MIOSHA Training Institute

MIOSHA Michigan Occupational Safety and Health Administration

Macomb Community College

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

MICHIGAN DEPARTMENT OF LABOR & ECONOMIC OPPORTUNITY

MIOSHA Michigan Occupational Safety and Health Administration

(Revised 02/24)

Part 10, Cranes and Derricks

Presented By:
Consultation Education and Training (CET) Division
Michigan Occupational Safety and Health Administration
Michigan Department of Labor and Economic Opportunity
www.michigan.gov/miosha
517-284 7720

MIOSHA
Michigan Occupational Safety and Health Administration

1

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.

2

Module One:

- Introduction, Objectives, and Scope

Downtown Kalamazoo, 2017

3

3

MIOSHA Standard is Identical to the Federal OSHA Standard

- MIOSHA: Construction Safety and Health Standard Part 10, Cranes and Derricks
- OSHA: 1926 Subpart CC – Cranes and Derricks in Construction.
- Effective Nov 8, 2010.
- Major revision to the old standard.

4

PART 10. CRANES AND DERRICKS

Table of Contents:

5

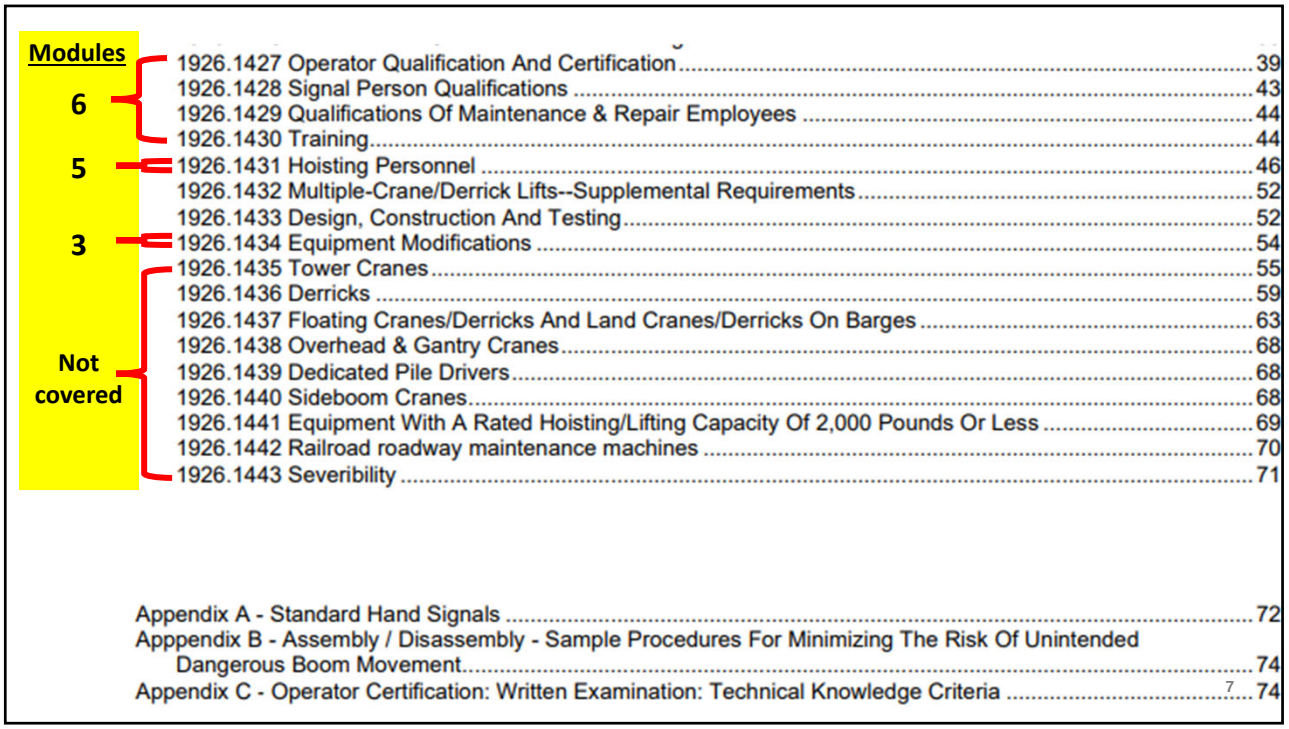
5

Modules

1

6

6



7

7

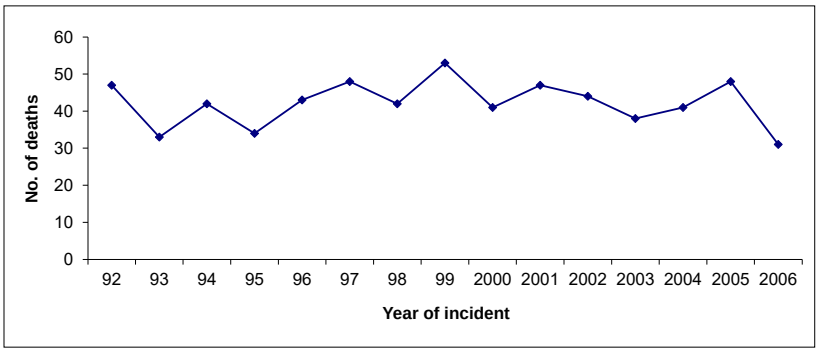
Crane-Related Deaths in Construction: 1992-2006

- This is the most current study available as of 2023.
- **632 crane-related deaths**
- - An average of 42 deaths/year
- **18 multiple-death incidents** involving a total of 40 deaths

- ***Source: U.S. Bureau of Labor Statistics Census of Fatal Occupational Injuries Research File.*** **Data identified by selecting CFOI Source and Secondary Source codes = "Cranes," and searching Narratives for key work "crane." Study conducted by CPWR.**

8

Crane-Related Deaths in Construction by Year, 1992-2006



Source: BLS CFOI

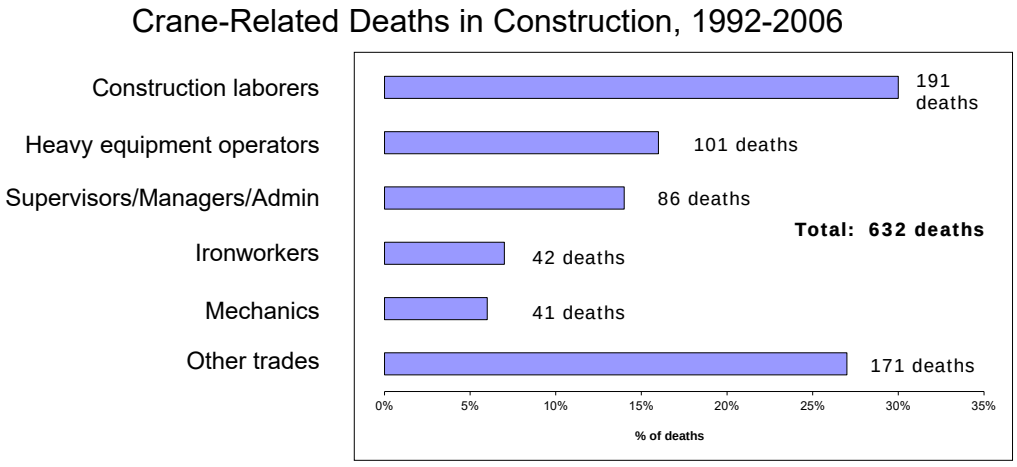
Discussion questions:

- Is there any reduction in crane fatalities over time?
- Do you think that OSHA needed to change something to decrease fatalities or would it get better on its own?

9

9

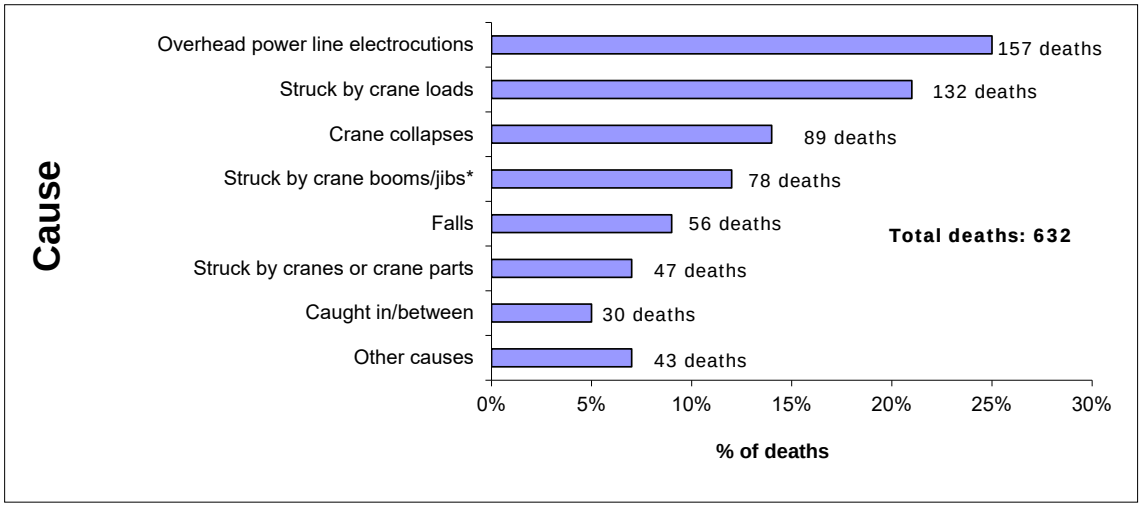
Trades of Workers Who Died



10

10

Causes of Crane-Related Deaths in Construction, 1992-2006

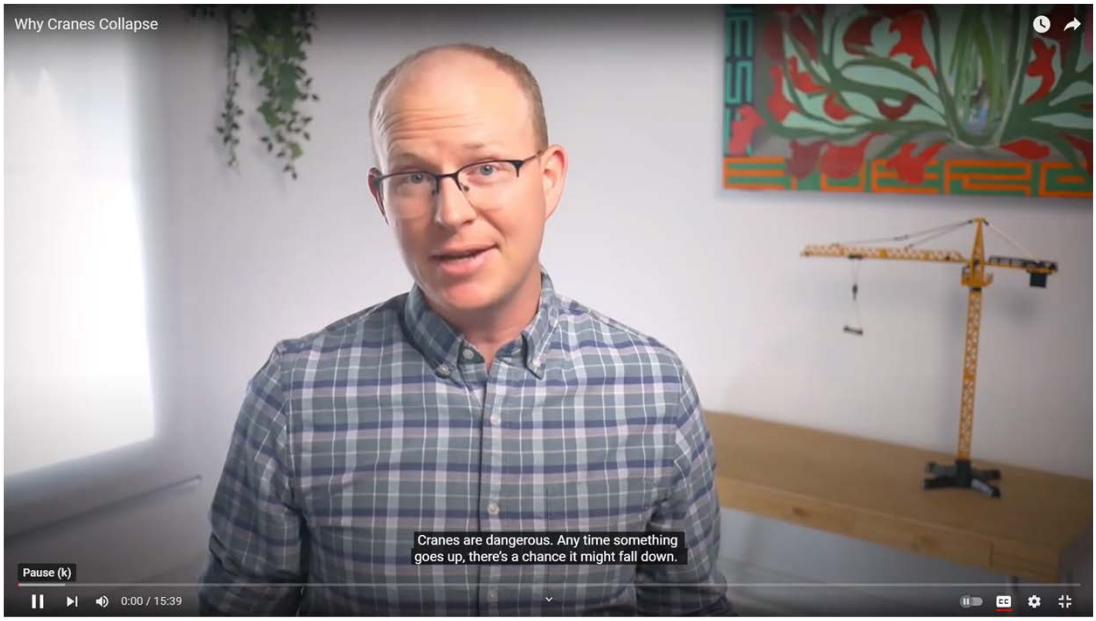


11

11

g0

Causes of crane failures



12

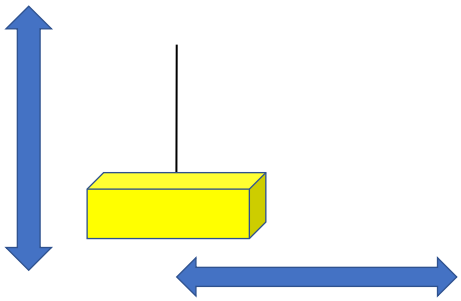
Slide 12

jg0 New slide. Video does an excellent job of explaining crane collapses. Replaces a different video that showed many different crane failures, but without explanatation.
jim getting, 2023-11-13T20:17:32.564

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.



13

Scope: Included List

Gives a laundry list of crane types. Not necessary to study each type.

- Articulating cranes (knuckle-boom)
- Crawler cranes
- Floating cranes
- Cranes on barges
- Locomotive cranes
- Mobile cranes
  - Wheel-mounted
  - Rough-terrain
  - All-terrain
  - Commercial truck-mounted
  - Boom truck cranes
- Industrial cranes, (carry-deck cranes)
- Dedicated pile drivers
- Service/mechanic trucks with a hoisting device
- Crane on a monorail
- Tower cranes
- Pedestal cranes
- Portal cranes
- Overhead and gantry cranes
- Straddle cranes
- Side-boom cranes
- Derricks
- Variations of equipment listed.

14

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.

Winch and hook on this attachment, so it is included.

Multi-function machine.

15

Specific Exclusions

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

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

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

Excluded

16

Specific Exclusions

Excluded

- 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.

17

Specific Exclusions

- 1001 (3)(p)(ii) Articulating/knuckle-boom truck cranes…
  - that deliver material
  - and the crane is used to transfer material from the truck onto a structure
  - and uses a fork and cradle at the end of the boom
  - and <u>the truck is equipped with a properly functioning automatic overload prevention device</u>.
  - Includes: sheetrock, plywood, bags of cement, packages of roofing shingles, rolls of roofing felt.

Excluded

18

Types of Cranes: Truck Mounted

19

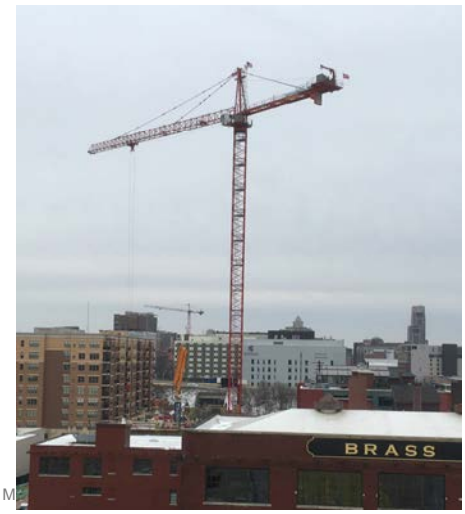
Types of Cranes: Rough Terrain

20

Types of Cranes: Crawler

21

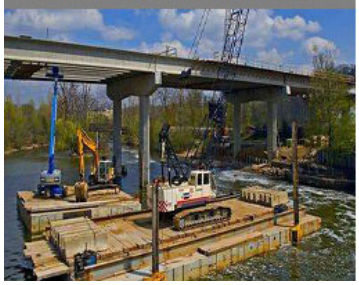
Types of Cranes: Tower



22

Types of Cranes

CRANES on BARGES



FLOATING CRANE

LOCOMOTIVE CRANE

23

Types of Cranes

SERVICE TRUCK CRANE*

PEDESTAL CRANE

DEDICATED PILE DRIVER

OVERHEAD / GANTRY

DERRICK

24

Module Two:

- Assembly / Disassembly

25

Definition

"Assembly and Disassembly"

- means the assembly, disassembly, or both, of equipment covered under this standard. Regarding 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.

Michigan Department of Labor & Economic Opportunity

The green crane is used to assemble the red tower crane. Kalamazoo - 2017

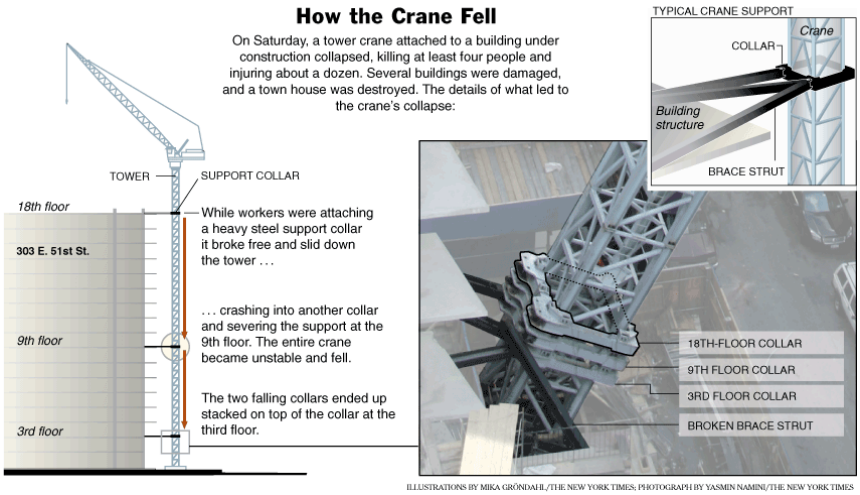
26

Assembly / Disassembly Hazards

- Electrical hazards.
- Lack of knowledge on proper assembly.
- Level conditions and ground conditions.
- Struck by.
- Overloading, knowing weight of pieces, and utilizing the load charts properly.
- Underground utilities not identified.
- Working within the swing radius.

A/D Hazards: Example: NYC Tower Crane 2008

- Seven people killed.
- Rigging ontractor securing a collar to the 18th floor.
- Used four slings to hold the collar, one badly worn.
- Instructions said to use eight slings.
- Construction manager offered four new slings, but they refused them.
- Owner/crew leader indicted on manslaughter, criminally negligent homicide.
- Later acquitted as failure to secure crane to the ground, failure by city to inspect, shoddy beams as brace struts came to light, spreading blame.



ILLUSTRATIONS BY MIKA GRÖNDAHL/THE NEW YORK TIMES; PHOTOGRAPH BY YASMIN NAMINI/THE NEW YORK TIMES

29

30

A/D: Ground Conditions

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.

31

Ground Conditions

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

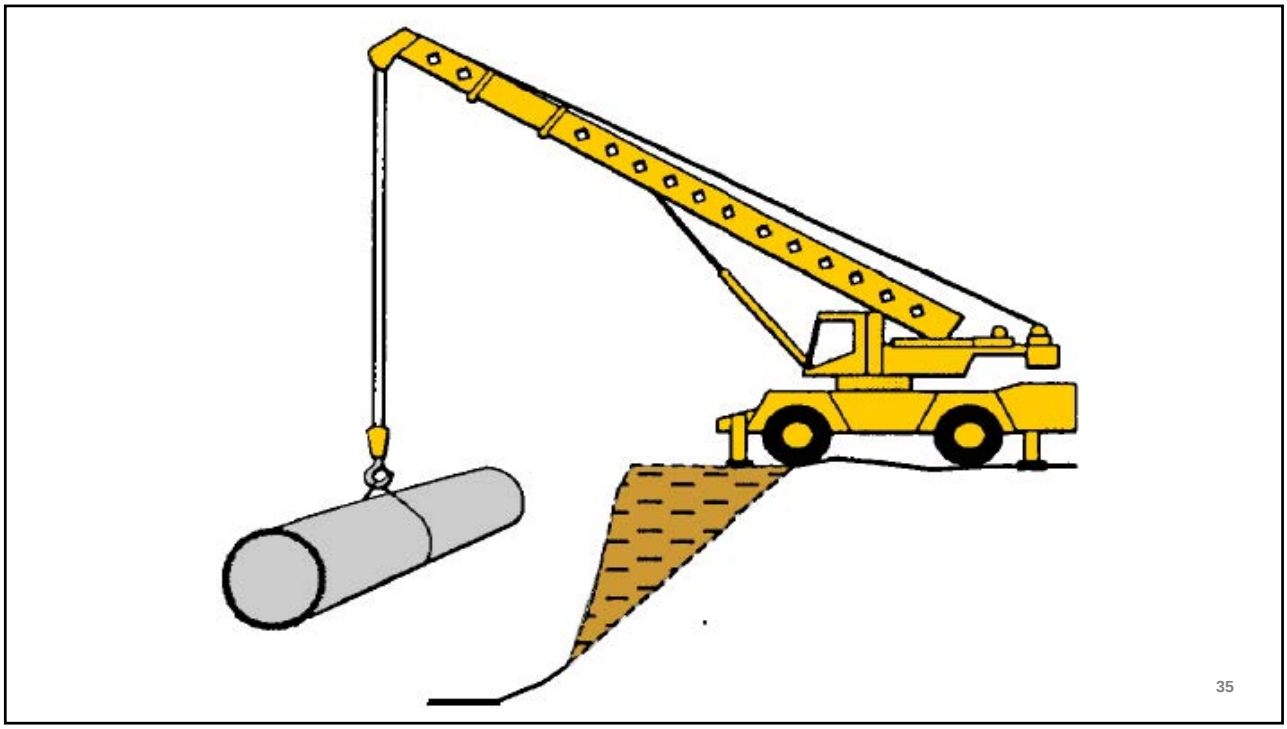
32

Ground Conditions: Things to Consider

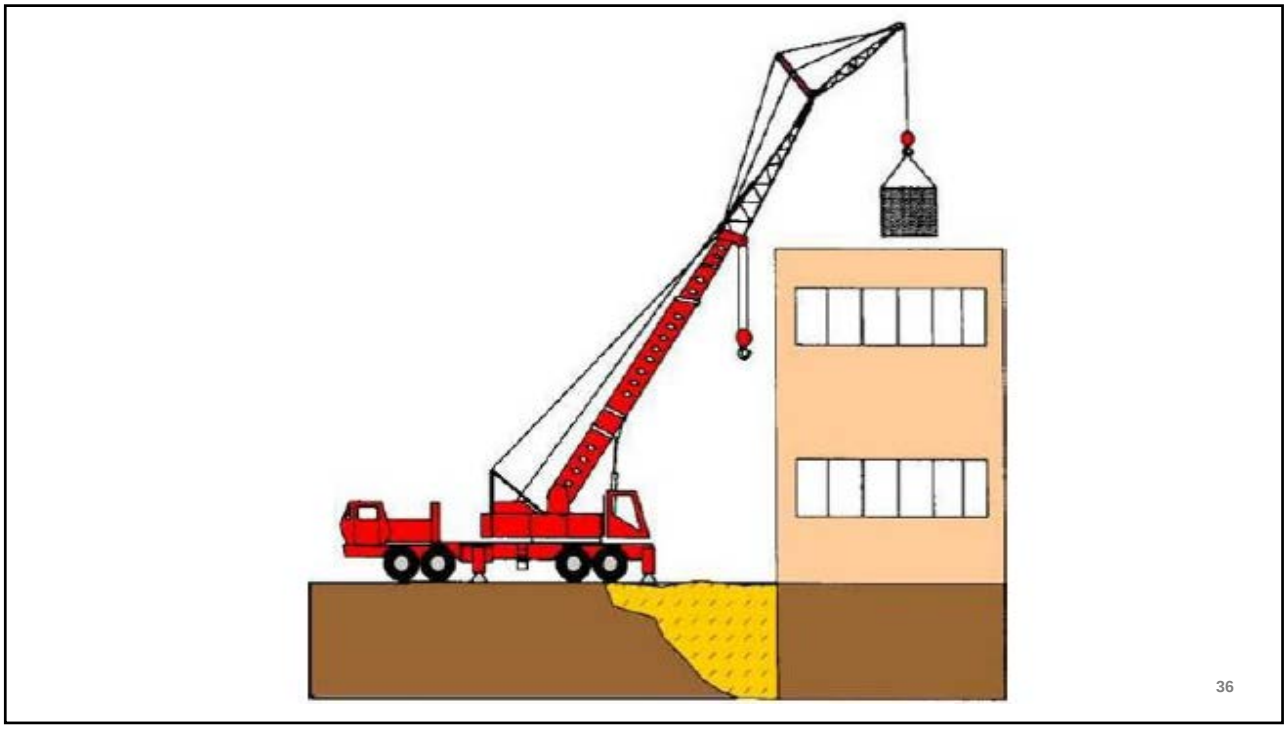
- What does the crane's manual say about ground conditions?
- Who evaluated the ground conditions?
- What type of soil is present?
- Is it firm and drained?
- Is the soil previously disturbed?
- Over utilities or vaults or near new buildings?
- Cracks in the asphalt/concrete paving? Have there been any new patches?

33

34



35



36

Outrigger Pad vs. No Pad

37

Qualified Person Needed to Determine Adequate Support

- PSI = pounds per square inch
- What is the force being delivered to each outrigger?
- What can the soil bear?
- What size cribbing or pads do you need?
- Applicable rules:
- A/D: 1926.1404(h)(1)
- Operations: 1926.1402(b)

Clay	Loose Firm Compact	13 psi 33 psi 54 psi
Silt	Loose Firm Compact	27 psi 33 psi 40 psi
Sand-Fine, Silty, or with trace of Clay compact	Loose Firm Compact	27 psi 40 psi 54 psi
Sand- Course to Medium	Loose Firm Compact	40 psi 60 psi 81 psi
Gravel – Sand and Gravel	Loose Firm Compact	54 psi 81 psi 110 psi

38

Are Your Operators Doing the Math, Or Guessing and Hoping?

Is the Lift is Safe? Sample Math

Facts:
Lifting 20,000 pounds

This puts 45,000 pounds of pressure on the outrigger (according to crane manual)

Soil is sand. We do not know how coarse or how compact.

Question:
What size cribbing or pads do you need?

(PSI = Pounds per square inch)

Facts:

- 45,000 pounds of pressure on the outrigger
- Soil is sand. We do not know how coarse or how compact.

Sand-Fine, Silty, or with trace of Clay compact	**Loose** Firm Compact	**27 psi** 40 psi 54 psi
Sand- Coarse to Medium	Loose Firm Compact	40 psi 60 psi 81 psi

39

39

How to Calculate if the Lift is Safe: Sample Math

1. Use the table. Use weakest version if compaction is unknown. sand (27 psi)
2. Divide the weight on outrigger (45,000 lbs) by the psi the soil can support (27 psi):

   45,000 lbs / 27 psi = 1,667 sq. inches
3. Calculate size of pads in sq. inches:

   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

Solution: We need 4' x 4' outrigger pads.

Facts:

- 45,000 pounds of pressure on the outrigger
- Soil is sand. We do not know how coarse or how compact.

Sand-Fine, Silty, or with trace of Clay compact	**Loose** Firm Compact	**27 psi** 40 psi 54 psi
Sand- Coarse to Medium	Loose Firm Compact	40 psi 60 psi 81 psi

40

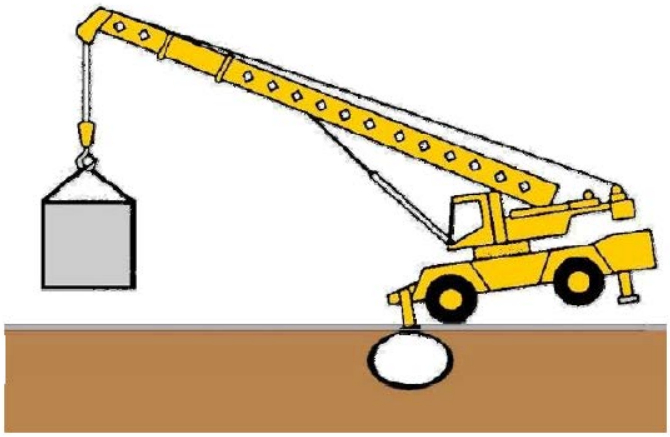
40

Look for Underground Hazards

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

41

Look for Underground Hazards



42

Assembly / Disassembly

- **Rule 1926.1403**
- Two options:

  (a) Follow manufacturer procedures

  or

  (b) Follow employer-developed procedures

  - 1926.1406: developed by qualified person.

Assembly / Disassembly

1926.1404 (a) "A/D director"

- (a)(1) Is both a “competent person” and a “qualified person.”
- (b) Must understand the applicable A/D procedures.
- (c) Must review the applicable procedures immediately prior to A/D begins.
- (d) Must ensure crew understand their tasks, hazards associated with tasks, and any hazardous locations to avoid.
- Must follow manufacturer’s prohibitions.
- All rigging work is done by a Qualified Rigger.
- When using outriggers - fully extend *or* deploy as per the load chart.

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 (o) Shipping pins
- 1404 (p) Pile driving
- 1404 (q) Outriggers and stabilizers
- 1404 (r) Rigging

45

1926.1404 (q) Outriggers and Stabilizers

- (1) The outriggers or stabilizers shall be either fully extended or, if the manufacturer's procedures permit, deployed as specified in the load chart.

46

1926.1404 (q) Outriggers and Stabilizers

- (2) The outriggers shall be set to remove the equipment weight from the wheels.

47

Disassembly Failure: 2019 Seattle Tower Crane

- Bolts and sleeves were removed from all sections of the vertical tower. Manufacturer procedures are to only remove bolts and sleeves for one mast section, and only after the section is attached to crane that will remove that section.
- Four killed. Two ironworkers, two people in cars below.
- 45 mph wind gust.

48

Activity One: Company Crane Policy

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

Outline some company rules / policies for cranes.

- Think about the entire process from before A/D begins through completion.
- Consider policies for training, documentation, planning, oversight, review.
- Include policies that would act as checks and balances to ensure that you don't have failures.
- Be prepared to share at least 5 policy ideas with the class.

10 minutes

49

Module Three

- Inspections

Crane name/number	Crane Type	Crane Capacity	Date of inspection:
Location	Hour Meter: start: stop:	Total Hours Operated	
Operator Name:			

MONTHLY INSPECTION: Inspect and mark items as satisfactory = S, Unsatisfactory = U, or not applicable = N/A

Walk Around Inspection	Notes	U	S	N/A
Control Mechanisms				
Control and drive mechanisms				
Air, hydraulic, and other pressurized lines				
Hydraulic system fluid level				
Hooks and latches				
Wire rope				
Reeving				
Electrical apparatus				
Tires				
Ground conditions				
Equipment level				
Operator cab windows				
Rails, stops, rail clamps				
Safety devices and operational aids				
Comments:				
Operator Signature	Supervisor Signature			

50

50

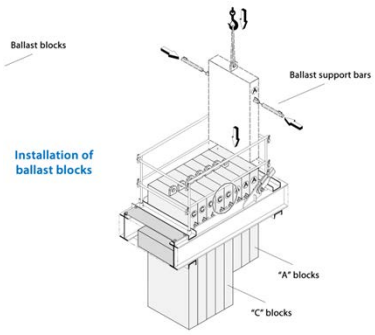
Inspections: Objectives

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.

51

What Just Happened?



Picture above from: https://www.morrow.com/crane101/

52

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, follow manufacturer's inspection procedures if more stringent than MIOSHA.

53

Activity Two: Types of Inspections Required

Activity: Take this page out of your materials and complete it during this module.

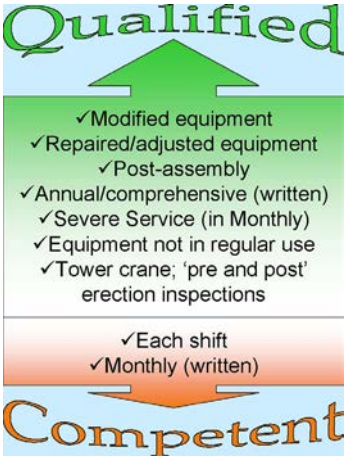
Type	Inspector Qualifications	Documented?	What to Inspect?
Post Assembly	Qualified person		
Shift (Daily)	Competent person		
Monthly			
Annual			
Modifications			
Repairs or Adjustments			
Severe Service			

54

Inspector Qualifications

Qualified person defined:
A person who through:
- 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.

Post-assembly Inspection

- In this picture, weep holes were plugged so water expanded and split the steel.
- Pre-assembly inspection of all parts is a critical step of assembly.

57

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.
- Taking apart equipment components and booming down not required.
- 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.

58

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 so, the equipment must be taken out of service until it is corrected. See 1926.1417

59

1926.1417 Operation

- Many rules under 1926.1417. The most relevant to inspection deficiencies are:
- 1926.1417 (f) (1) Tag-out. If equipment is taken 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. If a function(s) is taken 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.
- 1926.1417(j) If equipment adjustments or repairs are necessary:
  - (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; and
  - (2) The employer must notify all affected employees, at the beginning of each shift, of the necessary adjustments or repairs and all alternative measures.

60

Shift Inspections: Deficiencies Found

- 1926.1412(d)(3) If any deficiency in paragraph (d)(1)(xiv) of this section (safety devices/operational aids) is identified, the action specified in 1926.1415 and 1926.1416 must be taken prior to using the equipment. GJ(0

- 1415 (c) If it is a safety device, then no using the crane.
- 1416 (c) If it is an operational aid, then no use until it is repaired or an alternative is used.

61

"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

62

Slide 61

GJ(0 Added the second and third bullets to help preview the upcoming slides. Less confusing this way.
Getting, James (LEO), 2024-02-15T18:31:29.533

1926.1415 (a) Safety Devices

The following are required:

(1) Crane level indicator

(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.

63

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.

64

“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

Boom angle indicator and anti two-block device

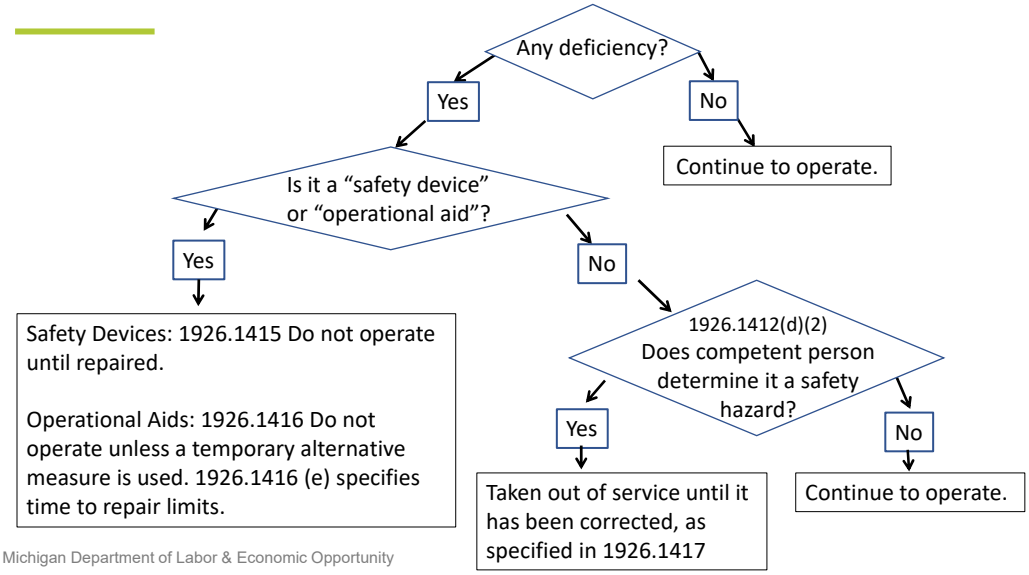
65

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.

66

Shift Inspection: Deficiencies



67

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.
  - 1412 (d)(2) and (3) are the corrective actions for shift inspections.

68

Monthly Inspections: Documentation

- 1926.1412 (e)(3)(i) The following information must be documented and maintained:
  - (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) Retained for a minimum of three months.

- In brief, monthly = shift inspection, with documentation.
- Discussion question: Do you think you might want to retain documents for more than three months?

Activity Three: Shift (and Monthly) Inspections

- Find a partner.
- 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

- Find a partner.
- Match the required inspection items with the pictures.

1. __ Control mechanisms for maladjustments interfering with proper operation.
2. __ Control and drive mechanisms for apparent wear or contamination.
3. __ Air, hydraulic and other pressurized lines for deterioration or leakage.
4. __ Hydraulic system for proper fluid level.


C

A


B


D

71

71

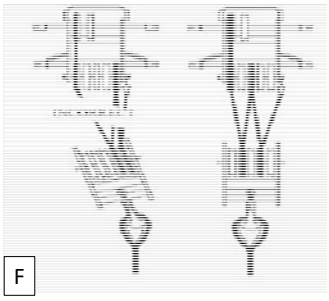
Activity Three: Shift (and Monthly) Inspections

- Find a partner.
- Match the required inspection items with the pictures.

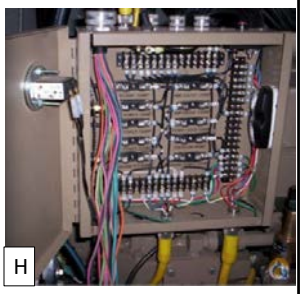
5. __ Hooks and latches for deformation, cracks, excessive wear, or damage.
6. __ Wire rope reeving for compliance with the manufacturer's specifications.
7. __ Wire rope, in accordance with wire rope shift inspection.
8. __ Electrical apparatus for malfunctioning, excessive deterioration, dirt or moisture accumulation.


E

Micrometer checking diameter of wire rope.


F


G


H

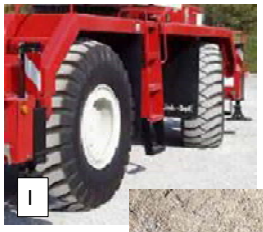
72

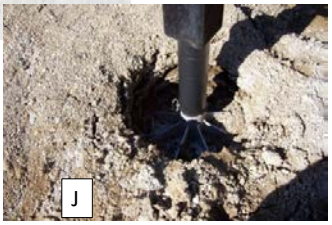
72

Activity Three: Shift (and Monthly) Inspections

- Find a partner.
- Match the required inspection items with the pictures.

9. __ Tires (when in use) for proper inflation and condition.
10. __ Ground conditions support, settling, water accumulation, or similar.
11. __ Equipment for level position within the manufacturer's tolerances.
12. __ Operator cab windows for cracks, breaks, other deficiencies that would hamper the operator's view.
13. __ Safety devices and operational aids for proper operation.





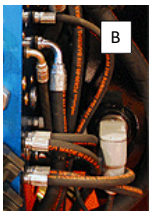
73

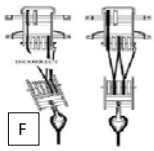
73

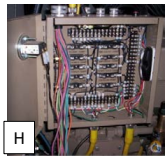
Activity Three: Shift (and Monthly) Inspections

- Answer Key

1. D Control mechanisms for maladjustments interfering with proper operation.
2. C Control and drive mechanisms for apparent wear or contamination.
3. B Air, hydraulic and other pressurized lines for deterioration or leakage.
4. A Hydraulic system for proper fluid level.
5. G Hooks and latches for deformation, cracks, excessive wear, or damage.
6. F Wire rope reeving for compliance with the manufacturer's specifications.
7. E Wire rope, in accordance with wire rope shift inspection.
8. H Electrical apparatus for malfunctioning, excessive deterioration, dirt or moisture accumulation.
9. I Tires (when in use) for proper inflation and condition.
10. J Ground conditions support, settling, water accumulation, or similar.
11. K Equipment for level position within the manufacturer's tolerances.
12. M Operator cab windows for cracks, breaks, other deficiencies that would hamper the operator's view.
13. L Safety devices and operational aids for proper operation.







74

74

Fire Extinguisher

One more item to inspect:

- 1926.1433(d)(6) An accessible fire extinguisher must be on the equipment.

75

Types of Inspections

WHEN	Inspector Qualifications	Documented?	What to Inspect?
Post Assembly	Qualified Person	Not addressed*	See 1926.1412(c)(1)
Shift (Daily)	Competent Person	No	1926.1412(d)(1) (i) to (xiv)
Monthly	Competent Person	Yes. Save 3 months	1926.1412(d)(1) (i) to (xiv)
Annual	Qualified Person		
Modifications	Qualified Person		
Repairs or Adjustments	Qualified Person		
Severe Service	Qualified Person		

76

Annual Inspections 1926.1412 (f)(1)

- At least every 12 months
- By a qualified person
- Includes:
  - (d) shift inspection items but use corrective actions in paragraphs (f)(4), (f)(5), and (f)(6).
  - (f)(2) Items (i) through (xxi).
  - **Disassembly is required, as necessary.**
  - (f)(3) This inspection must include functional testing to ensure it is functioning properly.

77

Annual Inspections

- 1926.1412 (f)(4) If a deficiency, the qualified person must determine if it either:
  - constitutes a safety hazard or,
  - not yet a safety hazard but 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.

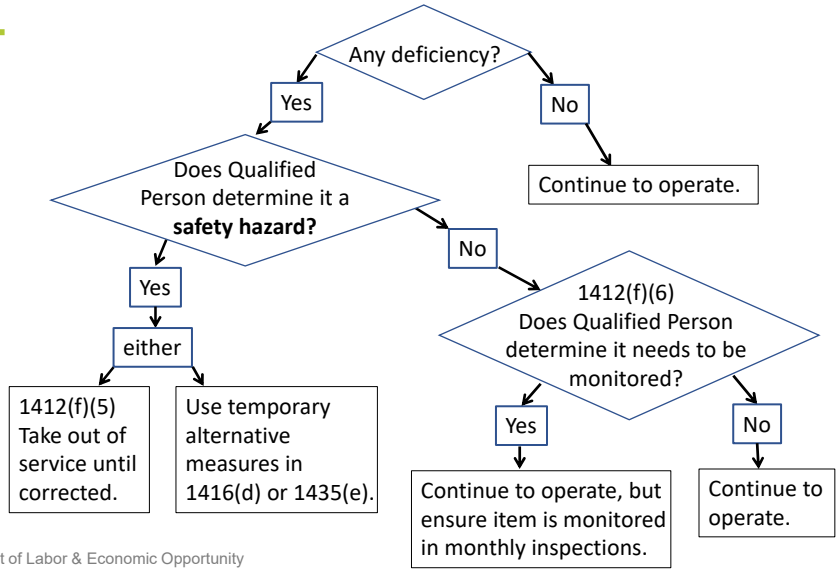
78

Annual Inspections

- 1926.1412(f)(5) If deficiency is a safety hazard, the equipment must be taken out of service until it has been corrected, except when temporary alternative measures are implemented as specified in 1926.1416(d) or 1926.1435(e). See 1926.1417.
- 1926.1412(f)(6) If the qualified person determines that, though not presently a safety hazard, the deficiency needs to be monitored, the employer must ensure that the deficiency is checked in the monthly inspections.

79

Annual Inspection: Deficiencies



80

Annual Inspections: Documentation

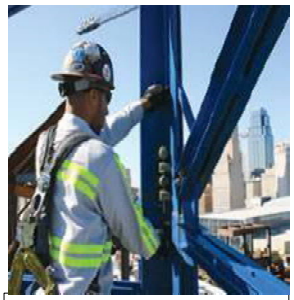
- 1926.1412(f)(7). The annual inspection must be documented, maintained, and retained for a minimum of 12 months, including:
  - (i) The items checked and the results of the inspection.
  - (ii) The name and signature of the person who conducted the inspection and the date.

81

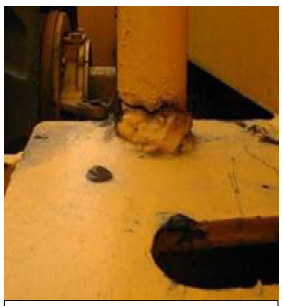
Annual Inspections
Some of the Additional Items Required to be Inspected.

Equipment structure, including the boom.

Deformed, cracked, or significantly corroded structural members.



Loose, failed, or significantly corroded bolts, rivets, and other fasteners.

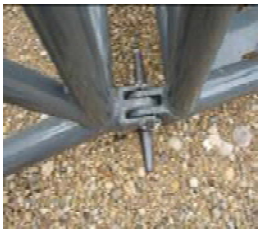


Cracked welds.

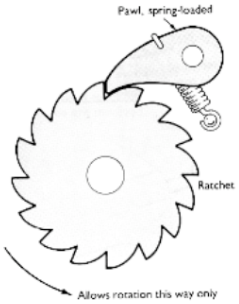
82

Annual Inspections
Some of the Additional Items Required to be Inspected.

Sheaves and drums for cracks or significant wear.



Pins, bearings, shafts, gears, rollers and locking devices for distortion, cracks or significant wear.

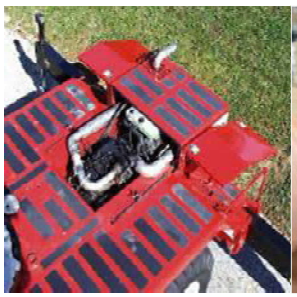


Brake and clutch system parts, linings, pawls and ratchets for excessive wear.

Safety devices operational aids for proper operation.

83

Annual Inspections
Some of the Additional Items Required to be Inspected



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.

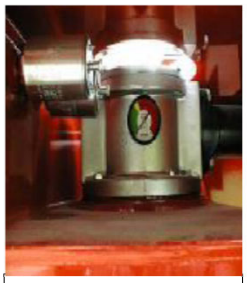
Tires for damage or excessive wear.

84

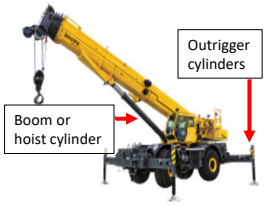
Annual Inspections
Some of the Additional Items Required to be Inspected

Hydraulic, pneumatic and other pressurized hoses, fittings and tubing.

Hydraulic and pneumatic pumps and motors.



Hydraulic and pneumatic valves.



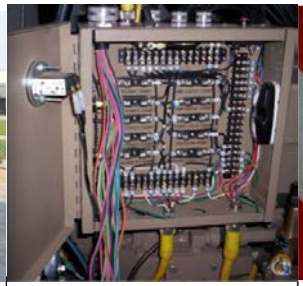
Hydraulic and pneumatic cylinders.

85

Annual Inspections
Some of the Additional Items Required to be Inspected

Outrigger or stabilizer pads and floats for excessive wear or cracks.

Slider pads for excessive wear or cracks.

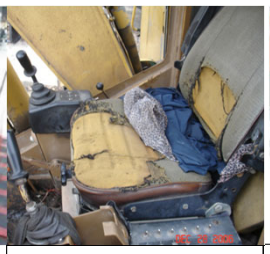


Electrical components and wiring for cracked or split insulation and loose or corroded Terminations.

Missing or unreadable warning labels and decals.

86

Annual Inspections
Some of the Additional Items Required to be Inspected

			
Originally equipped operator seat (or equivalent): missing.	Operator seat: Unserviceable.	Originally equipped steps, ladders, handrails, guards: missing.	Steps, ladders, handrails, guards: in unusable/ unsafe condition.

87

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.

88

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.

89

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

90

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.

91

Types of Inspections**

WHEN	Inspector Qualifications	Documented?	What to Inspect?
Post Assembly	Qualified Person	Not addressed*	See 1926.1412(c)(1)
Shift (Daily)	Competent Person	No	1926.1412(d)(1) (i) to (xiv)
Monthly	Competent Person	Yes. Save 3 months	1926.1412(d)(1) (i) to (xiv)
Annual	Qualified Person	Yes. Save 12 months	1926.1412(d)(1) + 1926.1412(f)(2)
Modifications	Qualified Person	Yes	1926.1412(a)(1)
Repairs or Adjustments	Qualified Person	Not addressed*	1926.1412(b)(1)(i) to (iii)
Severe Service	Qualified Person	Not addressed*	1926.1412(g)(1) and (2)

* 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.

92

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.?

93

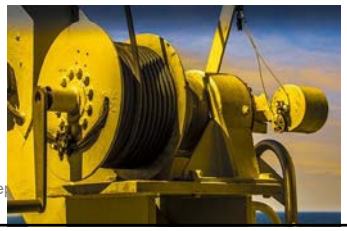
Wire Rope Inspections

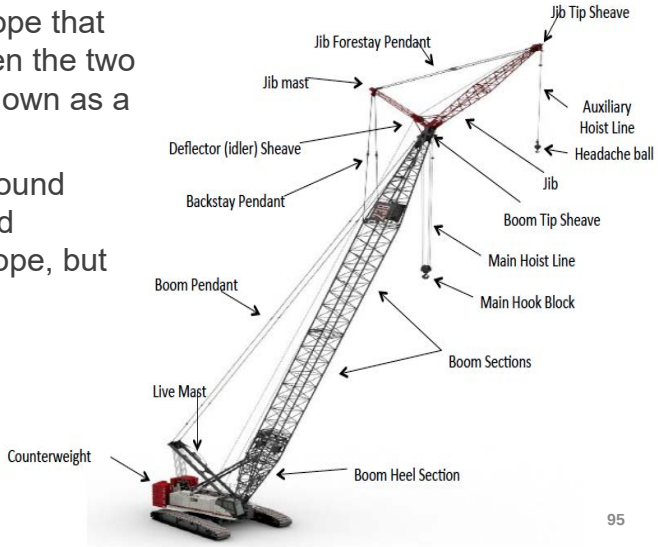
- The wire rope on the crane must be inspected.
- This is “above the hook” wire rope. Inspection of all rigging “below the hook” is addressed separately.
- In most cases, this inspection goes hand in hand with the crane inspection.
- OSHA and MIOSHA chose to write the rules for wire rope inspection separately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

94

Wire Rope is Used Two Ways on the Crane

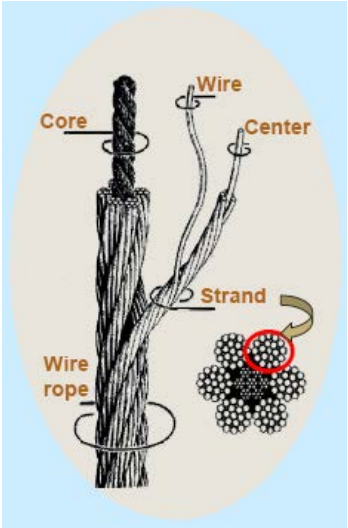
- **Standing (guy) rope:** A supporting rope that maintains a constant distance between the two parts connected by the rope. (Also known as a pendant line.)
- **Running rope:** A rope that travels around sheaves and/or drums. It is let out and drawn back up. It includes the hoist rope, but can include others.





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 six or eight strands laid around a fiber or wire rope center (core).



Wire Rope Inspections Required

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

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

97

97

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.

Michigan Department of Labor & Economic Opportunity

98

98

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 must 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).

99

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.

Rotation resistant wire rope

100

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).

101

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 three 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.

102

Category 1 Deficiencies

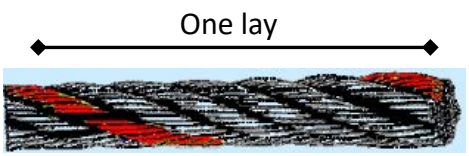
1926.1413(a)(2)(i)(A) Significant distortion of the rope, including:

- Kinking.
- Crushing.
- Unstranding.
- Birdcaging.
- Signs of core failure or steel core protrusion between the outer strands.

- (B) Significant corrosion.
- (C) Electric arc damage (from a source other than power lines) or heat damage.
- (D) Improperly applied end connections.
- (E) Significantly corroded, cracked, bent, or worn end connections (such as from severe service)

Categories 2 Deficiencies

- 1926.1413(a)(2)(ii)(A)(1) In running wire ropes, six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay.
- 1926.1413(a)(2)(ii)(A)(2) In rotation-resistant ropes, two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in 30 rope diameters.
- 1926.1413(a)(2)(ii)(A)(3) In standing ropes, more than two broken wires in one rope lay in sections beyond end connections or more than one broken wire at an end connection.
- 1926.1413(a)(2)(ii)(B) 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.
- 1926.1413(a)(2)(iii)(C) A broken strand.

105

Activity 4: Practice Inspecting

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

106

What's Wrong?

107

- Leaking hydraulics.

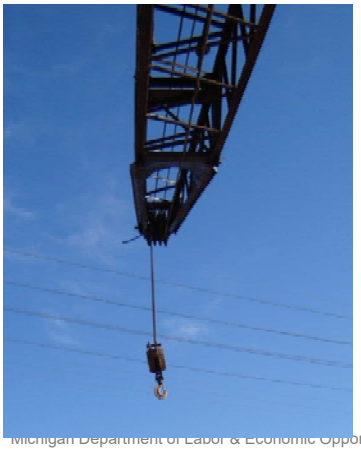
108

What's Wrong?

(Same crane in both pictures.)

109

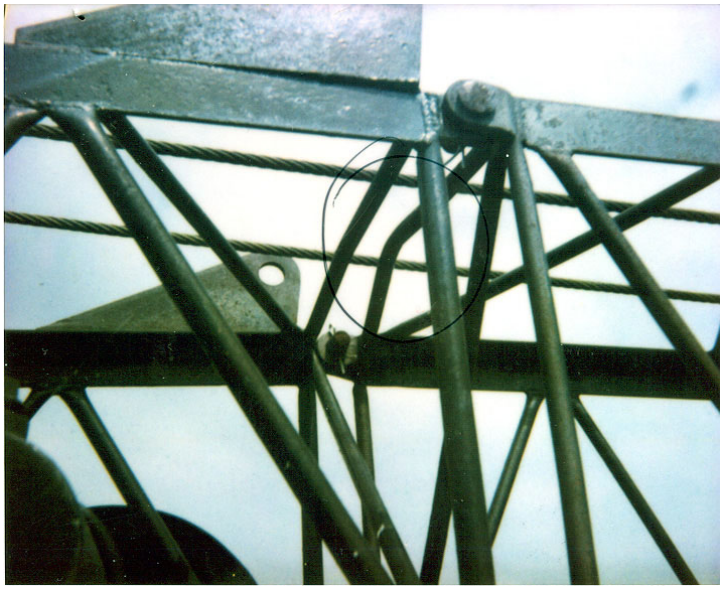
- Wire rope too small of diameter for sheave.
- Reeved wrong or terminated wrong.



(Same crane)

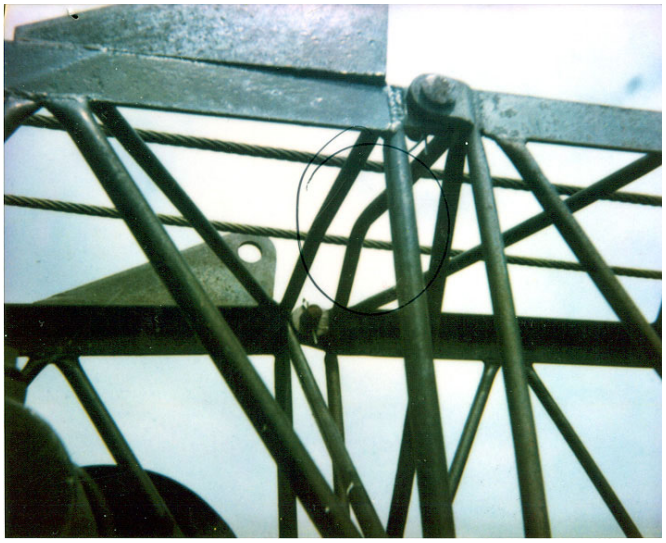
110

What's Wrong?



111

- Bent lattice.



112

What's Wrong?

113

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

114

What's Wrong?

115

- Too many broken wires.

116

What's Wrong?

117

- Bad cribbing
- Soft ground
- Not level

118

What's Wrong?

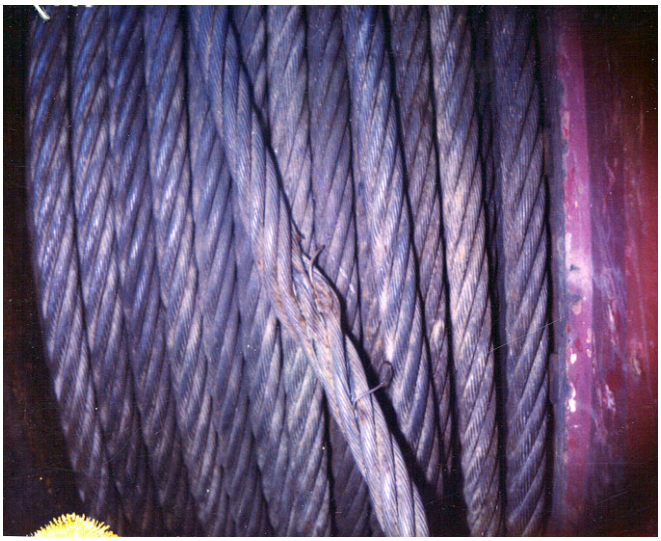
119

- Not "firm, drained, and graded" ground conditions.
- Crane mats might be used here.

Typical crane mat used with crawler cranes

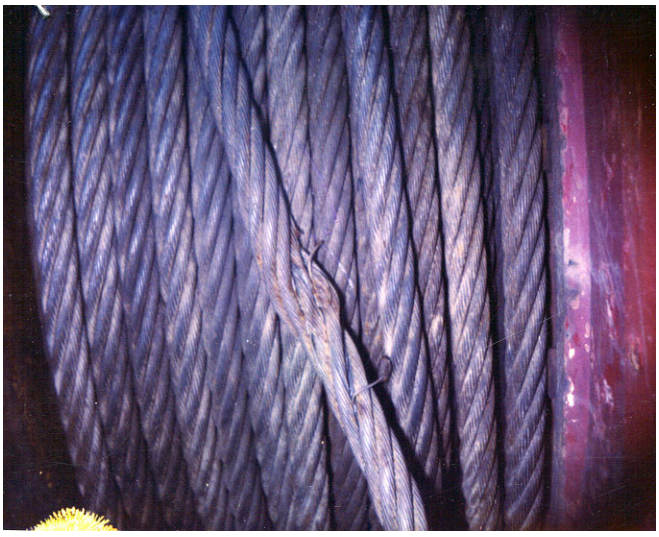
120

What's Wrong?



121

- Wire rope severely damaged.



122

What's Wrong?

123

123

- Outriggers in soft dirt conditions with no outrigger pads.

124

124

What's Wrong?

125

- Lifting over workers.

126

Lunch Break

127

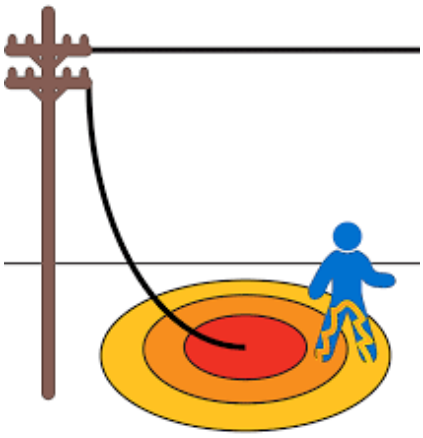
Module Four:

- Power Line Safety

128

129

Step Potential



- When the crane hits the powerline, electricity flows to the ground.
- Then it flows outward in all directions.
- It loses voltage the further it flows out.
- You become the path if your feet are in spots with different voltage.
- Keep your feet together and shuffle away.

130

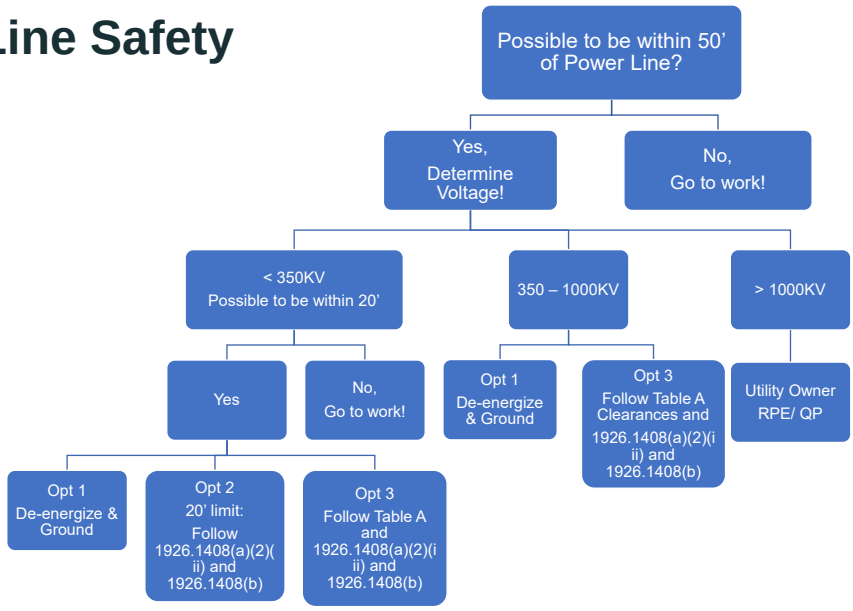
How far away from the power line is this crane's load line?

131

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

132

Power Line Safety

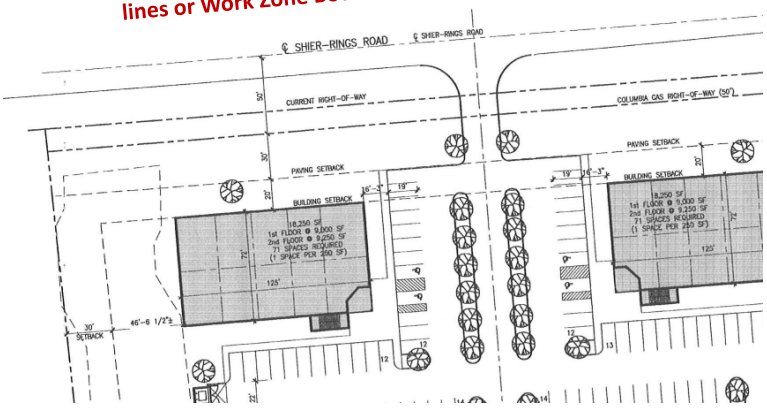


133

Site Plan

- Always review the site before the crane arrives. Power lines and ground conditions need planning.

Indicate the power lines, Voltages, and where warning lines or Work Zone Boundaries go on site plans!



http://www.dublin.oh.us/planning/projects/08-001/index.php

134

Power Line Safety

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

During 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 one of the following: (Options 1, 2, and 3)

- could = 360 degree boom rotation
- In other words, is it possible to get closer than 20 feet? Then use options 1, 2 or 3.

135

Power Line Safety

During Operations: 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:

136

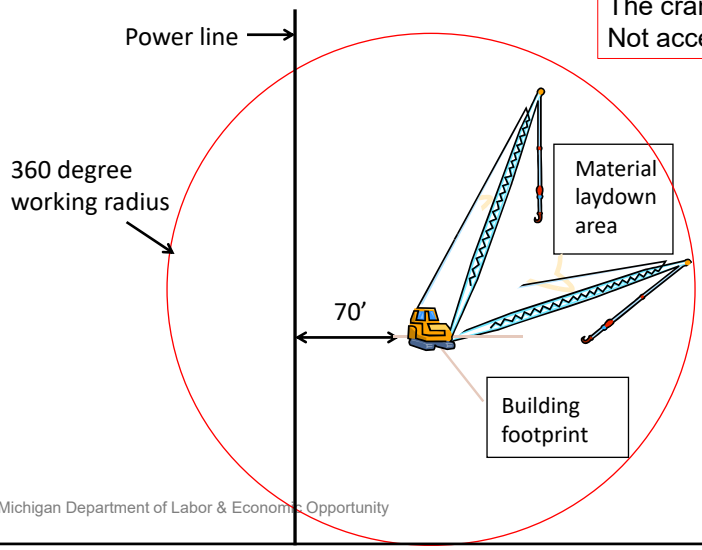
Work Zone Boundaries

- 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 that the boundaries are clear, and that the operator can clearly see these boundary markers.
  - Simplest boundary would be one straight line of flags. If several powerlines, it might require a complete perimeter around your jobsite.

137

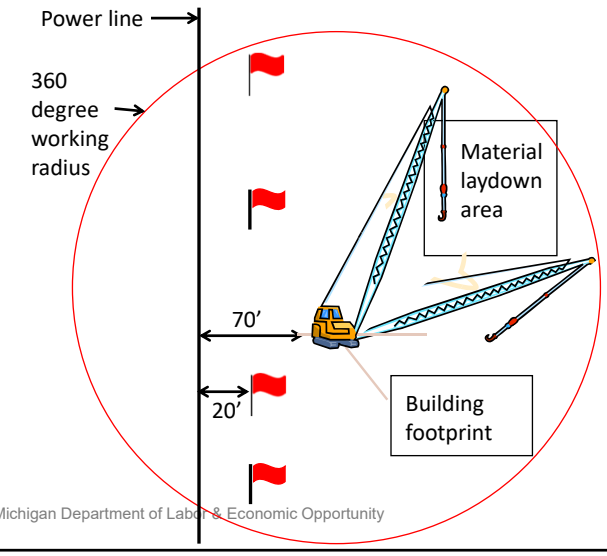
Example: NO Work Zone Boundary and Single Powerline

The crane can get closer than 20' to the powerline. Not acceptable.



138

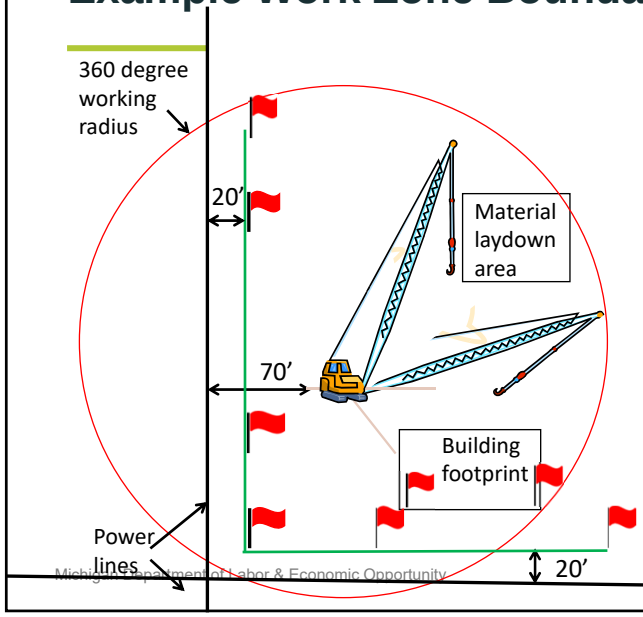
Example: Work Zone Boundary and Single Powerline



- Red flags as “Work zone Boundary”.
- Crane will not go past.
- Operator, rigger, signal person all know this.
- “Work zone” is everything to the right of the line of flags.
- This is acceptable. You do not need to use Option 1, 2, or 3.

139

Example Work Zone Boundary: Complete Perimeter



- The green line is a fence around the work site.
- Flags can be attached to the top of the fence.
- Now you have a Work Zone Boundary.
- Additional flags might be put on top of the building to help the operator or signal person when they are lifting onto the building.

140

Work Zone Boundary

- Flags on the fence identify the boundary.

141

If You Do Not Use "Work Zone Boundary"

- 1926.1408(a)(2) 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, then you must follow either Option (1), Option (2), or Option (3):

Requirement Options	Employer Responsibilities
Option 1: 1408(a)(2)(i) **De-energize and Ground**	Confirm with the utility owner that the power line has been de-energized, and visibly grounded at the worksite.
Option 2: 1408(a)(2)(ii) **Maintain 20 foot clearance** *50 foot if over 350 KV*	Maintain 20 feet clearance from the power line. Must implement the encroachment prevention measures.
Option 3: 1408(a)(2)(iii) **Determine voltage and use Table A clearance.**	(a) Determine the line's voltage and the minimum clearance permitted under Table A "minimum clearance". (b) Maintain the minimum clearance from the power line permitted under Table A. Must implement the encroachment prevention measures.

142

142

TABLE A—MINIMUM CLEARANCE DISTANCES

Voltage (nominal, kV, alternating current)	Minimum clearance distance (feet)
up to 50	10
over 50 to 200	15
over 200 to 350	20
over 350 to 500	25
over 500 to 750	35
over 750 to 1,000	45
over 1,000	(as established by the utility owner or operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution).

Note: The value that follows "to" is up to and includes that value. For example, over 50 to 200 means up to and including 200kV.

143

143

1926.1408(b) Encroachment Prevention Measures (for Options 2 and 3)

Assembly/Disassembly 1926.1407(b)	Operations 1926.1408(b)(2)
(1) Planning Meeting	(1) Planning Meeting
(2) Non-Conductive Tag Line	(2) Non-conductive Tag Line
(3) At least one of the following: • elevated warning line, barricade, or line of signs in view of the operator. • dedicated spotter, • proximity alarm, • range control warning, • range "slew" limiting device,	(3) Erect and maintain an elevated warning line, barricade, or line of signs, in view of the operator (Spotter needed if out of view), equipped with flags or similar high-visibility markings, at 20 feet or applicable clearance from Table A.
	(4) At least one of the following: • dedicated spotter • proximity alarm • range control warning, • Range "slew" limiting device, • Insulating link.

144

144

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.

145

Non-Conductive Tag Lines

WARNING: It is important to remember that all ropes, regardless of features or treatments, lose dielectric properties with use. Ropes that are ***wet*** or become ***dirty*** will conduct electricity.

-From: Chris Parrish, New England Ropes

- 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.

146

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.

147

Posting of Electrocution Warnings

1926.1407(g) There must be at least:

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

148

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 it has been deenergized and (at the worksite) visibly grounded. Exceptions:

1926.1408(d)(2)(ii) and (iii) the uppermost part of the equipment when extended/boomed all the way up would be more than 20 feet (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.

149

Working Closer Than Permitted? Not Allowed! Except…

1926.1410(a) It is infeasible to do the work without breaching the minimum approach distance under Table A.

1926.1410(b) After consultation with the utility owner or operator, it is infeasible to de-energize or relocate the power line.

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

150

Power Line Safety

Conclusion:

Determine the voltage of power lines.

- Use work-zone boundaries.
- Or, De-energize.
- Or, Option 2
- Or, Option 3 and follow Table A.

151

Traveling Under Power Lines

- 1926.1411(b)(4): Traveling under the Power Lines with no load; must use a spotter.

TABLE T—
MINIMUM CLEARANCE DISTANCES WHILE TRAVELING WITH NO LOAD

Voltage (nominal, kV, alternating current)	While traveling—minimum clearance distance (feet)
Up to 0.75	4
Over .75 to 50	6
Over 50 to 345	10
Over 345 to 750	16
Over 750 to 1,000	20
Over 1,000	(as established by the utility owner or operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution).

152

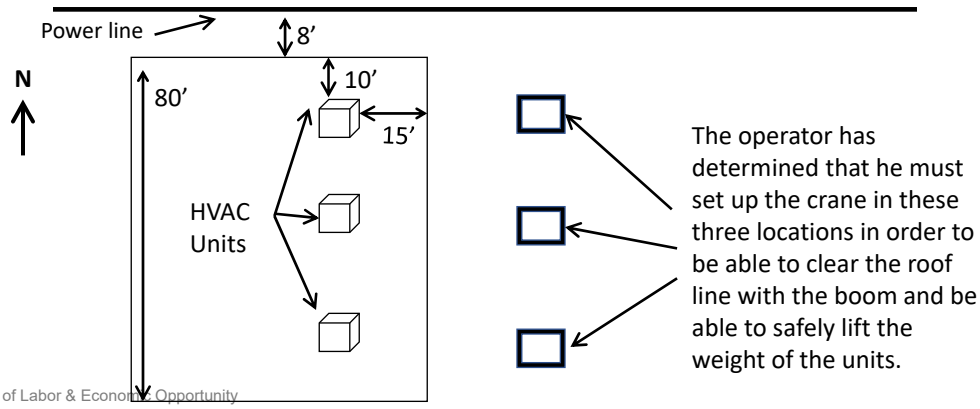
Activity 5:
Working Safely Around Power lines

- Small groups will work on a scenario.
- Review the assigned scenario and determine what is necessary for you to work safely regarding the power lines.
- Be prepared to present your ideas and possible solutions to the class.

153

Activity 5: Power line Safety Scenario 1

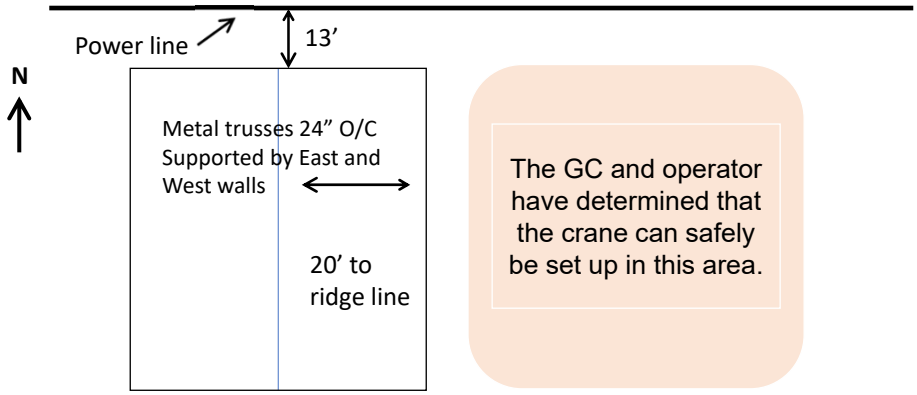
- Using an 80-ton rough-terrain crane. Removing the old HVAC units off the roof and installing the new HVAC units on the roof. Fully extended, it has 140' of boom.
- There is a power line running along the North side of the building, about eight feet from the edge of the building. You called and found that it was a 15kv line.



154

Activity 5: Power line Safety Scenario 2

- You brought your 110-ton Terex truck-mounted crane to a two-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 KV lines, 80' high.



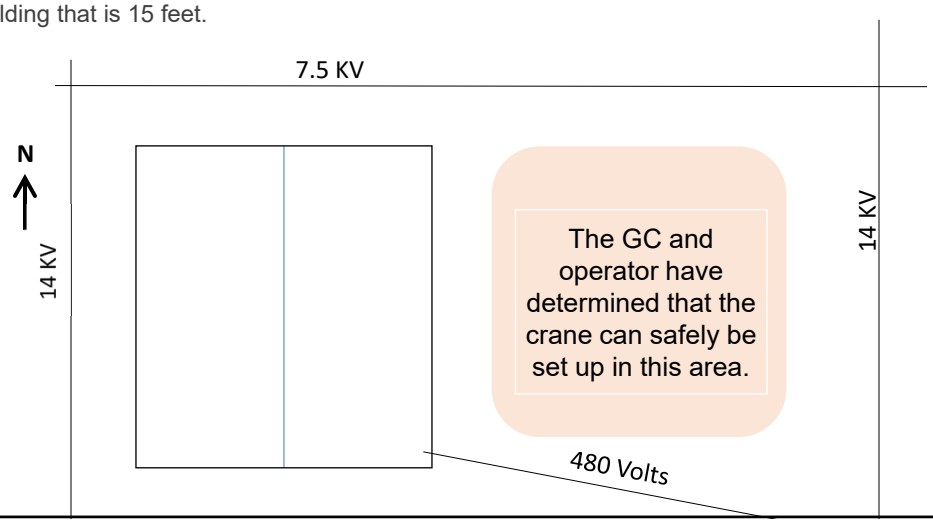
The GC and operator have determined that the crane can safely be set up in this area.

155

155

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 18 feet high from the ground, except the service line to the building that is 15 feet.



The GC and operator have determined that the crane can safely be set up in this area.

156

156

Module Five

- Operations

157

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)

158

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.

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 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.

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).

161

Operating Within Rated Capacity

Clearly NOT within the rated capacity

162

Using Load Charts

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

A bold or solid line is used to divide structural from stability capacities. All capacities above the bold line are structural capacities.

Tipping capacities

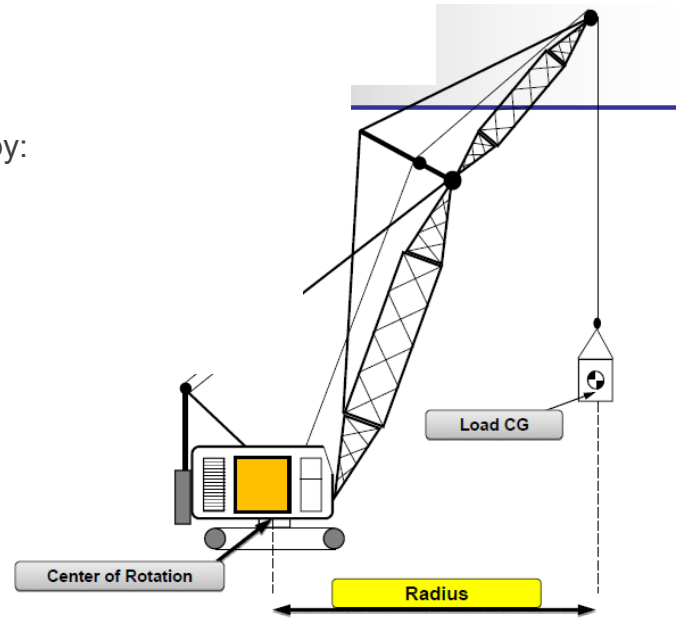
Radius		Boom	Length	
in Feet	36	49	62	75
12	160,000	103,000		
15	120,000	100,000	81,000	76,500
20	93,000	90,000	79,000	68,000
25	70,000	70,000	70,000	64,000
30	55,000	55,000	55,000	50,000

Using Load Weighing Devices

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

Load Capacity

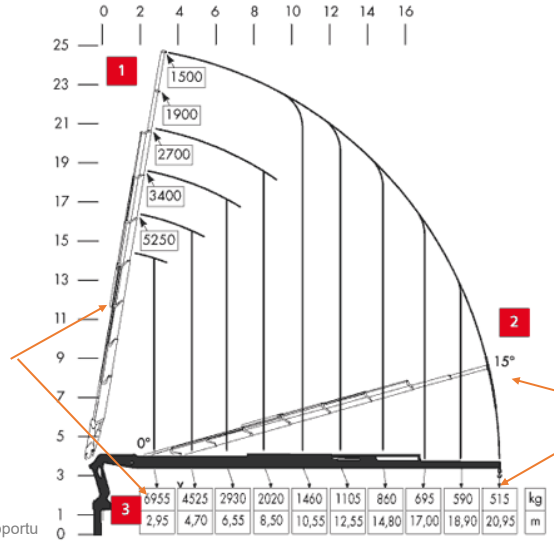
- The load capacity is affected by:
  - Crane radius
  - Boom length
  - Boom angle



165

Where is Capacity Highest and Lowest?

Steepest boom angle
+ Shortest boom
= Highest capacity

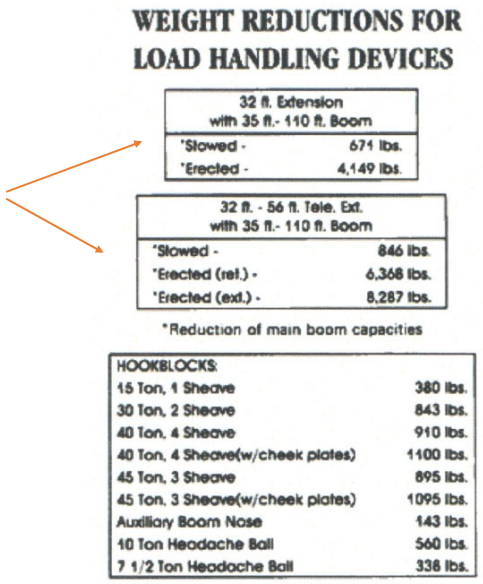


Flattest boom angle
+ Longest boom
= Lowest capacity

166

Effective Load

Effective weight of attachments (used to calculated the gross load) may be more or less than actual weight of that attachment.



WEIGHT REDUCTIONS FOR LOAD HANDLING DEVICES

32 ft. Extension with 35 ft.- 110 ft. Boom	
*Stowed -	671 lbs.
*Erected -	4,149 lbs.

32 ft. - 56 ft. Tele. Ext. with 35 ft.- 110 ft. Boom	
*Stowed -	846 lbs.
*Erected (ret.) -	6,368 lbs.
*Erected (ext.) -	8,287 lbs.

*Reduction of main boom capacities

HOOKBLOCKS:	
15 Ton, 1 Sheave	380 lbs.
30 Ton, 2 Sheave	843 lbs.
40 Ton, 4 Sheave	910 lbs.
40 Ton, 4 Sheave(w/cheek plates)	1100 lbs.
45 Ton, 3 Sheave	895 lbs.
45 Ton, 3 Sheave(w/cheek plates)	1095 lbs.
Auxiliary Boom Nose	143 lbs.
10 Ton Headache Ball	560 lbs.
7 1/2 Ton Headache Ball	338 lbs.

Page from cranes load charts.

Calculating Gross (Total) Load Can Be Complex

Must know:

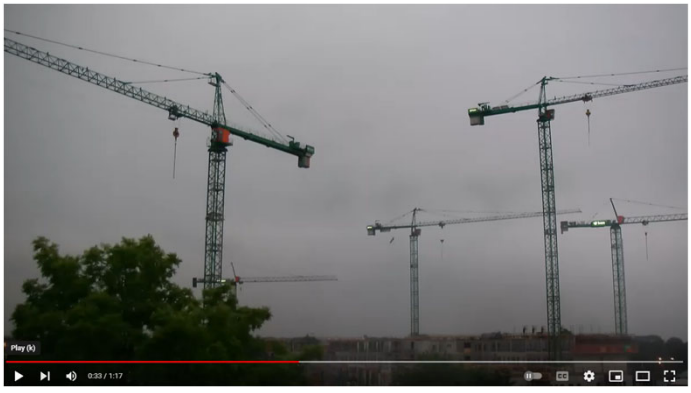
1. Correct configuration of the crane
2. Weight of line(s), block(s) or ball(s)
3. Weight of rigging below the hook
4. Effective weight of any attachments
5. Weight of object being lifted
6. Angle of boom
7. Length of boom
8. How to read the load chart and accompanying notes to properly add and subtract 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).
- Examples of things not allowed:
  - Talking to somebody in person
  - Phone
  - Television
  - Text
  - Social media
  - YouTube
  - Facebook
  - Talk radio
  - Eating
  - Etc.

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.



Wind

171

Compensating for Weather

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.

172

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.

173

Adjustments or Repairs

1926.1417(j) If equipment adjustments or repairs are necessary:

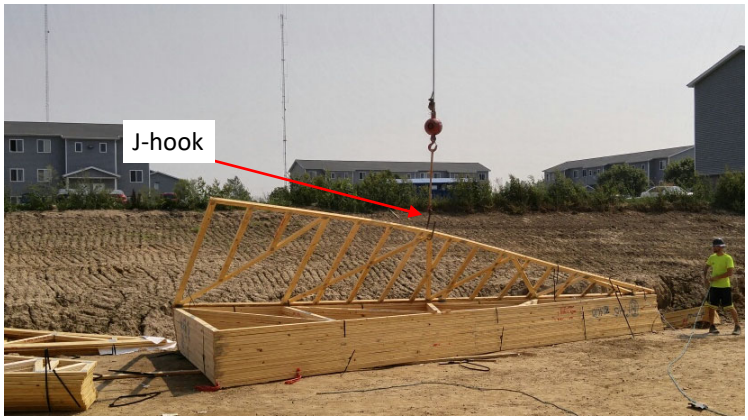
- 1926.1417(j)(1) The operator must, in writing, promptly inform the person designated by the employer to receive such information and, where there are successive shifts, to the next operator.
- 1926.1417(j)(2) The employer must notify all affected employees, at the beginning of each shift, of the necessary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

174

1926.1425(c)(2) Open Hooks

Open hook not allowed.

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



175

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.

176

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.

177

Swinging Counterweights

- 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.

Does this look like a dangerous situation?

178

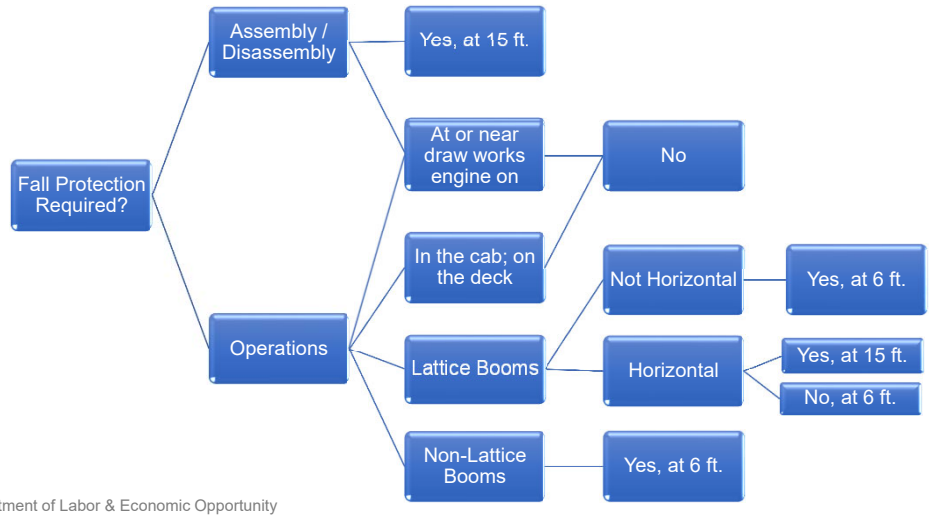
Keeping Clear of the Load

- 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.

179

180

Fall Protection



181

Anchoring (tie-off) to the Load Line

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 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(d)(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).

182

1926.1431 Hoisting Personnel with a Personnel Platform

(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.

183

Hoisting with Personnel Platforms

Many details such as:

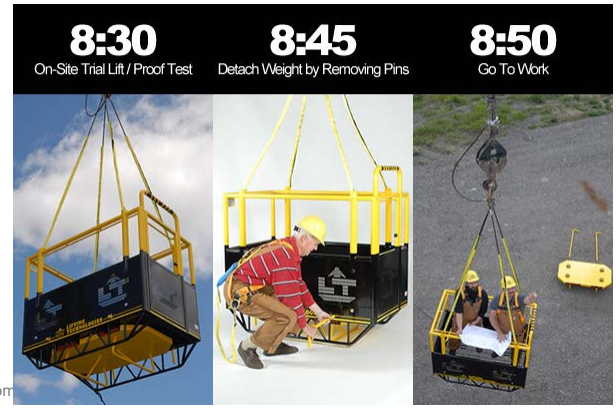
- 1926.1431 (1) Capacity: Must not exceed 50% when hoisting personnel.
- 1926.1431(e)(1) A qualified personnel familiar with structural design shall design the personnel platform and suspension system.
- 1926.1431(k)(1) Hoisting must be performed in a slow, controlled, cautious manner, with no sudden 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.

184

Hoisting with Personnel Platforms

1926.1431(h) Trial Lift and Inspection:

The trial lift shall be performed immediately before placing personnel on the platform.



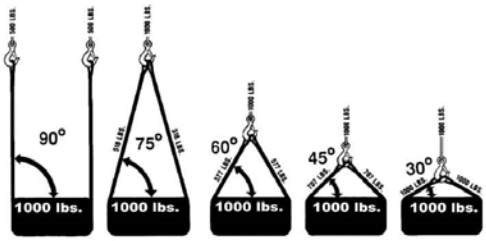
185

Module Six

- Training, Qualifications, and Certification

186

Objectives



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

187

187

Operator Certification and Evaluation:

- 1926.1427 (a) The employer shall ensure that the operator is trained, certified/licensed, and evaluated to operate the equipment.
- 1926.1427(a)(2) Exceptions. Not required for operators of:
  - Derricks. See 1926.1436(q).
  - Side boom 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).
- Note: the “evaluation” component is new as of September 2019.

Michigan Department of Labor & Economic Opportunity

188

188

Operator Certification:

	Rule	How	Portable	Valid for
1	1926.1427(d)	“Certification” by an accredited crane operator testing organization.	Yes	5 yrs
2	1926.1427(e)	“Certification” by an audited employer program.	No	5 yrs
3	1926.1427(c)(1)	“Licensing” by a government entity.	No	Up to 5 yrs

189

Operator Certification Criteria

1926.1427(d)(1)(i) 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.

190

Certified to Operate What?

- 1926.1427(d)(1)(ii)(B) Provide certification based on equipment type or type and capacity.
- Types currently listed by NCCCO

1. Mobile crane
2. Boom truck
3. Service truck
4. Tower crane
5. Overhead crane
6. Articulating crane
7. Digger derrick
8. Dedicated pile driver
9. Drill Rig

1926.1427(f) Evaluation

- 1926.1427(f)(1) Through an evaluation, the employer must ensure that each operator is qualified by a demonstration of:
  - (i) The skills and knowledge, as well as the ability to recognize and avert risk, necessary to operate the equipment safely, including those specific to the safety devices, operational aids, software, and the size and configuration of the equipment. Size and configuration includes, but is not limited to, lifting capacity, boom length, attachments, luffing jib, and counterweight set-up.
  - (ii) The ability to perform the hoisting activities required for assigned work, including, if applicable, blind lifts, personnel hoisting, and multi-crane lifts.
- In other words, your company must observe an operator in action and determine that they can safely operate that specific crane in that specific configuration.

Operator Evaluation in Context

- This evaluation is now spelled out in detail.
- But the expectation of evaluation has ALWAYS existed, and not just for cranes.
- CS Part 1, General Rules 115 (2) (b) An employer shall not permit the operation of machinery, equipment, and special tools, except by a qualified employee.
- Without the type of evaluation described in the crane rule, how would you possibly know that a worker is qualified?

193

1926.1427(f)(2) Previous Evaluation

- For operators employed prior to December 10, 2018, the employer may rely on its previous assessments of the operator in lieu of conducting a new evaluation of that operator's existing knowledge and skills.

194

Who Evaluates Operators?

- 1926.1427(f)(4) Conducted by an individual who has the knowledge, training, and experience necessary to assess equipment operators.
- 1926.1427(f)(5) The evaluator must be an employee or agent of the employer.
- 1926.1427(f)(6) Document the evaluation. Include:
  - Operator's name
  - Evaluator's name and signature
  - Date
  - Make, model, and configuration of equipment.
  - Documentation available at the worksite.

195

What if the Operator Runs Many Different Cranes?

- 1926.1427(f)(5) Once the evaluation is completed successfully, the employer may allow the operator to operate other equipment that the employer can demonstrate does not require substantially different skills, knowledge, or ability to recognize and avert risk to operate.

196

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.
- Do not just look for “open practical test sites” in Michigan (there are none). Look for “Practical Examiners for Hire” in Michigan (there are seven as of Jan. 2020).

Signal Person: When is One Required?

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

- (1) The load or load placement area 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) Employer must ensure signal person(s) meets the qualification requirements. Met by using either:

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

199

Signal Person Qualifications

- 1926.1428(c)(1) 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.
- 1926.1428(c)(2) Be competent in the application of the type of signals used.
- 1926.1428(c)(3) 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.

200

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.

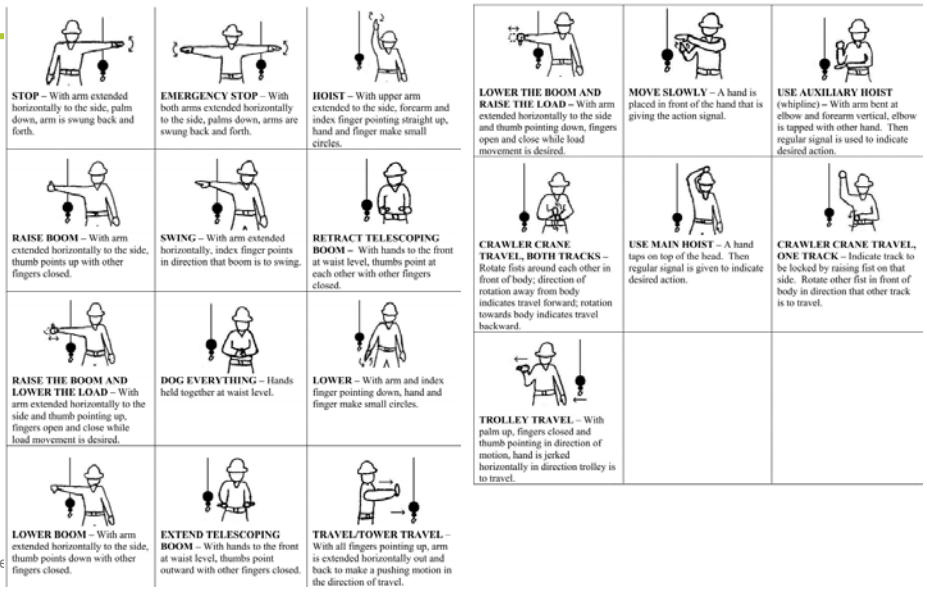
(2) Be competent in the application of the type of signals used.

(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.

APPENDIX A: Standard Hand Signals



STOP – With arm extended horizontally to the side, palm down, arm is swung back and forth.

EMERGENCY STOP – With both arms extended horizontally to the side, palms down, arms are swung back and forth.

HOIST – With upper arm extended to the side, forearm and index finger pointing straight up, hand and finger make small circles.

RAISE BOOM – With arm extended horizontally to the side, thumb points up with other fingers closed.

SWING – With arm extended horizontally, index finger points in direction that boom is to swing.

RETRACT TELESCOPING BOOM – With hands to the front at waist level, thumbs point at each other with other fingers closed.

RAISE THE BOOM AND LOWER THE LOAD – With arm extended horizontally to the side and thumb pointing up, fingers open and close while load movement is desired.

DOG EVERYTHING – Hands held together at waist level.

LOWER – With arm and index finger pointing down, hand and finger make small circles.

LOWER BOOM – With arm extended horizontally to the side, thumb points down with other fingers closed.

EXTEND TELESCOPING BOOM – With hands to the front at waist level, thumbs point outward with other fingers closed.

TRAVEL/TOWER TRAVEL – With all fingers pointing up, arm is extended horizontally out and back to make a pushing motion in the direction of travel.

LOWER THE BOOM AND RAISE THE LOAD – With arm extended horizontally to the side and thumb pointing down, fingers open and close while load movement is desired.

MOVE SLOWLY – A hand is placed in front of the hand that is giving the action signal.

USE AUXILIARY HOIST (whipline) – With arm bent at elbow and forearm vertical, elbow is tapped with other hand. Then regular signal is used to indicate desired action.

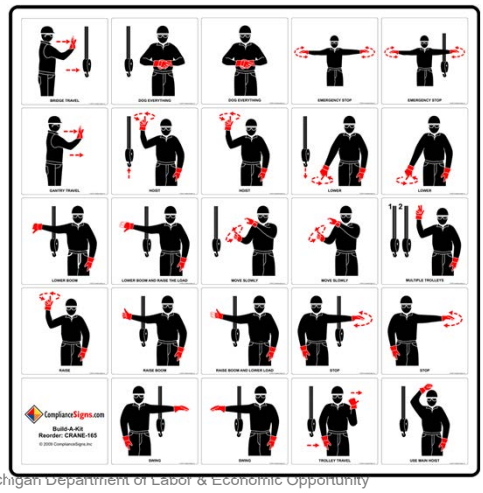
CRAWLER CRANE TRAVEL, BOTH TRACKS – Rotate fists around each other in front of body; direction of rotation away from body indicates travel forward; rotation towards body indicates travel backward.

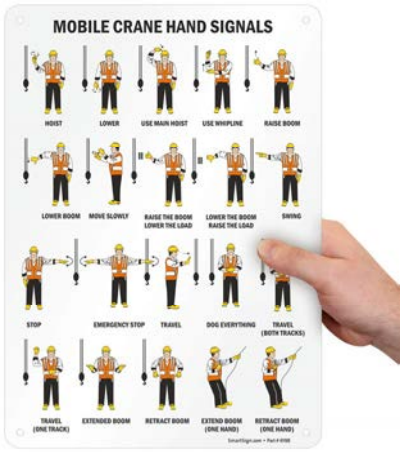
USE MAIN HOIST – A hand taps on top of the head. Then regular signal is given to indicate desired action.

CRAWLER CRANE TRAVEL, ONE TRACK – Indicate track to be locked by raising fist on that side. Rotate other fist in front of body in direction that other track is to travel.

TROLLEY TRAVEL – With palm up, fingers closed and thumb pointing in direction of motion, hand is jerked horizontally in direction trolley is to travel.

Many Other Crane Signals Charts for Sale





203

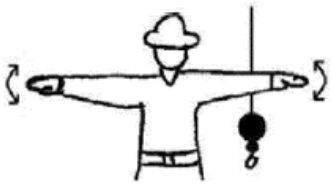
Signals: General Requirements

- 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 one 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.

204

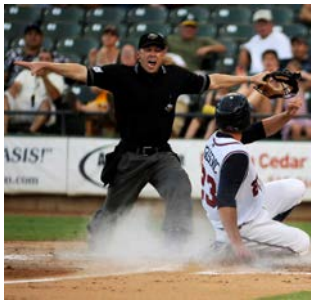
Emergency Stop

- 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 side, palms down, arms are swung back and forth.

Horizontal,
Not vertical motion



Qualified Signal Person: Documentation

1926.1428(a)(3) Documentation available at the site.

Specifies 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) 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 the following criteria shall be met:
  - (3) The materials shall be rigged by a qualified rigger.
- In other words, all rigging must be done by a qualified rigger.

207

Rigger Qualification

- 1926.1401 Definitions: “Qualified rigger” is 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 and evaluation of riggers.

208

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!

209

Struck by Falling Load

Note the deformation of the pallet.

Note the load leaning.

210

Struck by Falling Load

The crane operator is way up here and cannot easily see how objects are rigged.

Michigan Department of Labor & Economic Opportunity

211

Struck by falling load

The impressions from where the materials landed.

Michigan Department of Labor & Economic Opportunity 212

212

Operators-In-Training

- 1926.1427(a)(1) Operation during training.
- 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.

213

Operators in Training

- 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.

214

Operators in Training

- 1926.1427 (3) Paraphrased: Only tasks within the trainee's ability. Cannot perform high risk tasks unless the operator-in-training is certified and the trainer has determined the trainee is experienced and qualified to begin operating these high-risk tasks so they can get the necessary practice.
- High risk tasks:
  - Could get within 20 feet of a powerline
  - Hoisting personnel
  - Multiple-equipment lifts (tandem lifts)
  - Over shafts, cofferdams, tank farms
  - Multiple-lift rigging operations (Christmas-treeing)

215

Operators in Training

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

216

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:
  - (1) The suitability of the supporting ground and surface to handle expected loads.
  - (2) Site hazards.
  - (3) Site access.

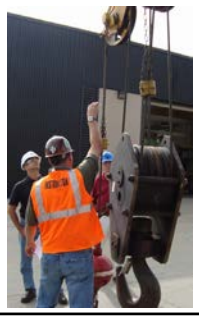
217

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.



218

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.

219

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.

Michigan Department of Labor & Economic Opportunity 220

220

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.

221

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

222

Training Summary

- EVERYBODY needs SOME training.
- Operators: certified by three options.
- Signal persons qualified by third 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.

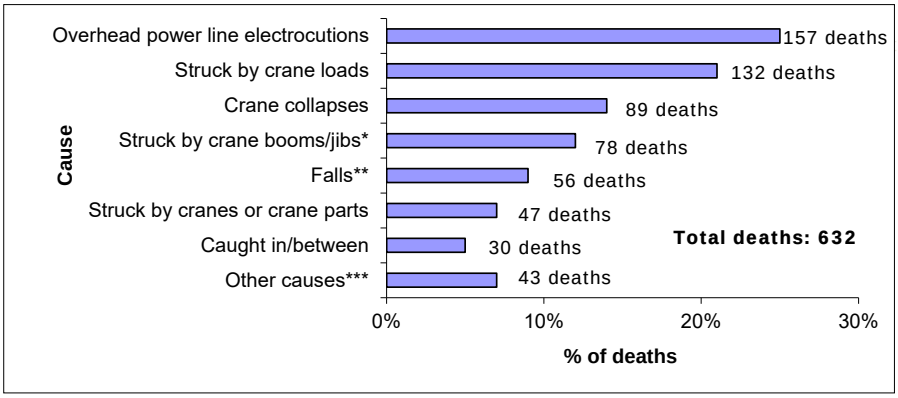
223

Module Seven

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

224

Review: Causes of Crane-Related Deaths in Construction



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

225

225

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.

226

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 operator's 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?

227

Review: Assembly / Disassembly

- “A/D director” is both a “competent person” and a “qualified person.”
- Must know and follow manufacturer’s A/D procedures.
- 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 to verify proper set-up.

228

Review: Inspections

- Daily and monthly inspections by competent person.
- Annual inspections by qualified person.
- Also inspection 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.

Wet spot indicates possible hydraulic leak.

229

Review: Types of Inspections**

WHEN	Inspector Qualifications	Documented?	What to Inspect?
Post Assembly	Qualified Person	Not addressed*	See 1926.1412(c)(1)
Shift (Daily)	Competent Person	No	1926.1412(d)(1) (i) to (xiv)
Monthly	Competent Person	Yes. Save 3 months	1926.1412(d)(1) (i) to (xiv)
Annual	Qualified Person	Yes. Save 12 months	1926.1412(d)(1) + 1926.1412(f)(2)
Modifications	Qualified Person	Yes	1926.1412(a)(1)
Repairs or Adjustments	Qualified Person	Not addressed*	1926.1412(b)(1)(i) to (iii)
Severe Service	Qualified Person	Not addressed*	1926.1412(g)(1) and (2)

* 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.

230

Review: Wire Rope Inspections Required

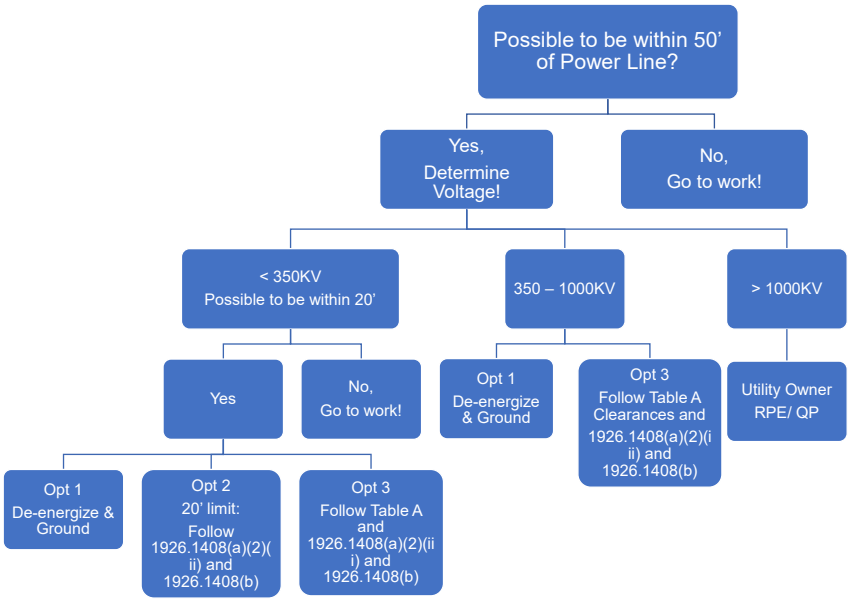
Type	Inspector Qualifications	Documented?	What to Inspect?
Post assembly			Inspection not addressed*
Shift (Daily)	Competent	No	1926.1413(a)(2) and (3)
Monthly	Competent	Yes	1926.1413(a)(2) and (3), 1926.1413(b)(2)
Annual	Qualified	Yes	1926.1413(a)(2) and (3), 1926.1413(b)(2), 1926.1413(c)(1), 1926.1413(c)(2)(i),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

* 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.

231

231

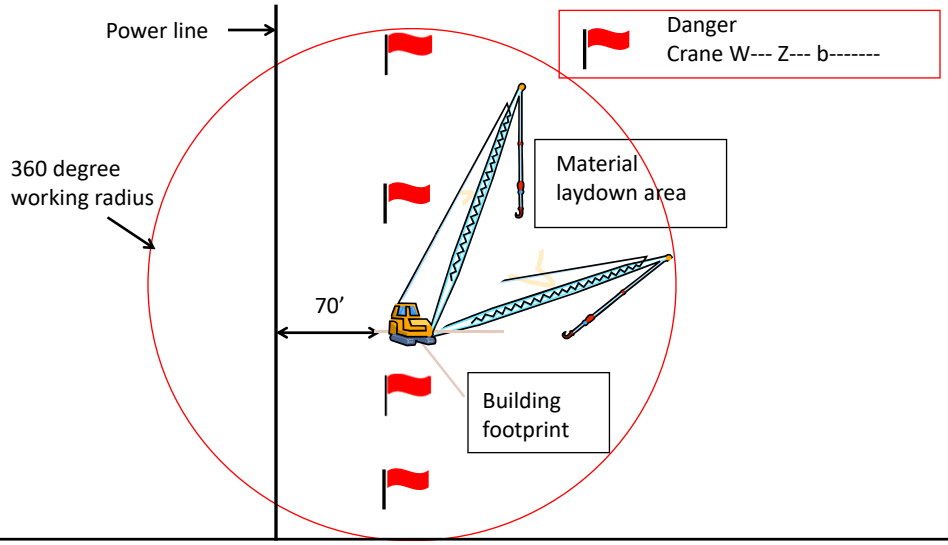
Review: Power Line Safety



232

232

Review: Easiest Option is a W_ _ _ Z_ _ _ B_ _ _ _ _ _ _ _



233

233

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:

Requirement Options	Employer Responsibilities
Option 1: 1408(a)(2)(i) De-energize and Ground	Confirm with the utility owner that the power line has been **de-energized**, and visibly grounded at the worksite.
Option 2: 1408(a)(2)(ii) 20 foot clearance *50 foot if over 350 KV*	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 **encroachment prevention measures** specified in paragraph (b).
Option 3: 1408(a)(2)(iii) Table A clearance	**(a) Determine the line's voltage** and the minimum clearance permitted under **Table A** "minimum clearance". (b) Use **encroachment prevention measures** specified in paragraph (b).

234

Review Operations

- Manual, Load Charts, and 10 BC fire extinguisher in cab available to Operator.
- 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.

235

Review of Signals

- Only one 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!

236

Review of Training

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

237

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.

238

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

Michigan Department of Labor & Economic Opportunity

239

Thank You

Survey

Michigan Occupational Safety and Health Administration

Consultation Education and Training Division

530 W. Allegan Street

Lansing, MI 48933

517-284 7720

www.michigan.gov/miosha

MIOSHA

Michigan Occupational Safety and Health Administration

240

Part 10. Cranes and Derricks

Student Resources

MIOSHA Standards:

Part 10. Cranes and Derricks

MIOSHA Fact Sheets:

Contractor's Directory to Overhead Power Line Safety

Cranes – Standard Hand Signals

Crane Operator Certification

Sample Crane Operator Evaluation

Other Resources:

Cranes Today Magazine

NCCCO - The National Commission for the Certification of Crane Operators

Vertikal

Topping Out of Freedom Tower

MIOSHA Fact Sheets:

Aerial Work Platforms & Lifting Equipment

MIOSHA Training Institute (MTI) Resources:

www.michigan.gov/mti

MIOSHA Training Calendar:

www.michigan.gov/mioshatraining

MIOSHA Homepage:

www.michigan.gov/miosha

Michigan Department of Labor and Economic Opportunity
Michigan Occupational Safety and Health Administration
Consultation Education and Training Division
525 W. Allegan St., P.O. Box 30643
Lansing, Michigan 48909-8143

For further information or to request consultation, education and training services
call 517-284-7720
or
visit our website at www.michigan.gov/miosha

www.michigan.gov/leo