants must keep all parts of the body inside the platform during raising, lowering, and horizontal movement, and must not stand, sit on, or work from the top or intermediate rail or toeboard, or use any other means/device to raise their working height.
- ⌋ Before employees exit or enter a hoisted personnel platform that is not landed, the platform must be secured to the structure where the work is to be performed, unless the employer can demonstrate that securing the platform to the structure would create a greater hazard.
- ⌋ If the platform is tied to the structure, the operator must not move the platform until the operator receives confirmation that it is freely suspended.
- ⌋ Tag lines must be used when necessary to control the platform.



Employees must wear personal fall arrest systems whenever they're occupying a personnel platform.

- J Where the platform is not equipped with controls, the equipment operator must remain at the equipment controls, on site, and in view of the equipment, at all times while the platform is occupied.
- J Where the platform is equipped with controls, all of the following must be met at all times while the platform is occupied:
 - O The occupant using the controls in the platform must be a qualified person with respect to their use, including the safe limitations of the equipment and hazards associated with its operation.
 - O The equipment operator must be at a set of equipment controls that include boom and swing functions of the equipment, and must be on site and in view of the equipment.
 - O The platform operating manual must be in the platform or on the equipment.
- J When wind speed (sustained or gusts) exceeds 20 mph at the personnel platform, or other potentially dangerous weather conditions are present, a qualified person must determine if, in light of the wind conditions, it is not safe to lift personnel. If it is not, the lifting operation must not begin (or, if already in progress, must be terminated).
- J Employees being hoisted must remain in direct communication with the signal person (where used) or the operator.
- J Except over water, employees occupying the personnel platform must be provided and use a personal fall arrest system attached to a structural member within the personnel platform. (The fall arrest system must meet the requirements in § 1926.502). When working over or near water, the requirements of § 1926.106 apply.



No lifts may be made on any other of the equipment load lines while personnel are being hoisted, except in pile driving operations.

-) No lifts may be made on any other of the equipment's load lines while personnel are being hoisted, except in pile driving operations.
-) Hoisting of employees while the equipment (other than derricks) is traveling is prohibited except in certain circumstances. Derricks are prohibited from traveling while personnel are hoisted.

Pre-Lift Meeting

A pre-lift meeting must be held before the trial lift to review the applicable requirements of this section and the procedures that will be followed. The meeting must be attended by the equipment operator, signal person (if used for the lift), employees to be hoisted, and the person responsible for the task to be performed.

Hoisting Personnel near Power Lines

Hoisting personnel within 20 feet of a power line that is up to 350 kV, and hoisting personnel within 50 feet of a power line that is more than 350 kV, is prohibited (except for power transmission and distribution work).



The pre-lift meeting must be attended by the equipment operator, signal person (if used for the lift), employees to be hoisted, and the person responsible for the task to be performed.

Module 5 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. The personnel platform itself must be able to support, without failure, its own weight and at least _____ times the maximum intended load.**
 - a. three
 - b. five
 - c. seven
 - d. nine

- 2. When hoisting employees, the total load (including the hook, load line and rigging) must not exceed _____ percent of the rated capacity for the radius and configuration of the hoisting equipment, except during proof testing.**
 - a. 50
 - b. 25
 - c. 10
 - d. 75

- 3. Prior to hoisting employees on the personnel platform, and after any repair or modification, the platform and rigging must be proof tested to _____ percent of the platform's rated capacity.**
 - a. 125
 - b. 50
 - c. 150
 - d. 200

- 4. When wind speed (sustained or gusts) exceeds _____ mph at the personnel platform, a qualified person must determine if, in light of the wind conditions, it is not safe to lift personnel.**
 - a. 10
 - b. 20
 - c. 30
 - d. 40

5. Hoisting personnel within _____ feet of a power line that is up to 350 kV is prohibited (except for power transmission and distribution work).
- a. 10
 - b. 15
 - c. 20
 - d. 25

Module 6: Multiple Crane/Derrick Operations

Multiple Crane/Derrick Lifts

Lifts in which more than one crane or derrick is used require careful planning and precise coordination. It is particularly important to determine how the weight of the load will be distributed among the multiple pieces of equipment during all phases of the operation to ensure that all are operated within their rated capacities. Accordingly, when more than one crane/derrick is used to support the load, a plan must be developed and implemented. The plan must be developed by a qualified person and be designed to ensure that all requirements of this standard are met. Where the qualified person determines that engineering expertise is needed for the planning, the employer must ensure that it is provided.

The multiple-crane/derrick lift must be directed by a lift director who meets the criteria for both a competent person and a qualified person, or by a competent person who is assisted by one or more qualified persons. The lift director must review the plan in a meeting with all workers who will be involved with the operation.

Design, Construction and Testing

For equipment to be used safely, it must be built with appropriate safety features and maintained in a safe condition. Although manufacturers are not directly subject to this standard, crane users rely on manufacturers to see that the equipment is built and tested so that it is safe when it leaves the manufacturer. Therefore, with the exceptions discussed below, the crane user's obligations under this section are met where the employer can refer to documentation from the manufacturer showing that the equipment has been designed, constructed and tested in accord with [Section 1433](#) and the equipment has not changed since it was manufactured (except in accord with [Section 1434](#) – Equipment Modifications).



The crane user's obligations are met where the employer can refer to documentation from the manufacturer showing the equipment has been designed, constructed and tested in accord with this section and the equipment has not changed since it was manufactured.

You **cannot** rely on manufacturer documentation to comply with the following requirements.

Rated Capacity and Related Information Requirements

The following information must be available in the cab:

-)] a complete range of the manufacturer's equipment rated capacities
-)] a work area chart for which capacities are listed in the load chart (the work area figure and load chart must clearly indicate the areas where no load is to be handled)
-)] recommended reeving for the hoist lines
-)] recommended parts of hoist reeving, size, and type of wire rope for various equipment loads
-)] recommended boom hoist reeving diagram, where applicable
-)] size, type and length of wire rope
-)] tire pressure (where applicable)
-)] caution or warnings relative to limitations on equipment and operating procedures, including an indication of the least stable direction
-)] position of the gantry and requirements for intermediate boom suspension (where applicable)
-)] instructions for boom erection and conditions under which the boom, or boom and jib combinations, may be raised or lowered
-)] whether the hoist holding mechanism is automatically or manually controlled, whether free fall is available, or any combination of these
-)] the maximum telescopic travel length of each boom telescopic section
-)] whether sections are telescoped manually or with power



You must ensure the necessary safety information can be found inside the cab of the crane.

-)] the sequence and procedure for extending and retracting the telescopic boom section
-)] maximum loads permitted during the boom extending operation, and any limiting conditions or cautions
-)] hydraulic relief valve settings specified by the manufacturer

Miscellaneous Requirements

-)] Load hooks (including latched and unlatched types), ball assemblies, and load blocks must be of sufficient weight to overhaul the line from the highest hook position for boom or boom and jib lengths and the number of parts of the line in use.
-)] Hook and ball assemblies, and load blocks, must be marked with their rated capacity and weight.
-)] Hooks must be equipped with latches, except where a qualified person has determined that it is safer to hoist and place the load without latches (or with the latches removed/tied-back), and routes for the loads are pre-planned to ensure that no employee is required to work in the fall zone except for employees necessary for the hooking or unhooking of the load.
-)] Posted warnings required by this standard, as well as those originally supplied with the equipment by the manufacturer, must be maintained in legible condition.
-)] An accessible fire extinguisher must be on the equipment.



There must be an accessible fire extinguisher on the equipment.

Equipment Modifications

This section applies to modifications that affect the capacity or safe operation of the equipment. Its provisions safeguard against unsafe equipment modifications and provide that the modifications are reflected in the equipment's instructions and specifications so that the modified equipment can be used safely.

Manufacturer Review and Approval

The equipment's manufacturer is uniquely qualified to evaluate any proposed modifications to the equipment. If the manufacturer is available and is willing to evaluate the proposed modifications, any modifications or additions that affect the capacity or safe operation of the equipment are only permitted where:

-) The manufacturer approves the modifications/additions in writing.
-) The load charts, procedures, instruction manuals, and instruction plates/tags/decals are modified as necessary to accord with the modification/addition.



The equipment's manufacturer is uniquely qualified to evaluate any proposed modifications to the equipment.

Manufacturer Review Unavailable

If the manufacturer is:

-) unavailable or unwilling to review the proposed modification/addition
-) rejects it in writing
-) fails to initiate the review or acknowledge the request within 30 days
-) fails to complete the review within 120 days, the modification/addition may be made if a registered professional engineer who is a qualified person with respect to the equipment involved:
 - o approves the modification/addition and specifies the equipment configurations to which that approval applies
 - o modifies load charts, procedures, instruction manuals, and instruction plates/tags/decals as necessary to accord with the modification/addition

Module 6 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. When more than one crane/derrick is used to support the load, a plan must be developed by a _____.
a. qualified person
b. qualified crane operator
c. registered engineer
d. competent person**
- 2. A multiple-crane/derrick lift must be directed by a lift director who meets the criteria for _____.
a. a competent person assisted by a qualified person
b. a qualified person
c. both a competent and a qualified person
d. both a and c**
- 3. With a couple exceptions, multiple-crane/derrick lift load hooks must be equipped with _____.
a. hazard information
b. safety Instructions
c. latches
d. flashing lights**
- 4. If the manufacturer is unavailable or will not review a modification to crane equipment, the modification may be made if a _____ who is a qualified person with respect to the equipment is involved.
a. certified safety professional
b. competent person
c. registered professional engineer
d. qualified crane operator**

- 5. Posted warnings required by this standard as well as those originally supplied with the equipment by the manufacturer must be maintained in ____.**
- a. poor condition
 - b. an ANSI 1002A.1 certified lock box
 - c. legible condition
 - d. a central office

Module 7: Tower Cranes and Derricks

Tower Cranes

Tower cranes present unique issues that are addressed in this section. In general, all provisions of the standard apply to tower cranes unless this section specifies different or additional requirements.

Additional Requirements for Erecting, Climbing, and Dismantling

To reflect industry terminology, "erecting, climbing, and dismantling" are used instead of "assembly/disassembly" when referring to tower cranes. The following requirements apply in addition to those specified in sections 1403-1406:

-)] Tower crane foundations and structural supports (including both the portions of the structure used for support and the means of attachment) must be designed by the manufacturer or a registered professional engineer.
-)] The Assembly/Disassembly (A/D) director must determine that tower crane foundations and structural supports are installed in accord with their design.
-)] The A/D Director must address the backward stability of self-erecting cranes or cranes on traveling or static undercarriages.
-)] Wind must not exceed the speed recommended by the manufacturer or, where the manufacturer does not specify this information, the speed determined by a qualified person.
-)] Towers must be erected plumb to the manufacturer's tolerance and verified by a qualified person. Where the manufacturer



Tower crane foundations and structural supports must be designed by the manufacturer or a registered professional engineer.



Always make sure the tower is erected plumb to the manufacturer's tolerance or at least 1:500.

does not specify plumb tolerance, the crane tower must be plumb to a tolerance of at least 1:500 (approximately 1 inch in 40 feet).

-) On jobsites where more than one fixed jib (hammerhead) tower crane is installed, the cranes must be located such that no crane can come in contact with the structure of another crane. Cranes are permitted to pass over one another.
-) Prior to, and during, all climbing procedures (including inside climbing and top climbing), the employer must comply with all manufacturer prohibitions and have a registered professional engineer verify that the host structure is strong enough to sustain the forces imposed through the braces, brace anchorages, and supporting floors.
-) Equipment must not be erected, dismantled or operated without the amount and position of counterweight and/or ballast in place as specified by the manufacturer or a registered professional engineer familiar with the equipment. The maximum counterweight and/or ballast specified by the manufacturer or registered professional engineer must not be exceeded.
-) The size and location of signs installed on tower cranes must be in accord with manufacturer specifications. Where these are unavailable, a registered professional engineer familiar with the type of equipment involved must approve in writing the size and location of any signs.

Particular Caution Required When Using Synthetic Slings

This requirement appears in section 1404(r) but bears repeating here: when using synthetic slings during erecting, climbing, and dismantling, you must follow the synthetic sling manufacturer's instructions, limitations, specifications and recommendations. Synthetic slings must be protected from abrasive, sharp or acute edges, and configurations that could cause a reduction of the sling's rated capacity, such as distortion or localized compression.



Synthetic slings must be protected from abrasive, sharp or acute edges, and configurations that could cause a reduction of the sling's rated capacity.

Safety Devices

Different safety devices than those specified in section 1415 are required on tower cranes. Those required on tower cranes are:

-)] **boom stops** on luffing boom type tower cranes
-)] **jib stops** on luffing boom type tower cranes if equipped with a jib attachment
-)] **travel rail end stops** at both ends of travel rail
-)] **travel rail clamps** on all travel bogies
-)] **integrally mounted check valves** on all load-supporting hydraulic cylinders
-)] **hydraulic system pressure limiting device**
-)] the following **brakes**, which must automatically set in the event of pressure loss or power failure, are required:
 - o **hoist brake** on all hoists
 - o **swing brake**
 - o **trolley brake**
 - o **rail travel brake**
-)] **deadman control** or forced neutral return control (hand) levers
-)] **emergency stop switch** at the operator's station
-)] **trolley end stops** at both ends of travel of the trolley



Jib stops are required on tower cranes.

Proper operation of these safety devices is required before operations can begin.

Operational Aids

Different operational aids than those specified in [Section 1416](#) are required for tower cranes. Those required on tower cranes are:

-) trolley travel limiting device at both trolley end stops
-) boom hoist limiting device that limits the range of the boom at the minimum and maximum radius
-) anti two-blocking device
-) hoist drum lower limiting device on tower cranes (manufactured after November 8, 2011)
-) load moment limiting device
-) hoist line pull limiting device
-) rail travel limiting device
-) boom hoist drum positive locking device and control
-) boom angle or hook radius indicator readable from the operator's station (required on all luffing boom tower cranes and on hammerhead tower cranes manufactured after November 8, 2011)
-) trolley travel deceleration device
-) boom hoist deceleration device
-) load hoist deceleration device
-) wind speed indicator
-) load indicating device on tower cranes (manufactured after November 8, 2011)



A boom angle is required on all luffing boom tower cranes and hammerhead tower cranes manufactured after November 8, 2011.

As with operational aids on other equipment, tower cranes may be operated for limited amounts of time with malfunctioning aids as long as the temporary alternative measures specified in the standard are taken.

Inspections

Additional inspection requirements for tower cranes are discussed under section 1412 (Inspections).

Derricks

Derricks also present unique issues that are addressed in this section. In general, all provisions of the standard apply to derricks unless this section specifies different or additional requirements.

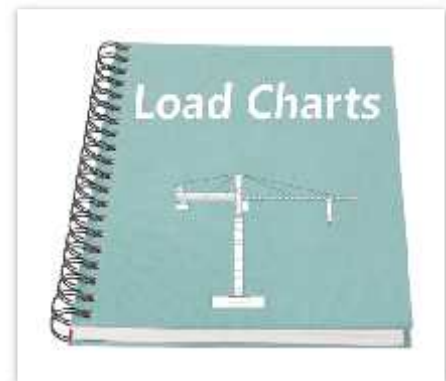
Operator Qualifications

Derrick operators need not meet the operator qualification/certification requirement of section 1427. However, you must train each derrick operator on how to operate the equipment safely.

Load Charts

For permanently installed derricks with fixed lengths of boom, guy, and mast, a load chart must be posted where it is visible to personnel responsible for the operation of the equipment. For derricks that are not permanently installed, the load chart must be readily available at the job site to personnel responsible for operating the equipment. Load charts must contain at least the:

-) rated capacity at corresponding ranges of boom angle or operating radii
-) specific lengths of components to which the rated capacities apply
-) required parts for hoist reeving
-) size and construction of rope (or may be included in the operating manual)



A load chart must be posted where it is visible to personnel responsible for the operation of the equipment.

Construction

Derricks must be constructed to meet all stresses imposed on members and components when installed and operated in accord with the manufacturer's/builder's procedures and within its rated capacity. Load anchoring data developed by the manufacturer or a qualified person must be used.

Specific additional construction requirements are specified for:

-) guy derricks
-) stiffleg derricks
-) gin pole derricks
-) chicago boom derricks

Swingers and Hoists

The boom, swinger mechanisms, and hoists must be suitable for the derrick work intended and must be anchored to prevent displacement from the imposed loads.

Hoists must meet the following requirements:

-) Base mounted drum hoists must meet certain specified requirements of ASME B30.7-2001 ("Base-Mounted Drum Hoists").
-) New hoists must be load tested to a minimum of 110% of rated capacity, but not more than 125% of rated capacity, unless otherwise recommended by the manufacturer. This requirement is met where the manufacturer has conducted the testing.
-) Hoists that have had repairs, modifications, or additions affecting their capacity or safe operation must be evaluated by a qualified person to determine if a load test is necessary. If it is, load testing must be conducted in the manner specified in the standard.



New hoists must be load tested to a minimum of 110% capacity, but not more than 125% rated capacity.

Operational Aids

The operational aids requirements listed in section 1416 apply to derricks except when 1) a boom hoist limiting device (required by section 1416 for other equipment) is not required for derricks, and 2) alternative requirements to those in section 1416 are specified for the following two operational aids:

Boom angle or radius indicator. Such a device is not required, but if the derrick is not equipped with a functioning one, the employer must ensure that either:

-) The boom hoist cable is marked with caution and stop marks. The stop marks must correspond to maximum and minimum allowable boom angles. The caution and stop marks must be in view of the operator or a spotter who is in direct communication with the operator
-) An electronic or other device that signals the operator in time to prevent the boom from moving past its maximum and minimum angles, or automatically prevents such movement, is used

Load weight/capacity device. Derricks manufactured after November 8, 2011 with a maximum rated capacity more than 6,000 pounds must have at least one of the following:

-) load weighing device
-) load moment indicator
-) rated capacity indicator
-) rated capacity limiter

Post-Assembly Approval and Testing

The following requirements apply to new or reinstalled derricks:

-) **Anchorage:** Anchorages, including the structure to which the derrick is attached (if applicable), must be approved by a qualified person.
-) **Functional test:** Prior to initial use, new or reinstalled derricks must be tested by a competent person with no hook load to verify proper operation. This test must include the following:

- o lifting and lowering the hook(s) through the full range of hook travel
- o raising and lowering the boom through the full range of boom travel
- o swinging in each direction through the full range of swing
- o actuating the anti-two-block and boom hoist limit devices (if provided)
- o actuating locking, limiting, and indicating devices (if provided)

) **Load test:** Prior to initial use, new or reinstalled derricks must pass a load test conducted by a competent person. Test loads must be at least 100% and no more than 110% of the rated capacity, unless otherwise recommended by the manufacturer or qualified person, but in no event must the test load be less than the maximum anticipated load. The test must consist of:

- o hoisting the test load a few inches and holding to verify that the load is supported by the derrick and held by the hoist brake(s)
- o swinging the derrick, if applicable, the full range of its swing, at the maximum allowable working radius for the test load
- o booming the derrick up and down within the allowable working radius for the test load
- o lowering, stopping, and holding the load with the brake(s)

) **Test documentation:** The functional and load tests must be documented. The document must contain the date, test results, and name of the tester. The document must be retained until the derrick is retested or dismantled, whichever occurs first. All such documents must be available during the applicable document retention period to all persons who conduct required inspections (see section 1412).

Load Testing Repaired or Modified Derricks

Derricks that have had repairs, modifications, or additions affecting the derrick's capacity or safe operation must be evaluated by a qualified person to determine if a load test is necessary. If it is, load testing must be conducted and documented.

Power Failure Procedures

If power fails during operations, the derrick operator must safely stop operations. This must include setting all brakes or locking devices and moving all clutch and other power controls to the off position.

Jumping

The process of jumping a derrick must be supervised by the Assembly/Disassembly (A/D) director.



Module 7 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. Tower crane foundations and structural supports must be designed by the manufacturer or a _____.
a. qualified person
b. authorized construction engineer
c. registered professional engineer
d. competent person**
- 2. Tower crane equipment must not be erected, dismantled or operated without the specified amount and position of _____.
a. crane personnel
b. counterweight and/or ballast
c. qualified person
d. warning signs**
- 3. Which of the following are safety devices required on tower cranes?
a. Boom and jib stops
b. Boom angle indicator
c. Radius indicator
d. Load moment limiting device**
- 4. For permanently installed derricks with fixed lengths of booms, guys, and masts, _____ must be posted where it is visible to personnel responsible for the operation of the equipment.
a. a safety data sheet
b. a warning sign
c. a load chart
d. operation steps**

- 5. Prior to initial use, new or reinstalled derricks must pass a load test conducted by a competent person. The test loads must be at least _____ of the rated capacity.**
- a. 90%
 - b. 100%
 - c. 150%
 - d. 200%

Module 8: Specialized Cranes and Equipment

Floating Cranes/Derricks and Land Cranes/Derricks on Barges

This section contains supplemental requirements for floating cranes/derricks and land cranes/derricks on barges, pontoons, vessels or other means of flotation (*i.e.*, vessel/flotation device).

The requirements of this section do not apply when using jacked barges when the jacks are deployed to the river, lake, or sea bed and the barge is fully supported by the jacks. Because this equipment is highly specialized and is not used by most construction employers, this course will only address a few of the areas where additional or different requirements are specified for this type of equipment.



Floating Crane.

Inspections

Additional items must be inspected during the shift, monthly, and annual inspections. In addition, every four years, a marine engineer, marine architect, licensed surveyor, or other qualified person who has expertise with respect to vessels/flotation devices must survey the internal portion of the barge, pontoons, vessel, or other means of flotation.

Safety Devices

The following additional safety devices are required for floating cranes and derricks on barges:

-) barge, pontoon, vessel, or other means of flotation list and trim device
-) positive equipment house lock
-) wind speed and direction indicator (if a competent person determines that wind is a factor that needs to be considered)

Working with a Diver

When a crane/derrick is used to lift a diver or divers into and out of the water, it must not be used for any other purpose until all the divers are back on board.

Land Cranes/Derricks on Floatation Devices

The rated capacity must be reduced to take into account the additional sources of instability (list, trim, wave action, and wind) resulting from operating on water. Alternative means of physical attachment and an exception to the requirement for physical attachment are specified.

Equipment Designed for Use on Floatation Devices

Requirements for maximum list, trim, and wind speed are specified. Additional rules to ensure the structural integrity and stability of the equipment apply to employer-made (as opposed to manufacturer-made) equipment.

Overhead & Gantry Cranes

Most overhead and gantry cranes are used in general industry rather than construction work. In some cases, overhead and gantry cranes that are usually used in general industry may engage in construction work when they are used to renovate the facility in which they are installed.

To prevent the same crane from being subject to general industry and construction standards at different times, this section provides that OSHA's General Industry standard (29 CFR 1910.179) applies to an overhead or gantry crane that is **permanently installed in a facility**.

For overhead and gantry cranes that are **not permanently installed in a facility**, this section lists the provisions of this standard that apply.

) Sections 1400 through 1414



When a crane is lifting a diver, it must not be used for any other purpose until all the divers are back on board.



The rated capacity of land cranes/derricks on floatation devices must be reduced to take into account the additional instability.

In addition, instead of the provision on boom free fall found in section 1426, sideboom cranes in which the boom is designed to free fall (live boom) are permitted only if manufactured prior to November 8, 2010. This section also specifies that sideboom cranes mounted on wheel or crawler tractors must meet certain listed requirements of ASME B30.14-2004 ("Side Boom Tractors").

Equipment with a Rated Hoisting/Lifting Capacity of 2,000 Pounds or Less

Although equipment with a capacity of 2,000 pounds or less does not require all of the precautions required for heavier equipment, its operation still presents significant hazards that can cause death or injury. For example, operation near energized power lines requires the same precautions as heavier equipment because the potential for electrocution is the same.

This section lists the provisions of the standard that apply to equipment with a capacity of 2,000 pounds or less and those for which modified requirements apply. The most significant differences are:

-) The requirement for operator qualification/certification in section 1427 does not apply. Instead, the employer must train each operator on the safe operation of the equipment before the operator may operate the equipment.
-) The requirements for shift, monthly, and annual inspections in section 1412 do not apply. However, post-assembly inspections and the wire rope inspections required by section 1413 must be conducted.
-) More limited assembly/disassembly requirements apply.
-) The safety devices and operational aids listed in sections 1415 – 1416 need not be used, except for two-block protection. However, safety devices and operational aids that are part of the original equipment must be maintained in accord with manufacturer procedures.
-) Signal persons must be adequately trained but need not meet the qualification requirements of section 1428.
-) Equipment covered by this section must not be used to hoist personnel.

Module 8 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

- 1. When a crane/derrick is used to lift a diver or divers into and out of the water, it must ____.**
 - a. only be used for hoisting additional equipment
 - b. not be used for any other purpose until all the divers are back on board
 - c. only be used for hoisting non-hazardous loads
 - d. not be used for any other purpose, unless approved by the site supervisor

- 2. When lifting/hoisting equipment with a rated capacity of ____ pounds or less is used, the requirement for operator qualification/certification does not apply.**
 - a. 2000
 - b. 3000
 - c. 4000
 - d. 5000

- 3. Lifting/hoisting equipment rated capacity of 2000 pounds or less must not be used to ____.**
 - a. hoist personnel
 - b. hoist loads within manufacturer specifications
 - c. hoist loads in enclosed areas
 - d. hoist loads away from power lines

- 4. Which additional safety device is required for floating cranes and derricks on barge?**
 - a. rain fall indicator
 - b. elevation indicator
 - c. depth indicator
 - d. wind speed indicator

5. Every four years, a _____ who has expertise with respect to vessels/flotation devices must survey the internal portion of the barge, pontoons, vessel, or other means of flotation.
- a. barge supervisor
 - b. qualified person
 - c. competent person
 - d. signal person

Glossary

Most of these definitions are in the 1926.1401 standard. A few other key terms have been added to this list to assist with clarification.

Assembly/Disassembly - The assembly and/or disassembly of equipment covered under this standard. With regard to tower cranes, “erecting and climbing” replaces the term “assembly,” and “dismantling” replaces the term “disassembly.” Regardless of whether the crane is initially erected to its full height or is climbed in stages, the process of increasing the height of the crane is an erection process.

A/D director (Assembly/Disassembly director) - An individual who meets this subpart’s requirements for an A/D director, irrespective of the person’s formal job title or whether the person is non-management or management personnel.

Assembly/Disassembly Supervisor (“A/D Supervisor”) - An individual who meets this Section's requirements for an A/D supervisor, irrespective of the person's formal job title or whether the person is non-management or management personnel.

Attachments - Any device that expands the range of tasks that can be done by the equipment. Examples include, but are not limited to: An auger, drill, magnet, pile-driver, and boom-attached personnel platform.

Audible signal - A signal made by a distinct sound or series of sounds. Examples include, but are not limited to, sounds made by a bell, horn, or whistle.

Bird Caging - the twisting of fiber or wire rope in an isolated area in the opposite direction of the rope lay, thereby causing it to take on the appearance of a bird cage.

Blocking (also referred to as “cribbing”) - Wood or other material used to support equipment or component(s) and distribute loads to the ground. It is typically used to support lattice boom sections during assembly/disassembly and under outrigger and stabilizer floats.

Boatswain's Chair - A single-point adjustable suspension scaffold consisting of a seat or sling (which may be incorporated into a full body harness) designed to support one employee in a sitting position.

Bogie - “travel bogie,” which is defined below.

Boom (equipment other than tower crane) - An inclined spar, strut, or other structural member that supports the upper hoisting tackle on a crane or derrick. Typically, the length and vertical angle of the boom can be varied to achieve increased height or height and reach when lifting

loads. Booms can usually be grouped into general categories of hydraulically extendible, cantilevered type, latticed section, cable supported type or articulating type.

Boom - if the “boom” (i.e., principle horizontal structure) is fixed, it is referred to as a jib; if it is moveable up and down, it is referred to as a boom.

Boom Angle Indicator - A device that measures the angle of the boom relative to horizontal.

Boom Hoist Limiting Device - A device that disengages boom hoist power when the boom reaches a predetermined operating angle. It also sets brakes or closes valves to prevent the boom from lowering after power is disengaged. (This includes boom hoist disengaging devices, boom hoist shut-off, boom hoist disconnects, boom hoist hydraulic reliefs, boom hoist kick-outs, automatic boom stop devices, or derricking limiters).

Boom Length Indicator - The length of the permanent part of the boom (such as ruled markings on the boom) or, as in some computerized systems, the length of the boom with extensions/attachments.

Boom Stop - A device that restricts the boom from moving a certain maximum angle and toppling over backward (this includes boom stops, belly straps with struts/standoff, telescoping boom stops, attachment boom stops, and backstops).

Boom Suspension Systems - A system of pendants, running ropes, sheaves, and other hardware which supports the boom tip and controls the boom angle.

Builder - The builder/constructor of equipment.

Center of Gravity - The point in an object around which its weight is evenly distributed, such that if a support is placed under that point, the object could balance on the support.

Certified welder - A welder who meets nationally recognized certification requirements applicable to the task being performed.

Certified Welder - A welder who meets certification requirements applicable to the task being performed, in accordance with the American Welding Society or the American Society of Mechanical Engineers.

Climbing - The process in which a tower crane is raised to a new working height, either by adding additional tower sections to the top of the crane (top climbing), or by a system in which the entire crane is raised inside the structure (inside climbing).

Come-A-Long - A mechanical device typically consisting of a chain or cable attached at each end that is use to facilitate movement of materials through leverage.

Competent Person - A person who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization from his employer to take prompt corrective measures to eliminate them.

Controlled Load Lowering - Lowering a load by means of a mechanical hoist drum device that allows a hoisted load to be lowered with maximum control using the gear train or hydraulic components of the hoist mechanism. Controlled load lowering requires the use of the hoist drive motor, rather than the load hoist brake, to lower the load.

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

Counterweight - A weight used to supplement the weight of equipment in providing stability for lifting loads by counterbalancing those loads.

Crane Level Indicator - A device for determining true horizontal.

Crane, Articulating - A crane whose boom consists of a series of folding, pin-connected structural members, typically manipulated to extend or retract by power from hydraulic cylinders.

Crane, Assist - A crane used to assist in assembling or disassembling a crane.

Crane, Crawler - Equipment that has a type of base mounting which incorporates a continuous belt of sprocket driven track.

Crane, Floating (or Floating Derrick) - Equipment designed by the manufacturer (or employer) for marine use by permanent attachment to a barge, pontoons, vessel or other means of flotation.

Crane, Land (or Land Derrick) - Equipment not originally designed by the manufacturer for marine use by permanent attachment to barges, pontoons, vessels, or other means of flotation.

Crane, Locomotive - A crane mounted on a base or car equipped for travel on a railroad track.

Crane, Mobile - A lifting device incorporating a cable suspended latticed boom or hydraulic telescopic boom designed to be moved between operating locations by transport over the road. These are referred to in Europe as a crane mounted on a truck carrier.

Crane, Overhead and Gantry - Includes overhead/bridge cranes, semigantry, cantilever gantry, wall cranes, storage bridge cranes, launching gantry cranes, and similar equipment, irrespective of whether it travels on tracks, wheels or other means.

Crane, Portal - A type of crane consisting of a rotating upperstructure, hoist machinery, and boom mounted on top of a structural gantry which may be fixed in one location or have travel capability. The gantry legs or columns usually have portal openings in between to allow passage of traffic beneath the gantry.

Crane, Side-Boom - A track-type or wheel-type tractor having a boom mounted on the side of the tractor, used for lifting, lowering, or transporting a load suspended on the load hook. The boom or hook can be lifted or lowered in a vertical direction only.

Crane, Tower - A type of lifting structure that utilizes a vertical mast or tower to support a working boom (jib) suspended from the working boom. While the working boom may be fixed horizontally or have luffing capability, it can always rotate about the tower center to swing loads. The tower base may be fixed in one location or ballasted and moveable between locations.

Critical lift - A crane lifting operation involving an exceptional level of risk due to factors such as load weight, lifting height, procedural complications, or proximity to situational hazards. Critical lifts are often identified by conditions exceeding a specified percentage of the crane's rated capacity (75%); however, any more complex issues may be involved.

Crossover Points - The locations on a wire rope which is spooled on a drum where one layer of rope climbs up on and crosses over the previous layer. This takes place at each flange of the drum as the rope is spooled on the drum, reaches the flange, and begins to wrap back in the opposite direction.

Dedicated Channel - A line of communication assigned by the employer who controls the communication system to only one signal person and crane/derrick or to a coordinated group of cranes/derricks/signal person(s).

Dedicated Pile-Driver - A machine that is designed to function exclusively as a pile-driver. These machines typically can both hoist the material that will be pile-driven and pile-drive the material.

Dedicated Spotter (power lines) - A person who meets the requirements of § 1926.1428 (signal person qualifications) and whose sole responsibility is to watch the separation between the power line and the equipment, the load line and the load (including rigging and lifting

accessories), and ensure through communication with the operator that the applicable minimum approach distance is not breached.

Directly Under the Load - A part or all of an employee is directly beneath the load.

Drum Rotation Indicator - A device on a crane or hoist which indicates in which direction and at what relative speed a particular hoist drum is turning.

Electrical Contact - When a person, object, or equipment makes contact or comes in close proximity with an energized conductor or equipment that allows the passage of current.

Employer-Made Equipment - Equipment designed and built by an employer for its own use.

Encroachment - When any part of the crane, load line or load (including rigging and lifting accessories) breaches a minimum clearance distance that this Section requires to be maintained from a power line.

Equipment Criteria - Instructions, recommendations, limitations and specifications.

Fall Protection Equipment - Guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems.

Fall Restraint System - A fall protection system that prevents the user from falling any distance. The system is comprised of either a body belt or body harness, along with an anchorage, connectors and other necessary equipment. The other components typically include a lanyard and may also include a lifeline and other devices.

Fall zone - The area (including but not limited to the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended materials could fall in the event of an accident.

Fall Zone - The area (including the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended materials could fall in the event of an accident.

Flange Points - A point of contact between rope and drum flange where the rope changes layers.

Free Fall (of the load line) - When only the brake is used to regulate the descent of the load line (the drive mechanism is not used to drive the load down faster or retard its lowering).

Free Surface Effect - Uncontrolled transverse movement of liquids in compartments that reduce a vessel's transverse stability.

Functional testing - The testing of a crane, typically done with a light load or no load, to verify the proper operation of a crane's primary function, i.e. hoisting, braking, booming, swinging, etc. A functional test is contrasted to testing the crane's structural integrity with heavy loads.

Hoist - A mechanical device for lifting and lowering loads by winding rope onto or off of a drum.

Hoisting - The act of raising, lowering or otherwise moving a load in the air with equipment covered by this Section. As used in this Section, "hoisting" can be done by means other than wire rope/hoist drum equipment.

Insulating Link/Device - An insulating device approved by a Nationally Recognized Testing Laboratory, as that term is defined in 29 CFR 1910.7(b).

Jib Stop (a.k.a. Jib Backstop) - Is similar to a boom stop but is for a fixed or luffing jib.

List - The angle of inclination about the longitudinal axis of a barge, pontoons, vessel or other means of flotation.

Load - The weight of the object being lifted or lowered, including the weight of the load-attaching equipment such as the load block, ropes, slings, shackles, and any other ancillary attachment.

Load Moment Indicator (also referred to as Rated Capacity Indicator) - A system which aids the equipment operator by sensing the overturning moment on the equipment, i.e. load X radius. It compares this lifting condition to the equipment's rated capacity, and indicates to the operator the percentage of capacity at which the equipment is working. Lights, bells, or buzzers may be incorporated as a warning of an approaching overload condition.

Load Moment Limiter (also referred to as Rated Capacity Limiter) - A system which aids the equipment operator by sensing the overturning moment on the equipment, i.e. load X radius. It compares this lifting condition to the equipment's rated capacity, and when the rated capacity is reached, it shuts off power to those equipment functions which can increase the severity of loading on the equipment, e.g., hoisting, telescoping out, or luffing out. Typically, those functions which decrease the severity of loading on the equipment remain operational, e.g., lowering, telescoping in, or luffing in.

Luffing Jib Limiting Device - Is similar to a boom hoist limiting device, except that it limits the movement of the luffing jib.

Marine Hoisted Personnel Transfer Device - A device, such as a "transfer net," that is designed to protect the employees being hoisted during a marine transfer and to facilitate rapid entry

into and exit from the device. Such devices do not include boatswain's chairs when hoisted by equipment covered by this Section.

Marine Worksite - A construction worksite located in, on or above the water.

Moving Point-To-Point - The times during which an employee is in the process of going to or from a work station.

Multi-Purpose Machine - A machine that is designed to be configured in various ways, at least one of which allows it to hoist (by means of a winch or hook) and horizontally move a suspended load. For example, a machine that can rotate and can be configured with removable tongs (for use as a forklift) or a winch pack, a jib with a hook at the end, or jib used in conjunction with a winch. When configured with the tongs, it is not covered with this Section. When configured with a winch pack, a jib with a hook at the end, or jib used in conjunction with a winch, it is covered under this Section.

Nationally recognized accrediting agency - is an organization that, due to its independence and expertise, is widely recognized as competent to accredit testing organizations. Examples of such accrediting agencies include, but are not limited to, the National Commission for Certifying Agencies and the American National Standards Institute.

Nationally Recognized Accrediting Agencies - An organization that is accredited by the National Commission for Certifying Agencies (NCCA) or the American National Standards Institute (ANSI) to establish standards for and assess the formal activities of testing organizations applying for or continuing their accreditation.

Nonconductive - Because of the nature and condition of the materials, used, and the conditions of use (including environmental conditions and condition of the material), the object in question has the property of not becoming energized (that is, it has high dielectric properties offering a high resistance to the passage of current under the conditions of use).

Operational Aids - Devices that assist the operator in the safe operation of the crane by providing information or automatically taking control of a crane function. These include the devices listed in 13 NCAC 07F .0917, §1926.1416 ("listed operational aids").

Operational Controls - Levers, switches, pedals and other devices for controlling equipment operation.

Operator – A person who is operating the equipment.

Pendants - Includes both wire and bar types. Wire type pendants mean a fixed length of wire rope with mechanical fittings at both ends for pinning segments of wire rope together. Bar type

pendants mean that instead of a wire rope, a bar is used. Pendants are typically used in a latticed boom crane system to easily change the length of the boom suspension system without completely changing the rope on the drum when the boom length is increased or decreased.

Personal Fall Arrest System - A system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, and a body harness and may include a lanyard, deceleration device, lifeline, or a combination of these.

Power Lines - Electrical distribution and electrical transmission lines.

Proximity Alarm - A device that provides a warning of proximity to a power line that has been approved by a Nationally Recognized Testing Laboratory, as that term is defined in 29 CFR 1910.7(b).

Qualified Evaluator (not a third party) - A person employed by the signal person's employer who has demonstrated to his employer that he/she is competent in accurately assessing whether individuals meet the Qualification Requirements in this Section for a signal person.

Qualified Evaluator (third party) - An independent entity that has demonstrated to the employer its competence to accurately assess whether individuals meet the Qualification Requirements in this Section for a signal person.

Qualified Person - A person who, by possession of a degree, certificate, or professional standing, or who by knowledge, training and experience, successfully demonstrated to their employer an ability to solve/resolve problems relating to the subject matter, the work, or a project.

Qualified Rigger - A rigger who meets the criteria for a qualified person.

Range control limit device - is a device that can be set by an equipment operator to warn that the boom or jib tip is at a plane or multiple planes.

Range Control Warning Device - A device that can be set by an equipment operator to warn that the boom or jib tip is at a plane or multiple planes.

Rated Capacity - The maximum working load permitted by the manufacturer under specified working conditions. Such working conditions typically include a specific combination of factors such as equipment configuration, radii, boom length, and other parameters of use.

Repetitive Pickup Points - When an operation involves the rope being used on a single layer and being spooled repetitively over a portion of the drum.

Rotation Resistant Rope - A type of wire rope construction that reduces the tendency of a rope to rotate about its axis under load. Usually, this consists of an inner system of core strands laid in one direction covered by an outer system of strands laid in the opposite direction.

Running Wire Rope - A wire rope that moves over sheaves or drums.

Runway - A firm, level surface designed, prepared and designated as a path of travel for the weight and configuration of the crane being used to lift and travel with the crane suspended platform. An existing surface may be used as long as it meets these criteria.

Special Hazard Warnings - Warnings of site-specific hazards (for example, proximity of power lines).

Stability (flotation device) - The tendency of a barge, pontoons, vessel or other means of flotation to return to an upright position after having been inclined by an external force.

Standard Method - The hand signals established in ASME B30.3-2004 and ASME B30.5-2004.

Standing Wire Rope - A supporting wire rope which maintains a constant distance between the points of attachment to the two components connected by the wire rope.

Tagline - A rope (usually fiber) attached to a lifted load for purposes of controlling load spinning and pendular motions or used to stabilize a bucket or magnet during material handling operations.

Tender - An individual responsible for monitoring and communicating with a diver.

Tilt Up or Tilt Down Operation - Raising or lowering a load from the horizontal to vertical or vertical to horizontal.

Travel Bogie (also referred to as Bogie) - An assembly of two or more axles arranged to permit vertical wheel displacement and equalize the loading on the wheels.

Trim - The angle of inclination about the transverse axis of a barge, pontoons, vessel or other means of flotation.

Two Blocking - A condition in which a component that is uppermost on the hoist line such as the load block, hook block, overhaul ball, or similar component, comes in contact with the boom tip, fixed upper block or similar component. This binds the system, and continued application of power can cause failure of the hoist rope or other component.

Unavailable Procedures - Procedures that are no longer available from the manufacturer, or have never been available from the manufacturer.

Upperworks - (also referred to as Superstructure or Upperstructure): The revolving frame of equipment on which the engine and operating machinery are mounted along with the operator's cab. The counterweight is typically supported on the rear of the upperstructure and the boom, or another front end attachment is mounted on the front.

Wire rope - means a flexible rope constructed by laying steel wires into various patterns of multi-wired strands around a core system to produce a helically wound rope.

Endnotes

1. Occupational Safety and Health Administration. (2011). Small Entity Compliance Guide for Final Rule for Cranes and Derricks in Construction. Retrieved from:
https://www.osha.gov/cranes-derricks/small_entity.html
2. Occupational Safety and Health Administration. (2010). 1926.CC Cranes & Derricks in Construction. Retrieved from:
https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=13
3. N.C. Department of Labor. (2010). A Guide to Cranes and Derricks. Retrieved from:
www.nclabor.com/osh/etta/indguide/ig20.pdf