Part 10.
Cranes and Derricks

Student Materials
MTI Level Two Compliance Course
Consultation Education and Training Division
Michigan Occupational Safety and Health Administration
Michigan Department of Labor and Economic Opportunity
www.michigan.gov/miosha
517-284-7720

(Revised 08/19)
Welcome

“Every day in America, 13 people go to work and never come home. Every year in America, nearly 4 million people suffer a workplace injury from which some may never recover. These are preventable tragedies that disable our workers, devastate our families, and damage our economy. American workers are not looking for a handout or a free lunch. They are looking for a good day’s pay for a hard day’s work. They just want to go to work, provide for their families, and get home in one piece.”

– Former Secretary of Labor Hilda Solis

Objectives

• Recognize Hazards of Cranes in Construction.

• Demonstrate understanding of Assembly/Disassembly, Inspection, Operational rules, Power line rules.

• Interpret Training Requirements for Operators, Riggers, Signal Persons, and all other personnel.

• Practice creating procedures that support compliance with Part 10.

Module One:
Introduction, Objectives, and Scope

Federal OSHA Standard

• 1926 Subpart CC – Cranes and Derricks in Construction
• Effective Nov 8, 2010
• Major revision to the old standard
• Revised Nov 10, 2018
  – Operators must be certified by Dec 10, 2018.
  – Operators must be evaluated by February 7, 2019.
  – See FAQ handout.
  – More on this later.

MIOSHA’s Equivalent Standard

• Construction Safety Standard Part 10: Cranes and Derricks
• Same as the Federal OSHA standard
• 3/15/2016 revised to remove excavators, elevators, hoists, and helicopters. Those are now in Part 15.
• 12/12/2018 changed MIOSHA rule numbers to Fed OSHA 1926 rule numbers.
• MIOSHA has not adopted OSHA’s Nov, 10, 2018 revisions as of Feb. 2019.
Interim Policy

- Until MIOSHA adopts the OSHA revisions, enforcement will follow the interim compliance guidance that OSHA provided.
- MIOSHA working to update our rules in Part 10. Cranes and Derricks, to mirror Federal OSHA.
- Quick summary of Interim Policy: Operators must be certified by type of crane as of 11/10/18. No other changes until MIOSHA changes its rules.

Interim Policy

U.S. Department of Labor Provides Interim Compliance Guidance For Crane Operators

- OSHA has issued guidance on how to comply with crane operator certification requirements until the new final rule becomes effective.
- OSHA is preparing to publish a final rule, but OSHA’s existing certification requirements will take effect on November 10, 2018, because OSHA’s final rule will not become effective prior to that date. The existing rule requires certification by crane type and lifting capacity. However, until the effective date of the new rule, once it is published, OSHA will accept operator certifications issued by type only, or by type and capacity.

NIOSH/CPWR Information in following slides

- Mike McCann: mmccann@cpwr.com
- Electronic Library of Construction Safety and Health (eLCOSH): www.miosh.org
- CPWR – The Center for Construction Research and Training: www.cpwr.com

CPWR – The Center for Construction Research and Training — is the research arm of the Building and Construction Trades Department, AFL-CIO. This research was funded as part of a grant with CPWR from NIOSH. The research is solely the responsibility of the authors and does not necessarily represent the official views of NIOSH.

Crane-Related Deaths in Construction 1992-2006

This is the most current study available as of 2019.

- 632 crane-related deaths
  - An average of 42 deaths/year
- 18 multiple-death incidents involving a total of 40 deaths


Discussion questions:
- Is there any reduction in crane fatalities over time?
- Do you think that we need to change something to decrease fatalities or will it just get better on its own?

Trades of Workers Who Died

Trade of Workers Who Died

Crane-Related Deaths in Construction, 1992-2006

- Construction laborers: 195 deaths
- Heavy equipment operators*: 60 deaths
- Supervisors/Managers/Admn: 36 deaths
- Ironworkers: 42 deaths
- Mechanics: 41 deaths
- Other trades**: 171 deaths
- Total: 632 deaths

* Includes 62 crane and tower operators, 21 operating engineers and other construction equipment operators, and 7 hoist and winch operators.
** Includes 24 welders, 21 electrical workers, 21 mechanics, 17 sheet metal workers, 14 truck drivers, and 73 others.

Source: BLS CFOI
Causes of Crane-Related Deaths in Construction, 1992-2006

<table>
<thead>
<tr>
<th>Cause</th>
<th>Number of Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead power line electrocutions</td>
<td>157 deaths</td>
</tr>
<tr>
<td>Crane collapse</td>
<td>69 deaths</td>
</tr>
<tr>
<td>Struck by crane booms/jibs</td>
<td>112 deaths</td>
</tr>
<tr>
<td>Falls*</td>
<td>56 deaths</td>
</tr>
<tr>
<td>Struck by crane or crane parts</td>
<td>47 deaths</td>
</tr>
<tr>
<td>Caught/struck by crane loads</td>
<td>10 deaths</td>
</tr>
<tr>
<td>Other causes***</td>
<td>43 deaths</td>
</tr>
<tr>
<td><strong>Total deaths: 632</strong></td>
<td></td>
</tr>
</tbody>
</table>

* Included 64 struck by falling booms/jibs
** Included 21 falls from cranes, 9 falls from crane baskets, 8 from crane loads.
***Other causes included 9 highway incidents.
(Source: BLS CFOI data)

Overhead Power Line Electrocutons

- **152 Worker on foot touching/guiding load**
- **25% Operating crane**
- **14% Worker not involved with crane, e.g., walking under load**
- **13% Flagging/directing**
- **32% Loading/unloading**
- **14% Other crane-related work**
- **7% Operating crane**

1992 - 2006
Number of Deaths: 157
(Source: BLS CFOI)

Struck By Crane Loads

- **1992 - 2006 Number of Deaths: 132**
- **132 Struck by crane loads**
- **24% Operating crane**
- **32% Flagging/directing**
- **32% Loading/unloading**
- **15% Loading/unloading**
- **7% Operating crane**

(Source: BLS CFOI)

Mobile Cranes

At least 71% of all crane-related incidents involved mobile cranes

Mobile cranes were involved in:
- 80 of 95 (84%) of overhead power line incidents
- 37 of 59 (63%) of crane collapses
- 35 of 59 (60%) of struck by boom/jib incidents

Part 10 Scope

1001 (a)(1) This standard applies to power operated equipment, when used in construction, that can:
1. Hoist,
2. Lower
3. And horizontally move a suspended load.

Scope: Included List

Such equipment includes, but is not limited to, any of the following:
- Articulating cranes (such as knuckle-boom cranes)
- Crawler cranes
- Floating cranes
- Cranes on barges
- Locomotive cranes
- Mobile cranes
  - Wheel-mounted
    - Rough-ground
  - All-terrain
  - Commercial truck-mounted
  - Boom truck cranes
Scope: Included List

- Industrial cranes, such as carry-deck cranes
- Dedicated pile drivers
- Service/mechanic trucks with a hoisting device
- Crane on a monorail
- Tower cranes

Scope: Included List

- Pedestal cranes
- Portal cranes
- Overhead and gantry cranes
- Straddle cranes
- Side-boom cranes
- Derricks
- Variations of equipment listed.

Scope: Attachments

1001 (2) This standard applies to equipment included in subrule (1) of this rule when used with attachments. These attachments, whether crane-attached or suspended include, but are not limited, to any of the following:

- (a) Hooks
- (b) Magnets
- (c) Grapples

Scope: Attachments 1001 (2)

- (d) Clamshell buckets
- (e) Orange peel buckets
- (f) Concrete buckets
- (g) Drag lines
- (h) Personnel platforms
- (i) Augers or drills
- (j) Pile driving equipment

Scope: Included List

1001 (1)(g) Multi-Function Machines when configured to hoist and lower by means of a winch or hook and horizontally move a suspended load.

Specific Exclusions

1001 (3)(b) Exclusions include, but are not limited to:

- (i) Power shovels
- (ii) Excavators
- (iii) Wheel loaders
- (iv) Backhoes
- (v) Loader backhoes
- (vi) Track loader

This machinery is also excluded when used with chains, slings, or other rigging to lift suspended loads.
Specific Exclusions

- 1001(3)(d) Digger derricks
- 1001 (3)(f) – (o), gantry systems, stacker cranes, mechanic’s truck, come-a-long, chainfalls, dedicated drilling rigs, ginpoles used for erecting communication towers, tree trimming and removal work, roustabouts
- 1001 (3)(h) Powered industrial trucks (except when using a winch and hook)

Specific Exclusions

1001 (3)(e) Machinery originally designed as vehicle-mounted aerial devices for lifting personnel and self-propelled elevating work platforms.

Specific Exclusions

1001 (3)(p)(i) Articulating/knuckle-boom truck cranes that deliver material to a construction site when used to transfer materials from the truck crane to the ground, without arranging the materials in a particular sequence for hoisting.

Specific Exclusions

1001 (3)(p)(ii) Articulating/knuckle-boom truck cranes that deliver material to a construction site when the crane is used to transfer building supply sheet goods from the truck onto a structure, using a fork and cradle at the end of the boom, but only when the truck is equipped with a properly functioning automatic overload prevention device. Includes: sheetrock, plywood, bags of cement, packages of roofing shingles, rolls of roofing felt.

Types of Cranes

- CRANES ON BARGES
- MOBILE CRANE
- FLOATING CRANE
- TOWER CRANE
- LOCOMOTIVE CRANE

Types of Cranes

- SERVICE TRUCK CRANE
- PEDESTAL CRANE
- OVERHEAD GANTRY
- DEDICATED PILE DRIVER
Module Two: Assembly / Disassembly

Definition

“Assembly and Disassembly” means the assembly, disassembly, or both, of equipment covered under this standard. With regard to tower cranes, this includes “climbing” and “dismantling.”

All cranes require some assembly and disassembly, even if that is just determining where to put the crane and deploying the outriggers.

Assembly / Disassembly Hazards

- Electrical hazards.
- Crane setup, level and ground conditions.
- Struck by.
- Overloading knowing the weights and utilizing the load charts properly.
- Underground utilities not identified.
- Working within the swing radius.

A/D Hazards: NYC Tower Crane 2008
1926.1402 (b) The equipment must not be assembled or used unless ground conditions are firm, drained, and graded to a sufficient extent so that, in conjunction (if necessary) with the use of supporting materials, the equipment manufacturer's specifications for adequate support and degree of level of the equipment are met.

1926.1402 (c) The controlling entity shall do both of the following:
• (1) Ensure ground preparations necessary to meet the (ground condition) requirements
• (2) Inform the user of the equipment and the operator of the location of hazards beneath the equipment set-up area;
  — Voids,
  — Tanks
  — Utilities
  — Hazards are identified in documents, such as site drawings, as-built drawings, and soil analyses
Qualified Person is Needed

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Loose Firm</th>
<th>Compact Firm</th>
<th>Compact Sand</th>
<th>Compact gravel</th>
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</thead>
<tbody>
<tr>
<td>Clay</td>
<td>13 psi</td>
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<td>54 psi</td>
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<tr>
<td>Silt</td>
<td>27 psi</td>
<td>33 psi</td>
<td>40 psi</td>
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</tr>
<tr>
<td>Sand-Fine, Silty, or with trace of Clay compact</td>
<td>27 psi</td>
<td>33 psi</td>
<td>40 psi</td>
<td>54 psi</td>
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<tr>
<td>Sand-Fine to Medium coarse</td>
<td>40 psi</td>
<td>60 psi</td>
<td>81 psi</td>
<td></td>
</tr>
<tr>
<td>Gravel – Sand and Gravel</td>
<td>54 psi</td>
<td>81 psi</td>
<td>110 psi</td>
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PSI = pounds per square inch

If Operators Do Not Do the Math, Are They Just Guessing and Hoping?

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PSI = Pounds per square inch

Based on the crane manual and the weight of material, you know you will put 45,000 pounds of pressure on an outrigger.

The soil on site is sand. We are not sure how coarse or how compact?

What size cribbing or pads do you need?
Do the math

Select the weakest sand (27 psi), since we do not know.

45,000 lbs / 27 psi

Convert the formula:
45000 / 27 psi = 1,667 sq. inches

What size pads do you need?
2' x 2' = 24" x 24" = 576 sq. inches
3' x 3' = 36" x 36" = 1296 sq. inches
4' x 4' = 48" x 48" = 2304 sq. inches

We will need 4' x 4' pads.

<table>
<thead>
<tr>
<th>Ground Conditions Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cracks in the asphalt/concrete paving? Have there been any new patches?</td>
</tr>
<tr>
<td>• Who evaluated the ground conditions?</td>
</tr>
<tr>
<td>• Is it firm and drained?</td>
</tr>
<tr>
<td>• Is the crane set up on previously disturbed soil?</td>
</tr>
<tr>
<td>• Over utilities or vaults or near new buildings?</td>
</tr>
<tr>
<td>• What type of soil is present?</td>
</tr>
<tr>
<td>• Does the crane operators manual give any direction for set up?</td>
</tr>
</tbody>
</table>

Are we sure that the sewer vault to the right does not extend under this outrigger. Are we creating pressure on the wall of the sewer vault by being so close?

Is the concrete strong enough? Will the outrigger fail if it is not fully supported?

Assembly / Disassembly

Rule 1926.1403
Two options:

(a) Follow manufacturer procedures
   or

(b) Employer procedures
   - follow 1926.1406, procedures developed by qualified person
Assembly / Disassembly

1926.1404 (h) A/D director shall address the following hazards:

- (1) Site and ground bearing conditions
- (3) Blocking material & location
- (4) Verify assist crane loads
- (5) (6) Pick points & center of gravity of the load
- (7) Stability upon pin removal
- (8) Snagging
- (9) Struck by hazard from counterweights
- (10) Boom hoist brake failure
- (11) Loss of backward stability
- (12) Wind speed and weather

Also:

- 1404 (j) Cantilevered boom sections
- 1404 (k) Weight of components
- 1404 (m) Components and configuration
- 1404 (c) Shipping pins
- 1404 (p) Pile driving
- 1404 (c) Outriggers and stabilizers
- 1404 (r) Rigging

Post-assembly Inspection

1926.1412(c)(1) Upon completion of assembly, the equipment shall be inspected by a qualified person.

Activity One: A/D Policy

With a partner, pick a crane type you are familiar with.

Outline A/D company policy items.

- Think about the entire process from before A/D begins through completion.
- Consider training, documentation, planning, oversight, review, etc.
- Think about the checks and balances you can put in place to ensure that you don’t have failures.
- Share with class.

15 minutes

Module Three: Inspections

Inspections: Objectives

Explain MIOSHA crane inspection requirements.
- Examine all inspection documentation.
- Determine compliance with crane and wire rope inspections.
- Recognize common violations [hazards] of MIOSHA requirements regarding crane inspections.
What Just Happened?

Hazards of Not Doing Inspections Each Shift

- Iowa, July 2000
- Erecting a water tower
- Outrigger set close to new foundation
- Poor ground conditions generally

Inspections: Manufacturer’s Procedures

- 1926.1412 (j) Any part of a manufacturer’s procedures regarding inspections that relate to safe operation that is more comprehensive or has a more frequent schedule of inspection than the requirements of this rule shall be followed.
- In other words, before doing ANY inspection, check with the manufacturer to determine if they have specific inspection procedures. Follow those if more stringent than MISHA.

Activity Two: Types of Inspections Required

<table>
<thead>
<tr>
<th>Type</th>
<th>Inspector Qualifications</th>
<th>Documented?</th>
<th>What to Inspect?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Assembly</td>
<td>Qualified person</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shift (Daily)</td>
<td>Competent person</td>
<td></td>
<td></td>
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<tr>
<td>Monthly</td>
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<tr>
<td>Annual</td>
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<tr>
<td>Modifications</td>
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<tr>
<td>Repairs or Adjustments</td>
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<tr>
<td>Severe Service</td>
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</tbody>
</table>

Inspector Qualifications

**Qualified person defined:**
A person who, through attainment of a recognized degree or certificate of professional standing or by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

**Competent person defined:**
A person who is trained, experienced, and capable of identifying an existing or potential hazard in surroundings, or under working conditions, that are hazardous or dangerous to an employee and who has the authority and knowledge to take prompt corrective measures to eliminate the hazards.
Post-Assembly Inspection

• 1926.1412 (c)(1) Upon completion of assembly, the equipment must be inspected by a qualified person to assure that it is configured in accordance with manufacturer equipment criteria.

• Simply stated: Somebody qualified verifies that the crane is put together properly. This requires documents from the manufacturer that specify appropriate configurations and assembly details (e.g. bolt torque).

• 1926.1412 (c)(3) Equipment shall not be used until an inspection under this rule demonstrates that the equipment is configured in accordance with the applicable criteria.

Shift Inspections

1926.1412 (d) A competent person must:

• Begin a visual inspection prior to each shift.

• Complete the inspection before or during that shift.

• Observation for apparent deficiencies.

• Determinations made in conducting the inspection must be reassessed in light of observations made during operation.

—Example: everything seemed fine, but now there is a screeching sound whenever the boom is lowered.

Shift Inspections: Deficiencies Found

• 1926.1412 (d)(2) If any deficiency, an immediate determination must be made by the competent person as to whether the deficiency constitutes a safety hazard. If the deficiency is determined to constitute a safety hazard, the equipment must be taken out of service until it is corrected. See 1926.1417

“Safety Devices” and “Operational Aids”

• Safety Device defined: A device used to prevent the unwanted or unsafe operation of a piece of equipment.

• 1926.1415 Examples:
  — Integral holding device or check valve on hydraulic outrigger jacks / stabilizers
  — Crane level indicator
  — Boom stops and jib stops
  — Locks on foot pedal brakes
  — Horn
  — Rail clamps on rails
1926.1415 (a) Safety Devices (more detail)

- **1926.1415(a) Safety devices.** The following safety devices are required:
  - (1) Crane level indicator
    - (i) either built into the equipment or is available on the equipment.
    - (ii) malfunctioning built‐in crane level indicator must be tagged‐out or removed. Malfunctioning removable crane level indicator must be removed.
  - (2) Boom stops, except for derricks and hydraulic booms.
  - (3) Jib stops (if a jib is attached).
  - (4) Foot pedal brakes must have locks.
  - (5) Hydraulic outrigger jacks and stabilizer jacks must have an integral holding device/check valve.
  - (6) Equipment on rails must have rail clamps and rail stops.
  - (7) Horn
    - (i) either built in or is on the equipment and immediately available to the operator.
    - (ii) If a built‐in horn is not working properly, it must be tagged‐out or removed. Malfunctioning removable horn must be removed.

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1926.1415 (a) Safety Devices (rules for use)

- **1926.1415(b)** Must not operate unless all of the devices are in proper working order.
- If a device stops working properly, the operator must safely stop operations.
- If any of the listed devices are not in proper working order, the equipment must be taken out of service and operations must not resume until the device is again working properly.
- See 1926.1417 (Operation). Alternative measures are not permitted to be used.

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“Safety Devices” and “Operational Aids”

- **Operational Aid defined:** Devices that assist the operator in the safe operation of the crane by providing information or automatically taking control of a crane function.
- **1926.1416 Examples:**
  - Boom angle indicator
  - Luffing jib limiting device
  - Anti two-block device
  - Boom length indicator
  - Load weighing device

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1926.1416 Operational Aids General

- (a) Required on all equipment, unless otherwise specified.
- (b) Operations must not begin unless the listed operational aids are in proper working order, except when being repaired, the employer uses the specified temporary alternative measures. Time periods permitted for repair are specified in paragraphs (d) and (e) of this section. More protective alternative measures specified by the crane/derrick manufacturer, if any, must be followed.
- (c) If a listed operational aid stops working properly during operations, the operator must safely stop operations until the temporary alternative measures are implemented or the device is again working properly. If a replacement part is no longer available, the use of a substitute device that performs the same type of function is permitted.

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1926.1416 Operational Aids Repair Time

- **1926.1416(d)** Category I operational aids and alternative measures must be repaired within 7 calendar days. Exception: Parts ordered within 7 days, the repair must be completed within 7 calendar days of receipt of the parts.
- **1926.1416(e)** Category II operational aids and alternative measures must be repaired within 30 calendar days. Exception: Parts ordered within 7 days, and the part is not received in time to repair in 30 days, the repair must be completed within 7 days of receipt of the parts.

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Shift Inspection: Deficiencies
Monthly Inspections

• 1926.1412 (e) Equipment that is in service is inspected monthly in accordance with 1412 (d).
  1412 (d) is shift inspection

• (2) Equipment must not be used until an inspection under these rules demonstrates that no corrective action under 1412 (d)(2) and (3) is required.

Monthly Inspections: Documentation

1926.1412 (e)(3)(i) The following information must be documented and maintained by the employer that conducts the inspection:
  − (A) The items checked and the results of the inspection.
  − (B) The name and signature of the person who conducted the inspection and the date.

1926.1412 (e)(3)(ii) This document shall be retained for a minimum of 3 months.

In brief, a monthly inspection is the same as a shift inspection, but it must be documented.

Discussion question: Do you think you might want to retain documents for more than 3 months?

Activity Three: Shift (and Monthly) Inspections

• Partner with the person next to you.
• Work together to match the required inspection items in the list with the picture that best depicts that item.

Example: Hydraulic system for proper fluid level.

Activity Three: Shift (and Monthly) Inspections

• Partner with the person next to you.
• Match the required inspection items in the list with the pictures.

Fire Extinguisher

Inspect for one more item also:
• 1926.1433(d)(6) An accessible fire extinguisher must be on the equipment.
### Types of Inspections

<table>
<thead>
<tr>
<th>Event</th>
<th>Inspector Qualifications</th>
<th>Documented?</th>
<th>What to Inspect?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Assembly</td>
<td>Qualified Person</td>
<td>Not addressed*</td>
<td>See 1037b. (1)</td>
</tr>
<tr>
<td>Shift (Daily)</td>
<td>Competent Person</td>
<td>No</td>
<td>See 1037c. (1)</td>
</tr>
<tr>
<td>Monthly</td>
<td>Competent Person</td>
<td>Yes, save 3 months</td>
<td>See 1037c. (1)</td>
</tr>
<tr>
<td>Annual</td>
<td>Qualified Person</td>
<td></td>
<td></td>
</tr>
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<td>Modifications</td>
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</table>

### Annual Inspections

- **1926.1412(f)(1)** At least every 12 months, the equipment must be inspected by a qualified person in accordance with paragraph (d) of this section (each shift), except that the corrective action set forth in paragraphs (f)(4), (f)(5), and (f)(6) must apply in place of the corrective action required by paragraphs (d)(2) and (d)(3) of this section.

- **1926.1412(f)(2)** In addition, at least every 12 months, the equipment must be inspected by a qualified person. Disassembly is required, as necessary, to complete the inspection. (List of items (i) through (xxi) follows this paragraph)

- **1926.1412(f)(3)** This inspection must include functional testing of the equipment as configured to determine if it is functioning properly.

### Annual Inspections: Deficiencies

- **1926.1412(f)(4)** If any deficiency is identified, an immediate determination must be made by the qualified person as to whether the deficiency constitutes a safety hazard or, though not yet a safety hazard, needs to be monitored in the monthly inspections.
- **Note:** no decision based on “safety device” or “operational aid.” The decision is based simply on the qualified person’s judgment.

### Annual Inspections: Documentation

- **1926.1412(f)(7)** Documentation of annual/comprehensive inspection. The following information must be documented, maintained, and retained for a minimum of 12 months, by the employer that conducts the inspection:
  - (i) The items checked and the results of the inspection.
  - (ii) The name and signature of the person who conducted the inspection and the date.
Some of the Additional Items Required to be Inspected.

- Equipment structure, including the boom.
  - Deformed, cracked, or significantly corroded structural members.
- Loose, failed, or significantly corroded bolts, rivets, and other fasteners.
- Cracked welds.
- Deformed, cracked, or significantly corroded structural members.
- Pins, bearings, shafts, gears, rollers and locking devices for distortion, cracks or significant wear.
- Brake and clutch system parts, linings, pawls and ratchets for excessive wear.
- Sheaves and drums for cracks or significant wear.
- Safety devices operational aids for proper operation.
- Equipment structure, including the boom.
  - Pins, bearings, shafts, gears, rollers and locking devices for distortion, cracks or significant wear.
- Brake and clutch system parts, linings, pawls and ratchets for excessive wear.
- Sheaves and drums for cracks or significant wear.
- Safety devices operational aids for proper operation.

Annual Inspections

- Pins, bearings, shafts, gears, rollers and locking devices for distortion, cracks or significant wear.
- Brake and clutch system parts, linings, pawls and ratchets for excessive wear.
- Sheaves and drums for cracks or significant wear.
- Safety devices operational aids for proper operation.

Annual Inspections

- Power plants for safety-related problems leaking exhaust emergency shut-down feature and proper operation.
- Chains and drive sprockets for excessive wear, excessive chain stretch.
- Travel steering, brakes, and locking devices, for proper operation.
- Tires for damage or excessive wear.
- Power plants for safety-related problems leaking exhaust emergency shut-down feature and proper operation.
- Chains and drive sprockets for excessive wear, excessive chain stretch.
- Travel steering, brakes, and locking devices, for proper operation.
- Tires for damage or excessive wear.

Inspections: Annual

- Outrigger or stabilizer pads and floats for excessive wear or cracks.
- Slider pads for excessive wear or cracks.
- Electrical components and wiring for cracked or split insulation and loose or corroded terminations.
- Missing or illegible warning labels and decals.
- Outrigger or stabilizer pads and floats for excessive wear or cracks.
- Slider pads for excessive wear or cracks.
- Electrical components and wiring for cracked or split insulation and loose or corroded terminations.
- Missing or illegible warning labels and decals.

Modified Equipment Inspections

• 1926.1412(a)(1) Equipment that has had modifications or additions which affect the safe operation of the equipment or capacity must be inspected by a qualified person prior to initial use. The inspection must meet all of the following requirements:
  – (i) Assure that the modifications or additions have been done in accordance with the approval obtained pursuant to 1926.1434 (Equipment modifications).
  – (ii) The inspection must include functional testing of the equipment.
• 1926.1412(a)(2) Equipment must not be used until an inspection demonstrates that the requirements of paragraph (a)(1)(i) of this section have been met.

Inspections After Repairs or Adjustments

• 1926.1412(b)(1) Repairs or adjustments that relate to safe operation must be inspected by a qualified person prior to initial use.
• 1926.1412(b)(1) Inspection requirements:
  – (i) Must meet manufacturer equipment criteria.
  – (iii) Include functional testing of the repaired or adjusted parts.
• 1926.1412(b)(4) Equipment must not be used until an inspection demonstrates that the repair or adjustment meets the requirements.

Severe Service Inspections

1926.1412(g) Where the severity of use is such that it may cause damage/excessive conditions, the employer must stop using the equipment and a qualified person must:
• (1) Inspect the equipment for structural damage to determine if the equipment can continue to be used safely.
• (2) In light of the use/conditions determine whether any items and conditions listed in paragraph (f) need to be inspected and inspect those items and conditions.
• (3) If a deficiency is found, the employer must follow the requirements in paragraphs (f)(4) through (6).
(f)(4) through (6) = Annual inspections

Inspections: Documents Available

• 1926.1412(k) All documents produced under this rule must be available, during the applicable document retention period, to all persons who conduct inspections under this rule.
• In other words, documentation must be ON THE CRANE so the operator can review it for each shift inspection.

Types of Inspections**

<table>
<thead>
<tr>
<th>Type</th>
<th>Inspector Qualifications</th>
<th>Documented?</th>
<th>When or Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Assembly</td>
<td>Qualified Person</td>
<td>Yes</td>
<td>See 1926.1412(c)(1)</td>
</tr>
<tr>
<td>Daily</td>
<td>Competent Person</td>
<td>No</td>
<td>1926.1412(b)(1) (to be done)</td>
</tr>
<tr>
<td>Monthly</td>
<td>Competent Person</td>
<td>No, but 2 months</td>
<td>1926.1412(b)(1) (to be done)</td>
</tr>
<tr>
<td>Annual</td>
<td>Qualified Person</td>
<td>Yes</td>
<td>1926.1412(b)(1) + 1926.1412(f)(2)</td>
</tr>
<tr>
<td>Modifications</td>
<td>Qualified Person</td>
<td>Yes</td>
<td>See 1926.1412(a)(1)</td>
</tr>
<tr>
<td>Repairs or Adjustments</td>
<td>Qualified Person</td>
<td>Yes</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Service Checks</td>
<td>Qualified Person</td>
<td>Yes</td>
<td>1926.1412(b)(3) and (4)</td>
</tr>
</tbody>
</table>

* Just because there is not a specific rule addressing documentation does not conclusively mean that documentation is not required. For some operations, it may be important to document these inspections in some way.
** This table is intended as an instructional aid. It is not a substitute for reading and understanding the rules in MIOSHA Construction Safety Standard Part 10. Cranes and Derricks.

Discussion Questions

1. Does a shift inspection happen before the shift or after shift?
2. What requires shutting down vs. keep operating?
3. If you do keep operating, how long before you should repair something?
4. How long do you think you should give an operator to do an inspection each day?
5. Should shift inspections be documented?
6. Should the crane have some sort of daily log to indicate hours crane was in service, number of critical lifts, who operated, all minor adjustments or repairs, etc.?
Wire Rope Inspections

- The wire rope on the crane must be inspected.
- This is "above the hook" wire rope. Inspection of all rigging "below the hook" is addressed separately.
- In most cases, this inspection goes hand in hand with the crane inspection.
- OSHA and MIOSHA chose to write the rules for wire rope inspection separately from the rules for inspecting the rest of the crane.

Wire Rope is Used Two Ways on the Crane

- Standing (guy) rope: A supporting rope that maintains a constant distance between the points of attachment to the two components connected by the rope. (Also known as a pendant line.)
- Running rope: A rope that travels around sheaves and/or drums. It is let out and drawn back up.

Wire Rope Defined

- 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.
- Wire rope is made of wires laid (not twisted) into a strand, with 6 or 8 strands laid around a fiber or wire rope center (core).

Wire Rope Inspections Required

<table>
<thead>
<tr>
<th>Type</th>
<th>Inspector Qualifications</th>
<th>Documented?</th>
<th>What to Inspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post assembly</td>
<td>Competent</td>
<td>No</td>
<td>1926.1413(a)(2) and (3)</td>
</tr>
<tr>
<td>Shift (Daily)</td>
<td>Competent</td>
<td>Yes</td>
<td>1926.1413(a)(2) and (3), 1926.1413(b)(2)</td>
</tr>
<tr>
<td>Monthly</td>
<td>Competent</td>
<td>Yes</td>
<td>1926.1413(a)(2) and (3), 1926.1413(b)(2)</td>
</tr>
<tr>
<td>Annual</td>
<td>Qualified</td>
<td>Yes</td>
<td>1926.1413(a)(2), 1926.1413(b)(2), 1926.1413(c)(1), 1926.1413(c)(2)(i), 1926.1413(c)(2)(ii)(A) to (D)</td>
</tr>
<tr>
<td>Modifications</td>
<td></td>
<td>Inspection not addressed*</td>
<td></td>
</tr>
<tr>
<td>Repair /adjust</td>
<td></td>
<td>Inspection not addressed*</td>
<td></td>
</tr>
<tr>
<td>Severe Service</td>
<td></td>
<td>Inspection not addressed*</td>
<td></td>
</tr>
</tbody>
</table>

* You should assume that you must inspect the wire rope as part of the standard crane inspection, even though it does not specifically state it in the standard.

Shift Wire Rope Inspections

- 1926.1413(a)(1) Visually inspected by a competent person prior to each shift.
- Observing all rope, including running and standing, that can be expected to be in use during the day's operations.
- Purpose: To discover damage that may be an immediate hazard.
- Untwisting or opening of wire rope or booming down is not required as part of this inspection.

Monthly Wire Rope Inspections

- 1926.1413(b)(1) Each month an inspection must be conducted in accordance with paragraph (a).
  - Paragraph (a) = wire rope shift inspection.
- 1926.1413(b)(2) Include any deficiencies that must be monitored (due to the annual inspection).
- 1926.1413(b)(3) Wire rope not used until proper corrective action taken.
- 1926.1413(b)(4) The inspection must be documented according to 1926.1412(e)(3) (monthly inspection documentation).
**Critical Review Items of Wire Rope**

- **1926.1413(a)(3)** During shift/monthly inspections, give particular attention to all of the following:
  - (i) Rotation resistant wire rope in use.
  - (ii) Wire rope being used for boom hoists and luffing hoists, particularly at reverse bends.
  - (iii) Wire rope at flange points, crossover points and repetitive pickup points on drums.
  - (iv) Wire rope at or near terminal ends.
  - (v) Wire rope in contact with saddles, equalizer sheaves or other sheaves where rope travel is limited.

**Annual Wire Rope Inspections**

- **1926.1413(c)(1)** At least every 12 months, inspected by a qualified person in accordance with paragraph (a) of this section (shift inspection).
- **1926.1413(c)(2)** In addition, inspected, as follows:
  - (i) deficiencies of the types listed in paragraph (a)(2).
  - (ii) cover the entire length of the wire ropes, particular attention to:
    - (A) Critical review items in paragraph (a)(3).
    - (B) Sections normally hidden during shift and monthly inspections.
    - (C) Wire rope subject to reverse bends.
    - (D) Wire rope passing over sheaves.
- **1926.1413(c)(4)** Documented according to 1926.1412(f)(7) (annual inspection).

**Categories of Deficiencies of Wire Rope**

- Part 10 lists three categories of deficiencies in wire rope.
  - 1926.1413(a)(2)(i) Category 1
  - 1926.1413(a)(2)(ii) Category 2
  - 1926.1413(a)(2)(iii) Category 3
- All 3 categories require the wire rope is not used until either the bad section is removed (shorten the rope) or the entire wire rope is replaced.
- Damage due to electrical contact always requires entire rope replacement.

**Category 1 Deficiencies**

- 1926.1413(a)(2)(i)(A) Significant distortion of the rope, including:
  - Kinking.
  - Crushing.
  - Unstranding.
  - Birdcaging.
  - Signs of core failure or steel core protrusion between the outer strands.
- 1926.1413(a)(2)(i)(C) Electric arc damage (from a source other than power lines) or heat damage.
- 1926.1413(a)(2)(i)(D) Improperly applied end connections.
- 1926.1413(a)(2)(i)(E) Significantly corroded, cracked, bent, or worn end connections (such as from severe service).

**Categories 2 Deficiencies**

- 1926.1413(a)(2)(ii)(A) In running wire ropes, 6 randomly distributed broken wires in 1 rope lay or 3 broken wires in 1 strand in 1 rope lay.
- 1926.1413(a)(2)(ii)(B) In rotation resistant ropes, 2 randomly distributed broken wires in 6 rope diameters or 4 randomly distributed broken wires in 30 rope diameters.
- 1926.1413(a)(2)(ii)(C) In standing ropes, more than 2 broken wires in 1 rope lay in sections beyond end connections or more than 1 broken wire at an end connection.
- 1926.1413(a)(2)(ii)(D) A diameter reduction of more than 5%.

**Categories 3 Deficiencies**

- 1926.1413(a)(2)(iii)(A) In rotation resistant wire rope, core protrusion or other distortion indicating core failure.
- 1926.1413(a)(2)(iii)(B) Prior electrical contact with a power line.
Activity 4: Practice Inspecting

- Raise your hand if you can spot what’s wrong in the picture.
- Can you identify the MIOSHA rule?

What’s Wrong?

- Leaking hydraulics.

What’s Wrong?

- Wire rope too small of diameter for sheave.
- Probably also either reeved wrong or terminated wrong.

What’s Wrong?
• Bent lattice.

What’s Wrong?

• Only two outriggers extended.
• On sidewalk without any pads under outrigger pads.

What’s Wrong?

• Too many broken wires.
• Bad cribbing
• Soft ground
• Not level

What's Wrong?

• Wire rope severely damaged.

What's Wrong?

• Outriggers in soft dirt conditions with no mats.
Module Four: Power Line Safety

- Lifting over workers.

How far away from the power line is this crane's load line?

Now can you better estimate how far away the load line is from the power line?
Power Line Safety

The rules for assembly/disassembly are different than the rules for operations.

Assembly/Disassembly:
- 1926.1407(a), Before assembling/disassembling, determine if any part of the equipment, load line, or load, including rigging and lifting accessories, could get closer than 20 feet to a power line. If this could occur, the employer shall meet the requirements in 1 of the following: (Options 1, 2, and 3)
  - could = 360 degree boom rotation
  - In other words, if you boomed all the way out, swung all the way around, is it possible to get closer than 20' ? If so, then you must choose one of the 3 options for precautions.

Operations:
Here you can establish Work Zone Boundaries, instead of using 360 rotation:
- 1926.1408(a) Before beginning operations, the employer must:
  - 1926.1408(a)(1) Identify the work zone by either:
    - (i) Demarcating boundaries (such as with flags, or a device such as a range limit device or range control warning device) and prohibiting the operator from operating the equipment past those boundaries, or
    - (ii) Defining the work zone as the area 360 degrees around the equipment, up to the equipment’s maximum working radius.
  - 1926.1408(a)(2) Determine 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 closer than 20 feet to a power line. If so, the employer must meet the requirements in Option (1), Option (2), or Option (3) of this section, as follows:

Work Zone Boundaries
- In other words, if you clearly mark your work zone boundaries, and if the power lines are more than 20' from the boundaries, then you are good. Just maintain the boundary.
- Note the language: 1926.1408(a)(1) (i) “(such as with flags, or a device such as a range limit device or range control warning device), and prohibiting the operator from operating the equipment past those boundaries.”
  - Expectation is that it is clearly evident where the boundaries are located and that the operator can clearly see these boundary markers.
  - Simplest would be one straight line of flags. Lots of powerlines might require a complete perimeter around your jobsite.
Example: Work Zone Boundary and Single Powerline

The flags make a line that the crane will not go past. Operator, rigger, signal person all know this rule. The workzone boundary is everything to the right of the line of flags. Now you are done. You do not need to use Option 1, 2, or 3.

Example Work Zone Boundary: Complete Perimeter

Imagine there is a fence (green line) around the work site. The General Contractor places flags along the top of the fence. Now you have a Work Zone boundary.

If You Do Not Use “Work Zone Boundary”

1926.1408(a)(2) Determine if any part of the equipment, load line or load (including rigging and lifting accessories), if operated up to the maximum working radius in the work zone, could get closer than 20 feet to a power line. If so, must meet the requirements in Option (1), Option (2), or Option (3), as follows:

<table>
<thead>
<tr>
<th>Requirement Options</th>
<th>Employer Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1: 1408(a)(2)(i) De-energize and Ground</td>
<td>Confirm with the utility owner that the power line has been de-energized, and visibly grounded at the worksite.</td>
</tr>
<tr>
<td>Option 2: 1408(a)(2)(ii) 20 foot clearance</td>
<td>Ensure that no part of the equipment, load line, or load (including rigging and lifting accessories), gets closer than 20 feet to the power line by implementing the measures specified in paragraph (b) of this section (Encroachment prevention measures).</td>
</tr>
<tr>
<td>Option 3: 1408(a)(2)(iii) Table A clearance</td>
<td>(a) Determine the line’s voltage and the minimum clearance permitted under Table A “minimum clearance”. (b) Determine if any part of the equipment, load line, or load, including rigging and lifting accessories, could get closer than the minimum clearance distance to the power line permitted under Table A. If this could occur, then you shall follow the requirements in paragraph (b) of this section.</td>
</tr>
</tbody>
</table>

1926.1408(b) Encroachment Prevention Measures “Subrule 4” for Options 2 and 3

<table>
<thead>
<tr>
<th>Assembly/Disassembly 1926.1407(b)</th>
<th>Operations 1926.1408(b)(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Planning Meeting</td>
<td>(1) Planning Meeting</td>
</tr>
<tr>
<td>(2) Non-Conductive Tag line</td>
<td>(2) Non-conductive Tag line</td>
</tr>
<tr>
<td>(3) As least one of the following:</td>
<td>(3) As least one of the following:</td>
</tr>
<tr>
<td>‐ dedicated spotter,</td>
<td>‐ dedicated spotter,</td>
</tr>
<tr>
<td>‐ proximity alarm,</td>
<td>‐ proximity alarm,</td>
</tr>
<tr>
<td>‐ range control warning,</td>
<td>‐ range control warning,</td>
</tr>
<tr>
<td>‐ Range limiting device,</td>
<td>‐ Range limiting device,</td>
</tr>
<tr>
<td>‐ Elevated warning line, barricade, or line of signs in view of the operator</td>
<td>‐ Elevated warning line, barricade, or line of signs in view of the operator</td>
</tr>
<tr>
<td>(4) As least one of the following:</td>
<td>(4) As least one of the following:</td>
</tr>
<tr>
<td>‐ dedicated spotter,</td>
<td>‐ dedicated spotter,</td>
</tr>
<tr>
<td>‐ range control warning,</td>
<td>‐ range control warning,</td>
</tr>
<tr>
<td>‐ Range limiting device,</td>
<td>‐ Range limiting device,</td>
</tr>
<tr>
<td>‐ Insulating link.</td>
<td>‐ Insulating link.</td>
</tr>
</tbody>
</table>

Exclusion for Power Transmission and Distribution

1926.1408(b)(5) The requirements of paragraph (b)(4) of this section do not apply to work covered by subpart V (Electric Power Transmission and Distribution) of this part.
“Non-Conductive Tag lines”

1926.1401 “Nonconductive” means that, 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.

Power Line Safety

1926.1407(d) Assembly or disassembly inside Table A clearance shall be prohibited.

1926.1407(e) Voltage information. Where Option (3) of this section is used, the utility owner/operator of the power lines must provide the requested voltage information within two working days of the employer’s request.

1926.1407(f) Power lines presumed energized.

Power Line Safety

1926.1407(g) Posting of electrocution warnings. There must be at least one electrocution hazard warning conspicuously posted in the cab so that it is in view of the operator and (except for overhead gantry and tower cranes) at least two on the outside of the equipment.

Power Line Safety: Working Below Powerlines

During operations...

1926.1408(d)(1) No part of the equipment, load line, or load (including rigging and lifting accessories) is allowed below a power line unless the employer has confirmed that the utility owner/operator has deenergized and (at the worksite) visibly grounded the power line. Exceptions:

1926.1408(d)(2)(ii) and (iii) the uppermost part of the equipment when extended/boom all the way up would be more than 20’ (or table A clearance) from the powerline.

OR

1926.1408(d)(2)(iv) the employer demonstrates that compliance with this subrule is infeasible and meets the requirements of 1926.1410.

Conclusion:
Determine the voltage of power lines.
• Use work-zone boundaries.
• Or, De-energize.
• Or, Option 2
• Or, Option 3 and follow Table A.
Traveling Under Power Lines
1926.1411(b)(4): traveling under the Power Lines with no load; must use a spotter

<table>
<thead>
<tr>
<th>Voltage (normal, kV, alternating current)</th>
<th>Table 1: Minimum clearances while traveling with no load</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 to 34</td>
<td>10</td>
</tr>
<tr>
<td>Over 34 to 70</td>
<td>16</td>
</tr>
<tr>
<td>Over 70 to 100</td>
<td>20</td>
</tr>
<tr>
<td>Over 100 to 1,000</td>
<td>25</td>
</tr>
<tr>
<td>Over 1,000</td>
<td>100</td>
</tr>
</tbody>
</table>

1926.1410(a) The employer determines that it is infeasible to do the work without breaching the minimum approach distance under Table A.
1926.1410(b) The employer determines that, after consultation with the utility owner or operator, it is infeasible to de-energize and ground the power line or relocate the power line.

Activity 5: Working Safely Around Power lines
- Small groups will work on a scenario.
- Review the assigned scenario and determine what is necessary for you to work safely in regards to the power lines.
- Be prepared to present your ideas and possible solutions to the class.

Activity 5: Power line Safety Scenario 1
- You brought your 80-ton Grove rough-terrain crane to an industrial building in order to remove the old HVAC units off the roof and install the new HVAC units on the roof. Fully extended, it has 140’ of boom.
- There is a power line running along the North side of the building, about 8’ from the edge of the building. You called and found that it was a 15kv line.

Activity 5: Power line Safety Scenario 2
- You brought your 110-ton Terex truck-mounted crane to a 2-story building site to install trusses that weigh 1000 lb. Fully extended, it has 164’ of boom. The ridge line runs North/South and is 46’ high.
- Prior to arrival, your estimator observed power lines on the North Side of the building. They are 13 horizontal feet from the edge of the building. The utility has told you they are 138, 7.5kV lines, 80’ high.

Activity 5: Power line Safety Scenario 3
- You brought your 110-ton Terex truck mounted crane to a job site. The crane is 12 feet high when traveling.
- Prior to arrival, your estimator observed power lines completely surrounding the building on the job site. They appear to be distribution lines on all four sides and measured 10’ high from the ground, except the service line to the building that is 15 feet.

Activity 5: Power line Safety Scenario 4
- All of the following is REQUIRED:
  - Power Line Owner or registered professional engineer - Sets Minimum Approach Distance
  - Planning Meeting - Procedures
  - Dedicated Spotter
  - Elevated Warning Line or Barricade
  - Insulating Link/Device
  - Nonconductive Rigging
  - Range Limiter [if Equipped]
  - Nonconductive Tag Line [if used]
  - Barricades - 10 feet from Equipment
  - Limit Access to Essential Employees
  - Ground the Crane
  - Deactivate Automatic Re-energizer
Module Five: Operations

Operations: Safety Concerns

- Lack of operator training due to the many crane types
- Using the wrong crane for the job
- Not understanding load charts and crane limitations
- Not checking for proper foundation and ground support
- Multiple contractors utilizing the same crane
- Multiple lift jobs (more than one crane working together to lift an object)

Must Follow Manufacturer Procedures

1926.1417(a) The employer must comply with all manufacturer procedures applicable to the operational functions of equipment, including its use with attachments.

Rated Capacity and Load Weight

- 1926.1417(o)(3) The operator must verify that the load is within the rated capacity by at least one of the following:
  - (i) Determined from a source recognized by the industry (e.g. the load’s manufacturer), or by a recognized calculation method (e.g. calculating a steel beam from measured dimensions and a known per foot weight), or by other equally reliable means.
  - OR
  - (ii) The operator must begin hoisting the load to determine weight, using the crane’s weighing device (computer).

Operating Within Rated Capacity

Manual Must Be In Cab

1926.1417(c)(1) The procedures applicable to the operation of the equipment... must be readily available in the cab at all times for use by the operator.

(2) Where rated capacities are available in the cab only in electronic form: In the event of a failure that makes the rated capacities inaccessible, the operator must immediately cease operations or follow safe shut-down procedures until the rated capacities (in electronic or other form) are available.
Using Recognized Sources and Load Charts

- Load charts have specific details on calculating the weight of crane components and set-up for a safe lift.
- The crane manufacturer creates the load chart.
- Capacities on the load chart are indicated as strength of materials (structural) or tipping (stability) capacities.

Using Load Weighing Devices

- Operator verifies the weight by beginning to hoist the load.
- If it exceeds 75% capacity, the operator must double check the weight of the load by a secondary method.

Load Capacity

The load capacity is affected by:
- Crane radius
- Boom length
- Boom angle

Load Capacity Table

<table>
<thead>
<tr>
<th>Radius in Feet</th>
<th>Base</th>
<th>Boom</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>12,000</td>
<td>10,000</td>
<td>8,000</td>
</tr>
<tr>
<td>20</td>
<td>10,000</td>
<td>8,000</td>
<td>6,000</td>
</tr>
<tr>
<td>25</td>
<td>8,000</td>
<td>6,000</td>
<td>4,000</td>
</tr>
<tr>
<td>30</td>
<td>6,000</td>
<td>4,000</td>
<td>2,000</td>
</tr>
</tbody>
</table>

Where is Capacity Highest and Lowest?

- Steepest boom angle = Highest capacity
- Flattest boom angle = Lowest capacity

Gross vs. Net Load

- Gross Load: Weight of the entire, talla, bell, block, rigging, load
- Net Load: Weight of the object being lifted

Effective Load

Effective weight of attachments (used to calculated the gross load) may be more or less than actual weight of that attachment.
Calculating Gross Load Can Be Complex

Must know:
1. Correct configuration of the crane
2. Weight of line(s), block(s) or ball(s)
3. Weight of rigging below the hook
4. Effective weight of any attachments
5. Weight of object being lifted
6. Angle of boom
7. Length of boom
8. How to read the load chart and accompanying notes to properly add and subtract all the above.

Operator Not Distracted

• 1926.1417(d) The operator must not engage in any practice or activity that diverts his/her attention while actually engaged in operating the equipment, such as the use of cellular phones (other than when used for signal communications).

Storm Warning

• 1926.1417(h) Storm warning. 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.

• Video of tower cranes as storm approaches (1 min. 17 sec) :
  https://youtu.be/0yPb53YHf9a

Wind

1926.1417(n) 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.

Compensating for Weather

Big Blue Big Decisions
Authority to Stop Operation

1926.1418 Whenever there is a concern as to 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.

Adjustments or Repairs

1926.1417(j) If equipment adjustments or repairs are necessary:
- 1926.1417(j)(1) The operator must, in writing, promptly inform the person designated by the employer to receive such information and, where there are successive shifts, to the next operator.
- 1926.1417(j)(2) The employer must notify all affected employees, at the beginning of each shift, of the necessary adjustments or repairs and all alternative measures.

Ground Conditions

Grand Rapids – March 27, 2009

What is Wrong Here?

1926.1425(c)(2) Open Hooks

Exception: i-hook allowed for wooden trusses. (This truss must be lifted with a spreader beam, not a single hook.)

Counterweights

- 1926.1417(aa)(1)(i) Equipment must not be operated without the counterweight or ballast in place as specified by the manufacturer.
- 1926.1417(aa)(1)(ii) The maximum counterweight or ballast specified by the manufacturer for the equipment must not be exceeded.
Work Area Control

• 1926.1424(a)(2) To prevent employees from entering the swing radius hazard areas, the employer must:
  • (i) Train employees in how to recognize struck-by and pinch or crush hazards.
  • (ii) Erect and maintain control lines, warning lines, railings, or similar barriers to mark the boundaries.

• 1926.1424(a)(3)(i) 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.

Swinging Counterweights

1926.1425 Keeping Clear of the Load

• 1926.1425(a) Where available, hoisting routes that minimize the exposure of employees to hoisted loads must be used, to the extent consistent with public safety.
• (b) An employee shall not be within the fall zone of a suspended load, except:
  – Hooking, unhooking or guiding a load.
  – Initially attaching the load.
  – Operating a concrete hopper or concrete bucket.
  – Must use Qualified Rigger.

Definitions

"Qualified rigger" means an individual who is a qualified person with specific training and experience demonstrating the ability to solve or resolve problems relating to rigging.

Fall Protection

1926.1423(j) A personal fall arrest system is permitted to be anchored to the crane’s hook (or other part of the load line) where all of the following requirements are met:

1. A qualified person has determined that the set-up and rated capacity of the crane meets or exceeds the requirements in 1926.502(g)(15).
2. The equipment operator must be at the work site and informed that the equipment is being used for this purpose.
3. No load is suspended from the load line when the personal fall arrest system is anchored to the crane’s hook (or other part of the load line).
1926.1431 Hoisting Personnel

(a) Prohibited 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.

Using Personnel Platforms

Many details such as:
• 1926.1431 (1) Capacity: Must not exceed 50% when hoisting personnel.
• 1926.1431(e)(1) A qualified personnel familiar with structural design shall design the personnel platform and suspension system.
• 1926.1431(k)(1) Hoisting must be performed in a slow, controlled, cautious manner, with no sudden movements.
• 1926.1431(m) Pre-lift meeting. A pre-lift meeting must be held with the operator, signal person, workers to be hoisted, and person responsible for the lift.

Using Personnel Platforms

1926.1431(h) Trial Lift and Inspection:
The trial lift shall be performed immediately before placing personnel on the platform.

Module Six:
Training, Qualifications, and Certification

Objectives
• Crane Operator certification
• Signal person qualifications
• Rigger personnel qualifications
• Service (maintenance/repair) qualifications
• Employee overhead powerline training
• Discuss questions to ask

Operator Qualification & Certification:
• Interim Rule (11/10/18 until MIOSHA adopts new rules):
• 1926.1427(a) The employer shall ensure that the operator is qualified or certified to operate the equipment.
• 1926.1427(a)(3) Exceptions. Not required for operators of:
  -- Derricks. See 1926.1436(q).
  -- Sideboom cranes. See 1926.1440(a).
  -- Equipment with a maximum manufacturer-rated hoisting or lifting capacity of 2,000 pounds or less. See 1926.1441(e).
Operator Qualification and Certification:

Interim Rule
Three options to comply by 11/10/18:

<table>
<thead>
<tr>
<th>Rule</th>
<th>How</th>
<th>Portable</th>
<th>Valid for</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1926.1427(b) &quot;Certification&quot; by an accredited crane operator testing organization.</td>
<td>Yes</td>
<td>3 yrs</td>
</tr>
<tr>
<td>2</td>
<td>1926.1427(c) &quot;Qualification&quot; by an audited employer program.</td>
<td>No</td>
<td>5 yrs</td>
</tr>
<tr>
<td>3</td>
<td>1926.1427(e) &quot;Licensing&quot; by a government entity.</td>
<td>No</td>
<td>Up to 5 yrs</td>
</tr>
</tbody>
</table>

1926.1427(k) Phase-in period: The employer shall ensure that operators of equipment covered by this standard are competent to operate the equipment safely.

Operator Certification Criteria

Interim Rule
1926.1427(b)(1)(ii) Certification must be based on both of the following:

- A written test.
- A practical test that the individual has the skills necessary for safe operation of the equipment.

- Note: Certification is done by testing. It is not receiving training.
- Note: Just because an operator is certified for a class of cranes does not mean that they are fully capable and trained to run any crane of that type.

New OSHA Rule on Operator Certification

Effective Dec 10, 2018 federally. MIOSHA effective date has not been determined.
1926.1427 Operator training, certification, and evaluation.
(a) The employer must ensure that each operator is trained, certified/licensed, and evaluated in accordance with this section before operating any equipment covered under subpart CC, except for the equipment listed in paragraph (a)(2) of this section.
(1) An employee who has not been certified/licensed and evaluated to operate assigned equipment in accordance with this section may only operate the equipment as an operator-in-training under supervision in accordance with the requirements of paragraph (b) of this section.

New OSHA Rule on Operator Certification - continued

Effective Dec 10, 2018 federally. MIOSHA effective date has not been determined.

Major differences:
1. Remove the requirement to certify by crane type AND capacity. Now only required to be certified by crane type.
2. Under the option of an employer having their own program to certify operators, it replaces the word "qualification" with the word "certification" to eliminate confusion.
3. Requires the employer to conduct a written and practical "evaluation" of an operator’s knowledge, skills, and abilities with each specific crane. Evaluation must be documented.

Operator Certification Resources

- NCCCO (National Commission for the Certification of Crane Operators) website is a good place to start finding info on how to get your operators certified.
  www.nccco.org
- Many options to get operators certified.

Signal Person: When is One Required?

1926.1419 (a) A signal person shall be provided in each of the following situations:

- (1) The point of operation, meaning the load travel or the area near or at load placement, is not in full view of the operator.
- (2) When the equipment is traveling, the view in the direction of travel is obstructed.
- (3) Due to site specific safety concerns, either the operator or the person handling the load determines that it is necessary.
Qualified Signal Person

1926.1428(a) The employer must ensure that each signal person meets the qualification requirements. Met by using either:

- (1) Option (1): Third-party qualified evaluator (with documentation).
- (2) Option (2): Employer’s qualified evaluator. The employer’s qualified evaluator assesses the individual and determines that he or she meets the qualification requirements and provides documentation of that determination. Not portable.

Definitions

“Qualified signal person” means an individual who is a qualified person with specific training and experience demonstrating the ability to solve or resolve problems relating to signaling.

“Signal system” means an audible or visual method of communication between the equipment operator and the persons on the landing or floors.

“Standard method” means the protocol in Appendix A of this standard for hand signals.

Signal Person Qualifications

1926.1428 (c) Signal persons must:

1. Know and understand the type of signals used. If hand signals are used, know the Standard Method for hand signals.
2. Be competent in the application of the type of signals used.
3. Have a basic understanding of equipment operation and limitations, including crane dynamics involved in swinging and stopping loads and boom deflection from hoisting loads.
4. Know and understand the relevant requirements of 1926.1419 to 1926.1422 (rules on signaling) and 1926.1428.
5. Demonstrate that he/she meets the requirements in (c)(1) through (4) of this section through an oral or written test, and through a practical test.

Signals: General Requirements

- 1926.1419 (b) Signals shall be by hand, voice, audible, or new signals.
- 1926.1419 (c) (1) When using hand signals, the standard method shall be used.
- 1926.1419 (h) Only 1 person shall give signals, except emergency stop.
- 1926.1419 (k) Must use operator’s direction perspective.
- 1926.1420(c) Operator shall receive signals using a hands-free device.

APPENDIX A: Standard Hand Signals

Emergency Stop

- 1926.1417 (y) The operator must obey a stop (or emergency stop) signal, irrespective of who gives it.

EMERGENCY STOP - With both arms extended horizontally to the sides, palms down, arms are swung back and forth.
Qualified Signal Person: Documentation

1926.1428(a)(3) The employer must make the documentation for whichever option is used available at the site while the signal person is employed by the employer. The documentation shall specify each type of signaling, such as hand signals and radio signals, for which the signal person meets the requirements.

Rigger Qualification

Two rules indicate need for a Qualified Rigger:

• Assembly and Disassembly: 1926.1404(r) Rigging. In addition to following the requirements in 1926.251 and other requirements in this and other standards applicable to rigging, when rigging is used for assembly/disassembly, the employer must ensure that:
  – (1) The rigging work is done by a qualified rigger.

• Keeping Clear of the Load: 1926.1425(c) When employees are engaged in hooking, unhooking, or guiding the load, or are in the initial connection of a load to a component or structure and are within the fall zone, all of the following criteria shall be met:
  – (3) The materials shall be rigged by a qualified rigger.

Rigger Qualification

• 1926.1401 Definitions: “Qualified rigger” means a rigger who meets the criteria for a qualified person.
• No specific training requirements outlined in the standard.
• No specific documentation requirements outlined in the standard.
• So how do you make a rigger a qualified rigger?
  – You should evaluate riggers to ensure they are qualified for the type of rigging they will perform.
  – You should document training of riggers.

Struck by Falling Load

June 22, 2009

• A load of roofing materials was hoisted by a tower crane to a staging area located on the same roof.
• Material became dislodged from a wooden pallet.
• Striking the worker located on the roof.
• Unsafe rigging, must use Qualified Rigger.
• Unsafe position, within the Fall Zone!
Struck by falling load

The impressions from where the materials landed.

Operators-In-Training

Existing Rule

1926.1427(f) Pre-qualification/certification training period. An employee who is not qualified or certified under this section is permitted to operate equipment only as an operator-in-training and only where the requirements of this paragraph are met.

• (1) sufficient training prior to operating to enable the operator-in-training to operate safely under limitations.
• (3) The tasks performed shall be within the operator-in-training’s ability.
• (4) Trainer. The operator-in-training shall be continuously monitored by an operator’s trainer (some requirements for the trainer here).
• (6) The operator-in-training shall not operate in some circumstances such as near powerlines, hoisting personnel, multiple-equipment lifts, multi-lift rigging (Christmas-treeing), over cofferdams and shafts, or in tank farms.

Operators in Training: This is the New Rule

Effective Dec 10, 2018 federally. MIOSHA effective date has not been determined.

1926.1427 (b) Operator training. The employer must provide each operator-in-training with sufficient training, through a combination of formal and practical instruction, to ensure that the operator-in-training develops the skills, knowledge, and ability to recognize and avert risk necessary to operate the equipment safely for assigned work.

(1) The employer must provide instruction on the knowledge and skills listed in paragraphs (j)(1) and (2) of this section to the operator-in-training.
(2) The operator-in-training must be continuously monitored on site by a trainer while operating equipment.

Operators in Training – New Rules continued

Effective Dec 10, 2018 federally. MIOSHA effective date has not been determined.

• 1926.1427 (i) Paraphrased: prohibits certain high risk tasks, except when the operator is certified for that crane and the trainer has determined the operator in training to be trained, experienced, and qualified to begin operating these high risk tasks such that they can get the necessary practice.
• High risk tasks:
  – Hoisting personnel
  – Multiple-equipment lifts (tandem lifts)
  – Over shafts, cofferdams, tank farms
  – Multiple-lift rigging operations (Christmas-treeing)

Operators in Training – New Rules continued

Effective Dec 10, 2018 federally. MIOSHA effective date has not been determined.

• Much more about operators-in-training. Just the highlights covered here.

Training for All Operators

1926.1427(j)(1)(i) Operators must know the information necessary for safe operation of the specific type of equipment, including the following:

(A) The controls and operational/performance characteristics.
(B) Use of, and the ability to calculate load/capacity information on a variety of configurations of the equipment.
(C) Procedures for preventing and responding to power line contact.
(D) Technical knowledge similar to the criteria listed in Appendix C applicable to the specific type of equipment the individual will operate.
(E) Technical knowledge applicable to:
  – The suitability of the supporting ground and surface to handle expected loads.
  – Site hazards.
  – Site access.
Training for All Operators

1926.1427(j)(1)(ii) Able to read and locate relevant information in the equipment manual and other materials.

1926.1427(j)(2) Has the skills necessary for safe operation of the equipment, (determined through a practical test) including the following:
   (i) Ability to recognize, from visual and auditory observation, the items listed in 1926.1412(d) (shift inspection).
   (ii) Operational and maneuvering skills.
   (iii) Application of load chart information.
   (iv) Application of safe shut-down and securing procedures.

Training for All: Overhead Powerlines

1926.1430(a). The employer must train each operator and crew member in the topics listed in 1926.1408(g):

- (1)(i) Procedures in the event of electrical contact.
  - (A) Danger of contacting equipment and ground at same time.
  - (B) Stay in cab, unless imminent danger of fire.
  - (C) Safe exit.
  - (D) Energized zone, step potential.
  - (E) Stay back from equipment, zone.
  - (F) Safe clearance distance from power lines.
- (1)(ii) Presumed energized.
- (1)(iii) Presumed un-insulated.
- (1)(iv) Limitations of insulating and limiting devices.
- (1)(v) Limitations of grounding.

Overhead Powerline Training: Spotters

1926.1408(g)(2) Spotters shall be trained to enable them to effectively perform their task, including training on the applicable requirements of this rule.

Maintenance and Repair Personnel Qualifications

1926.1429(a) Maintenance, inspection, and repair personnel may operate the equipment only where the following are met:

- (1) Operation is limited to functions necessary to perform maintenance, inspection, or verify its performance.
- (2) The personnel either:
  - (i) Operate equipment under direct supervision of a certified operator OR
  - (ii) Are familiar with the operation, limitations, characteristics, and hazards associated with the type of equipment.

1926.1429(b) Maintenance and repair personnel shall meet the definition of a qualified person with respect to the equipment and maintenance or repair tasks performed.

Training:

Additional training requirements for:

- Fire extinguisher use
- Fall hazards
- Tag-out requirements
- Equipment with rated capacity less than 2000 lbs.
- Avoiding crush/pinch points (e.g. rotating counterweights)
- Material and material hoists

Training Summary

EVERYBODY needs SOME training.

- Operators: certified by 3 options.
- Signal persons qualified by 3rd party or employer.
- Rigger qualified.
- Operators-in-training monitored by certified operator/trainer.
- Powerline training for all affected.
- Maintenance and repair personnel must be qualified persons.
Module Seven

- Review and Important Things to Know
- Crane and Safety Resources
- Post Test

Review: Causes of Crane-Related Deaths in Construction

<table>
<thead>
<tr>
<th>Cause</th>
<th>% of deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overhead power line electrocutions</td>
<td>36 deaths</td>
</tr>
<tr>
<td>Struck by crane loads</td>
<td>47 deaths</td>
</tr>
<tr>
<td>Crane collapses</td>
<td>35 deaths</td>
</tr>
<tr>
<td>Struck by crane boom/jib**</td>
<td>157 deaths</td>
</tr>
<tr>
<td>Falls*</td>
<td>56 deaths</td>
</tr>
<tr>
<td>Struck by crane or crane part</td>
<td>78 deaths</td>
</tr>
<tr>
<td>Caught in/between</td>
<td>89 deaths</td>
</tr>
<tr>
<td>Other causes***</td>
<td>632 deaths</td>
</tr>
</tbody>
</table>

* Included 64 struck by falling booms/jibs
** Included 21 falls from cranes, 8 falls from crane baskets, 8 from crane loads.
*** Other causes included 9 highway incidents.
Source: BLS CFOI data

Review: Included/ Excluded in the Scope

1926.1400(a) This standard applies to power operated equipment, when used in construction, that can
1. hoist,
2. lower,
3. and horizontally move a suspended load.

Exclusions:
Digger Derrick, Aerial Work Platforms, Delivery Equipment, multi-function machines when not used with a hook or winch.

Review: Ground Conditions

- The controlling entity shall ensure ground preparations necessary...
- Who evaluated the ground conditions?
- What type of soil is present?
- Is it firm and drained?
- Does the crane operators manual give any direction for set up?
- Has the operator calculated the size of the crane mats based upon the soil and the weight of the load to be lifted?
- Cracks in the asphalt/concrete paving? Have there been any new patches?
- Is crane set up on previously disturbed soil? Check for compaction.
- Over utilities or vaults or near new buildings?

Review: Assembly / Disassembly

- "A/D director" is both a "competent person" and a "qualified person."
- A/D Director is competent and qualified person who carries out manufacture's A/D procedures and must notify crew of their tasks, hazards associated with tasks, and any hazardous locations to avoid.
- All rigging work is done by a Qualified Rigger.
- When using outriggers - fully extend or deploy as per the load chart.
- Post Assembly Inspection.

Review: Inspections

- Daily and monthly inspections by competent person.
- Annual inspections by qualified person.
- Inspect after assembly, modification, repair, severe service.
- Do not let the rules confuse you: if there is an unsafe condition present, you must get it fixed prior to operating that crane.
**Review: Types of Inspections**

<table>
<thead>
<tr>
<th>Type</th>
<th>Inspector Qualifications</th>
<th>Documented?</th>
<th>What to Inspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post assembly</td>
<td>Qualified Person</td>
<td>No</td>
<td>See 1926.1412(c)(1)</td>
</tr>
<tr>
<td>Shift (Daily)</td>
<td>Competent Person</td>
<td>No</td>
<td>1926.1412(b)(1)(ii)(iv)</td>
</tr>
<tr>
<td>Monthly</td>
<td>Competent Person</td>
<td>Yes, 3 months</td>
<td>1926.1412(b)(1)(ii)(iv)</td>
</tr>
<tr>
<td>Annual</td>
<td>Qualified Person</td>
<td>Yes</td>
<td>1926.1412(b)(1)(ii)(iv)</td>
</tr>
<tr>
<td>Modifications</td>
<td>Qualified Person</td>
<td>Yes</td>
<td>1926.1412(a)(1)</td>
</tr>
<tr>
<td>Repairs / adjustments</td>
<td>Qualified Person</td>
<td>No</td>
<td>1926.1412(b)(1)(i) to (iii)</td>
</tr>
<tr>
<td>Severe Service</td>
<td>Qualified Person</td>
<td>No</td>
<td>1926.1412(b)(1)(ii)(iv)</td>
</tr>
</tbody>
</table>

* Just because there is not a specific rule addressing documentation does not conclusively mean that documentation is not required. For some operations, it may be important to document these inspections in some way.

** This table is intended as an instructional aid. It is not a substitute for reading and understanding the rules in MIOSHA Construction Safety Standard Part 10. Cranes and Derricks.

---

**Review: Wire Rope Inspections Required**

<table>
<thead>
<tr>
<th>Type</th>
<th>Inspector Qualifications</th>
<th>Documented?</th>
<th>What to Inspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post assembly</td>
<td>Competent Person</td>
<td>No</td>
<td>1926.1413(a)(2) and (3)</td>
</tr>
<tr>
<td>Shift (Daily)</td>
<td>Competent Person</td>
<td>Yes</td>
<td>1926.1413(a)(2) and (3), 1926.1413(b)(2)</td>
</tr>
<tr>
<td>Monthly</td>
<td>Competent Person</td>
<td>Yes</td>
<td>1926.1413(a)(2) and (3), 1926.1413(b)(2)</td>
</tr>
<tr>
<td>Annual</td>
<td>Qualified Person</td>
<td>Yes</td>
<td>1926.1413(a)(2) and (3), 1926.1413(b)(2), 1926.1413(b)(3)(H) to (I)</td>
</tr>
<tr>
<td>Modifications</td>
<td>Competent Person</td>
<td>No</td>
<td>1926.1413(b)(2)(G)</td>
</tr>
<tr>
<td>Repair /adjust</td>
<td>Competent Person</td>
<td>No</td>
<td>1926.1413(b)(2)(G)</td>
</tr>
<tr>
<td>Severe Service</td>
<td>Competent Person</td>
<td>No</td>
<td>1926.1413(b)(2)(G)</td>
</tr>
</tbody>
</table>

* You should assume that you must inspect the wire rope as part of the standard crane inspection, even though it does not specifically state it in the standard.

---

**Review: Power Line Safety**

- Possible to be within 50' of Power Line?
  - Yes, De-energize & Ground
  - No, Go to work!

- Is material laydown area within 70'?
  - Yes, De-energize & Ground
  - No, Go to work!

- Building footprint within 350 – 1000KV?
  - Yes, De-energize & Ground
  - No, Go to work!

- Danger Crane W – Z - b –

---

**Review: Three Other Options**

If operated up to the maximum working radius in the work zone, could get closer than 20 feet to a power line. Then Option (1), Option (2), or Option (3), as follows:

<table>
<thead>
<tr>
<th>Requirement Options</th>
<th>Employer Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1: 1408(a)(2)(i)</td>
<td>De-energize and Ground</td>
</tr>
<tr>
<td>Option 2: 1408(a)(2)(ii)</td>
<td>Ensure that no part of the equipment, load line, or load (including rigging and lifting accessories), gets closer than 20 feet to the power line by implementing the enclosure prevention measures specified in paragraph (b).</td>
</tr>
<tr>
<td>Option 3: 1408(a)(2)(iii)</td>
<td>Determine the line’s voltage and the minimum clearance permitted under Table A “minimum clearance. (a) Use enclosure prevention measures specified in paragraph (b).</td>
</tr>
</tbody>
</table>

---

**Review: Easiest Option is a**

- W Z b

---

**Review: Easiest Option is a**

- Power line Safety
- Material laydown area
- Building footprint
- Power line
- Danger Crane

---

**Review: Operations**

- The Operator is responsible to verify that a load is within the rated capacity of the crane.
- Outriggers must be fully deployed or per manufacturer.
- Adjust procedures for wind, ice and snow.
- Anybody can give an emergency stop signal.
- When there is a concern about safety, the operator may stop and refuse to handle loads until a qualified person has determined that safety has been assured.
- An employee shall not be permitted under a suspended load.
- Rotating Counterweights must be barricaded to prevent struck by and crushed by hazards.
Review of Signals

- Only 1 signal person at any one time.
- The signal person AND operator must know the hand signals being used.
- The signal person must be able to observe the load and other workers at all times.
- The signal person must always be in plain view of the crane operator.
- Signal person’s primary concern: watch the load!

Review of Training

- EVERYBODY needs SOME training.
- Operators: Certified by 3 options.
- Signal persons qualified by 3rd party or employer.
- Rigger qualified.
- Power line training for all assigned to work with the equipment.
- Maintenance and repair personnel must be qualified persons.

Assessment

- Quick quiz to ensure you have understood the basic concepts presented.
- Passing score of 70% correct is required.
- Class reference materials/books are not allowed to be used.
- Discussion with others is not allowed.
- Either answers will be reviewed after everyone completes and submits their assessment OR the instructor will grade your quiz and allow you to review items you missed.

Online Transcript

www.macomb.edu/webadvisor

- Choose NonCredit/Continuing Education
- Log In

What?

- Check individual courses – Proficient / Not Proficient
- Track courses taken through the MTI
- Request a transcript to show certification
- Manage account information

How?

- Select What’s My User ID?
- Key in the Last Name and SS# or Macomb ID
- Select Log In
- If you need help call 586-498-4106 or email mti@macomb.edu

Thank You!
Be Safe!

Michigan Occupational Safety and Health Administration
Consultation Education and Training Division
530 W. Allegan Street
Lansing, MI 48933

To request consultation, education and training services, call 517-284 7720 or www.michigan.gov/miosha
Part 10. Cranes and Derricks

Student Resources

MIOSHA Standards:

Part 10. Cranes and Derricks

MIOSHA Fact Sheets:

Crane Operator Certification
Contractor’s Directory to Overhead Power Line Safety
Highlights of the New Part 10 – Cranes and Derricks Standard

Other Resources:

Cranes Today Magazine
The National Commission for the Certification of Crane Operators
Vertikal
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