

14XX Tower Cranes

Sections 14XX – 14XX (and the sections they refer to) apply to all Tower Cranes except equipment with a manufacturer-rated hoisting/lifting capacity of 2000 pounds or less.

1410 Erecting, Climbing and Dismantling – Selection of Manufacturer or Employer Procedures

When erecting, climbing and dismantling equipment, the employer shall comply with either:

- (a) all manufacturer procedures applicable to erecting, climbing and dismantling, or
- (b) employer procedures for safe erecting, climbing and dismantling. Employer procedures may be used instead of manufacturer procedures only where the employer can demonstrate that the procedures used meet the requirements in section 14XX through 14XX.

14XX Erecting Climbing and Dismantling – General Requirements (applies to all erecting, climbing and dismantling operations)

- (a) *Supervision – Competent-qualified person.* Erecting, climbing and dismantling must be supervised by a person who meets the criteria for both a competent person and a qualified person (“competent-qualified person”), or by a competent person who is assisted by one or more qualified persons (“supervision team”).
- (b) *Knowledge of procedures.* The competent-qualified person/supervision team supervising the erecting, climbing and dismantling operation must understand the erecting, climbing and dismantling procedures.
- (c) *Review of procedures.* The competent-qualified person/supervision team supervising the erecting, climbing and dismantling operation must review the erecting, climbing and dismantling procedures immediately prior to the commencement of erecting, climbing and dismantling unless the competent-qualified person/ supervision team has applied them to the same type and configuration of equipment (including accessories, if any) with sufficient frequency, or sufficiently recently, so that they are already known and understood.
- (d) *Crew instructions.* Before commencing erecting, climbing and dismantling operations, the competent-qualified person supervising the erecting, climbing and dismantling operation must determine that the crew members understand all of the following:
 - (1) Their tasks.
 - (2) The hazards associated with their tasks.
 - (3) The hazardous positions/locations that they need to avoid.

(e) *Unexpected crane movements.* The operator shall not move any aspect of the equipment (or load) until the operator:

- (1) Knows where the employees working on the erecting, climbing and dismantling operation are located.
- (2) Sounds a warning that is understood by the erecting, climbing and dismantling workers as a signal that some aspect of the equipment (or load) is about to be moved.
- (3) Allows time for the erecting, climbing and dismantling workers in areas that are in danger from the movement of the equipment (or load) that is about to take place to get clear.

(f) *Self erecting cranes.* Employees must not be in or under the tower, jib, or rotating portion of the crane during erecting, climbing and dismantling operations until the crane is secured in a locked position and the competent person in charge indicates it is safe to enter this area.

(g) *Addressing specific hazards.* The competent-qualified person/ supervision team supervising the erecting, climbing and dismantling operation must address all hazards associated with the operation with methods to protect the employees from them, including, but not limited to, the following:

- (1) *Site and ground bearing conditions.* Site and ground conditions must be adequate for safe erecting, climbing and dismantling operations and to support the equipment during erecting, climbing and dismantling.
- (2) *Foundations and structural supports.* Tower crane Foundations and structural supports shall be designed by the manufacturer or a registered professional engineer.

(3) *Blocking material.* The size, amount, and method of stacking blocking must be sufficient to sustain the loads and maintain stability.

(4) *Proper location of blocking.* Blocking must be appropriately placed to:

- (i) Protect the structural integrity of the equipment, and
- (ii) Prevent dangerous movement and collapse.

(5) *Calculating assist crane loads.* Assist crane loads that will be imposed on the assist crane (if used) at each phase of erecting, climbing and dismantling must be calculated before erecting, climbing and dismantling begins in order to prevent exceeding manufacturer instructions, recommendations, specifications and limitations for the assist crane.

(6) *Component pick points.* The point(s) of attachment of rigging to components must be suitable for preventing structural damage and facilitating safe handling of the components.

(7) *Center of gravity.*

(i) The center of gravity of the load must be identified unless that is unnecessary for the method used for maintaining stability.

(ii) Where there is insufficient information to accurately identify the center of gravity, measures designed to prevent unintended dangerous movement resulting from an inaccurate identification of the center of gravity must be used. (See Non-mandatory Appendix XX for examples of techniques).

(8) *Snagging.* Suspension ropes and pendants must not be allowed to catch on the jib connection pins or cotter pins.

(9) *Loss of backward stability.* Backward stability must be considered before swinging self erect cranes or cranes on travelling or static undercarriages.

(10) *Wind velocity.* Wind velocity must not exceed that recommended by the manufacturer or, in the absence of the manufacturer's information, a qualified person, during the erecting, climbing and dismantling procedure.

(11) *Capacity limits.* During all phases of erecting, climbing and dismantling, manufacturer recommendations, specifications and limitations for maximum loads imposed on the equipment, equipment components (including rigging), and lifting lugs and equipment accessories must be met for the equipment being erecting, climbing and dismantling.

(h) *Secondary braking device.* If the equipment has a boom hoist pawl or secondary brake, the pawl or secondary brake must be activated while the boom is being held during an assembly/disassembly operation.

(i) [Reserved]

(j) [Reserved]

(h) *Weight of components.* The weight of the components must be readily available.

(l) [Reserved]

(m) *Components and Configuration.* The selection of components and configuration of the equipment (including pendant length), must be in accordance with manufacturer instructions, recommendations, limitations, and specifications. Where these are unavailable, a registered

professional engineer familiar with the type of equipment involved must approve in writing the selection and configuration of components.

- (n) *Manufacturer prohibitions.* The employer must comply with all manufacturer prohibitions.
- (o) *Signage.* The size and location of signs installed on tower cranes must be in accordance with manufacturer instructions, recommendations, limitations, and specifications. Where these are unavailable, a registered professional engineer familiar with the type of equipment involved must approve in writing the size and location of any signs.
- (p) *Plumb tolerance.* Towers shall be erected plumb to the manufacturer's tolerance and verified by a qualified person. In the absence of the manufacturer's specifications, a qualified person shall determine the crane tower is plumb to a tolerance of at least 1:500 (approximately 1 inch - 40 feet).
- (q) *Multiple tower crane jobsites.* On jobsites where more than one tower crane is installed, the location of the cranes shall be so that no crane may come in contact with the structure of another crane. Cranes are permitted to pass over one another.
- (r) *Climbing procedures.* Prior to, and during, all climbing procedures (inside climbing and top climbing) the employer shall;
 - 1. Comply with all manufacturer prohibitions.
 - 2. Have a registered professional engineer verify that the host structure is strong enough to sustain the forces imposed through the braces, brace anchorages or supporting floors.
 - 3. Wind velocity must not exceed that recommended by the manufacturer or, in the absence of the manufacturer's information, a qualified person, during the entire climbing procedure.

1411 Erecting, Climbing and Dismantling – Employer Procedures – General Requirements

- (a) When using employer procedures instead of manufacturer procedures for erecting, climbing and dismantling, the employer shall ensure that the procedures are designed to:
 - (1) Prevent unintended dangerous movement, and to prevent collapse, of part or all of the equipment.
 - (2) Provide adequate support and stability of all parts of the equipment during the erecting, climbing and dismantling process.

(3) Position employees involved in the erecting, climbing and dismantling operation so that their exposure to unintended movement or collapse of part or all of the equipment is minimized.

(4) Incorporate all manufacturer prohibitions.

(b) *Qualified person.* Employer procedures must be developed by a qualified person.
[still under discussion]

(c) *Certification.* Employer procedures must be certified by a qualified person and by the employer.
[still under discussion]

1412 Operation – Procedures

(a) The employer shall comply with all manufacturer procedures applicable to the operation of equipment, including its use with attachments.

(b) *Unavailable operation procedures.*

(1) Where the manufacturer procedures are unavailable, the employer shall ensure compliance with all procedures necessary for the safe operation of the equipment and attachments.

(2) Procedures for the controls must be developed by a qualified person.

(3) Procedures related to the capacity of the equipment must be developed and signed by a registered professional engineer familiar with the equipment.

(d) *Accessibility.*

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

(3) Where load capacities are available in the cab only in electronic form: in the event of a failure which makes the load capacities inaccessible, the operator must immediately cease operations or follow safe shut-down procedures until the load capacities (in electronic or other form) are available.

14XX Authority to stop operation (See chapter 14XX [same as mobile cranes])

14XX Radio, telephone or other electronic transmission of signals. (See chapter 14XX [same as mobile cranes])

- (1) The equipment used to transmit signals shall be tested before beginning [the lift] [lift operations] [crane/derrick operations] to ensure that the signal transmission is clear and reliable.
- (2) Signal transmission must be through a dedicated channel.

14XX Voice signals – additional requirements (See chapter 14XX [same as mobile cranes])

- (1) Prior to beginning [lift operations], the lift supervisor (if there is one), crane operator, and signal person, shall contact each other and review the Standard Voice Signals (see Appendix __).
- (2) Each voice signal shall contain the following three elements, given in the following order:
 - (i) Direction.
 - (ii) Distance and/or speed.
 - (iii) Stop command.
- (3) *Communication with multiple cranes/derricks.* Where the signal person is in communication with more than one crane/derrick, a system for identifying the crane/derrick each signal is for must be used, as follows:
 - (i) for each voice signal, prior to giving the direction, the signal person shall identify the crane/derrick the signal is for, or
 - (ii) an equally effective method of identifying the crane/derrick the signal is for must be used.

[Should (3) apply to all types of signal communication, or just voice?]

14XX Hand signal chart. Hand signal charts must be either posted on the equipment or readily available at the site.

14XX Signal Person Qualifications (See chapter 14XX [same as mobile cranes])

- (a) The employer [which employer?] shall ensure that each signal person meets the Qualification Requirements in paragraph (e) prior to giving any signals.
- (b) *Documented qualifications.* The requirement in paragraph (a) is met where the employer has documentation from a qualified evaluator showing that the signal person meets the Qualification Requirements (see paragraph (e)).

(c) Where the employer does not have documentation showing that the signal person meets the Qualifications Requirements in paragraph (e), the employer is prohibited from using the individual as a signal person unless a comprehensive assessment demonstrates that the Qualification Requirements have been met. That assessment must include:

- (1) A verbal or written examination of the individual to determine if they know, understand and are competent in the application of the Standard Method for the signals used.
- (2) Observation of the individual giving signals during trial lifts.

(d) If subsequent actions by the signal person indicate that the individual may not meet the Qualification Requirements, the employer must not allow the individual to continue working as a signal person until a comprehensive assessment (or re-assessment) is made in accordance with paragraph (c) that confirms that the individual meets the Qualification Requirements.

(e) *Qualification Requirements.* Each signal person must:

- (1) Know and understand the Standard Method (see Appendices __, __, and __) for the type of signals used.
- (2) *Be competent in the application of the Standard Method for the type of signals used, in light of the equipment and conditions at the site.*

14XX . Requirements for equipment with a manufacturer-rated *hoisting/lifting capacity* below 2000 pounds.

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14XX Operational Aids

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14XX Inspections

(a) *New, modified and repaired equipment.* Prior to initial use, new equipment and equipment that has been modified or repaired must be inspected by a competent person to determine if it meets the requirements of manufacturer instructions, recommendations, limitations, and specifications, or, where these are unavailable, the instructions, recommendations, limitations, and specifications of a registered professional engineer familiar with the type of equipment involved.

(b) *Post-assembly.*

(1) Upon completion of assembly, the equipment must be inspected by a qualified person to assure if it is configured in accordance with manufacturer instructions, recommendations, limitations, and specifications. Where these are unavailable, the competent person must determine if it is configured in accordance with the instructions, recommendations, limitations, and specifications of a registered professional engineer familiar with the type of equipment involved.

(2) Any aspect of the configuration that fails to meet the requirements in Paragraph (1) shall be corrected prior to using the equipment.

(3) A load test *using certified weights or scaled weights using a certified scale with a current certificate of calibration* shall be conducted after each erection in accordance with the manufacturer's instructions.. Where these are unavailable a registered professional engineer familiar with the type of equipment involved shall provide written procedures.

(c) *Pre-shift.*

(1) Equipment shall be visually inspected prior to each shift by a [competent person]; the inspection shall include observation for deficiencies during [trial] operation. ([Disassembly is not required as part of this inspection unless the results of the visual inspection or trial operation indicate that further investigation necessitating disassembly is needed]). At a minimum this inspection shall include the following:

- (i) All control mechanisms for maladjustments [interfering with proper operation?]
- (ii) All control [and drive?] mechanisms for excessive wear of components and contamination by lubricants, water or other foreign matter.
- (iii) All hydraulic, and other pressurized lines for deterioration or leakage, particularly those which flex in normal operation.
- (iv) Hooks and latches for deformation, chemical damage, cracks, or wear.
- (v) Wire rope reeving for compliance with the manufacturer's specifications.
- (vi) Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt or moisture accumulation.
- (vii) Hydraulic system for proper fluid level.
- (viii) Tires (when in use) for proper inflation and pressure.

(ix) Ground conditions around the equipment for proper support, including ground settling under and around outriggers or supporting foundations, ground water accumulation, or similar conditions.

(x) The equipment for level position when on outriggers or static undercarriage.

(xi) Rails, *rail stops, rail clamps* and supporting surfaces when the crane is equipped with rail travelling.

(xii) Safety devices, including, but not limited to, boom angle indicators, boom or trolley travel limiting devices, load moment limit devices, anti-two block devices, and load moment indicators where required. [or: Operational aids for proper functioning. (if we use "operational aids", then what is definition of that?)]

(xiii) *Tie-ins, braces, floor supports and floor wedges where the crane is supported by the structure.*

(2) If any deficiency in (i) through (xi) is identified, an immediate determination shall be made by the [competent person] as to whether the deficiency constitutes a hazard. If the deficiency is determined to constitute a hazard, the equipment shall be removed from service until the deficiency has been corrected.

(3) If any deficiency in (xii)(safety devices/operational aids) is identified, [this will then refer to section on safety devices/operational aids].

(4) Pre-shift inspections of the equipment's wire rope shall be done in accordance with section _____

(5) A qualified rigger (a rigger who is also a qualified person) shall inspect the rigging prior to each shift in accordance with 1926.251.

[Paragraph on operator authority to stop moved into separate section]

(d) *Monthly*. Each month the equipment shall be inspected in accordance with paragraph _____ (pre-shift inspections). The results of this inspection shall be documented.

(e) *Annual/periodic*.

(1) At least each year the equipment shall be inspected in accordance with paragraph _____ (pre-shift inspections).

(2) In addition, at least once a year, the equipment shall be inspected for the following:

- (i) Deformed, cracked, or corroded members in the equipment structure (including the boom or jib, counterjib, tower, and supporting structural components).
- (ii) Loose bolts or rivets.
- (iii) Cracked welds.
- (iv) Cracked or worn sheaves and drums.
- (v) Worn, cracked or distorted parts such as pins, bearings, shafts, gears, rollers and locking devices.
- (vi) Excessive wear on brake and clutch system parts, linings, pawls and ratchets.
- (vii) Operational aids for significant inaccuracies (see section ____ [operational aids]).
- (viii) Gasoline, diesel, electric, or other power plants for proper operation.
- (ix) Suspension cables or bars (pendants) for corrosion, deformations or cracks.
- (x) Platforms and handrails for damage, corrosion or distortion.
- (xi) Hydraulic, pneumatic and other pressurized hoses, fittings and tubing, as follows:
- (A) Evidence of leakage at the surface of the flexible hose or its junction with the metal and couplings.
 - (B) Blistering or abnormal deformation of the outer covering of the hose.
 - (C) Leakage at threaded or clamped joints that cannot be eliminated by normal tightening or application of manufacturer procedures.
 - (D) Evidence of excessive abrasion or scrubbing on the outer surface of a hose, rigid tube, or fitting. Means shall be taken to eliminate the interference of elements in contact or otherwise protect the components. [this needs to be moved to the repair section].
- (xiii) Hydraulic and pneumatic pumps and motors, as follows:
- (A) Loose bolts or fasteners.

- (B) Leaks at joints between sections.
- (C) Shaft seal leaks.
- (D) Unusual noises or vibration.
- (E) Loss of operating speed.
- (F) Excessive heating of the fluid.
- (G) Loss of pressure.

(xiv) Hydraulic and pneumatic cylinders, as follows:

- (A) Drifting caused by fluid leaking across the piston.
- (B) Rod seals leakage.
- (C) Leaks at welded joints.
- (D) Scored, nicked, or dented cylinder rods.
- (E) Dented case (barrel).
- (F) Loose or deformed rod eyes or connecting joints.

(xv) Hydraulic filters, as follows:

- (A) Evidence of rubber particles on the filter element. If found, check for hose, D-ring or other rubber component deterioration.
- (B) Metal chips or pieces on the filter. If found, check for pump, motor or cylinder failure.

(xvi) Additional inspection items for _____ [crane category]

(xvii) Additional inspection items for _____ [crane category]

(xviii) Additional inspection items for _____ [crane category]

(3) If under the manufacturer's inspection instructions an item/ condition listed in paragraph (i) needs to be inspected sooner than annually, then the manufacturer's instructions shall apply for scheduling the inspection of that condition.

(4) If the manufacturer specifies that an item/condition not listed in paragraphs (1) or (2) is to be inspected, then that item/condition shall be inspected in accordance with the manufacturer instructions.

(5) *Heavy Service*

The inspection in (e)(2) must be done monthly where the equipment is operated at 85-100% of the rated load capacity as a regular specified procedure, or in excess of 10 lift cycles per hour. [From Dept. of Energy]

(6) *Severe Service*

The inspection in (e)(2) must be done monthly where the equipment is operated in extreme temperatures or in a corrosive atmosphere. [From Dept. of Energy].

(7) The inspections under this section shall be documented.

(f) *Equipment not in regular use.*

(1) Equipment that has been idle for 1 month or more, but less than 6 months, shall be inspected by a [qualified person] in accordance with the requirements of paragraph (c)(Pre-shift inspection) before being placed in service [what does "placed in service" mean? Does this mean that it will be inspected twice before it is used – this inspection plus the pre-shift inspection?]

(2) Equipment that has been idle for 6 months or more shall be inspected by a qualified person in accordance with paragraph (e) (annual/periodic inspection) before being placed in service.

(3) *Stand-by cranes.* Stand-by cranes shall be inspected by a [qualified person] in accordance with the requirements of paragraph (c)(Pre-shift inspection) before being placed in service. [Same question as in (1)].

[What do we do about cranes "exposed to adverse environmental conditions?].

(4) If the manufacturer's inspection instructions call for a more rigorous inspection, then the manufacturer's instructions shall apply to this inspection.

DEFINITIONS

- Attachments* means any device that expands the range of tasks that can be done by the equipment. These include, but are not limited to: an auger, drill, magnet, pile-driver, and personnel platform.
- Audible signal* means a signal made by a distinct sound or series of sounds. Examples include, but are not limited to, sounds made by a bell, horn, or whistle.
- Come-a-long* means a mechanical device typically consisting of a chain or cable attached at each end that is used to facilitate movement of materials through leverage.
- Chainfall* see come-a-long.
- Climbing* The process where the crane is raised to a new working height, either by adding additional tower sections to the top of the crane (top climbing) or the entire crane is raised inside the structure (inside climbing).
- Crew Leader* A worker who is both a competent person and a qualified person, who oversees an erecting/dismantling operation.
- Dedicated pile-driver* is a machine that is designed to function exclusively as a pile-driver. These machines typically have the ability to both hoist the material that will be pile-driven and to pile-drive that material.
- Dedicated Channel* A line of communication [assigned to] [used by] only one signal person and crane/derrick.
- In-the-air assembly operations* [Need definition]
- Operation* _____
- Operational aids* [Need definition]
- Procedures* include, but are not limited to: instructions, [diagrams],[recommendations], warnings, specifications, protocols and limitations
- Paragraph* refers to a paragraph in the same section of this Subpart that the word paragraph is used, unless otherwise specified.
- Qualified*

- Evaluator* means an entity that has demonstrated that it is competent in accurately assessing whether individuals meet the Qualification Requirements in this Subpart for a signal person.
- Qualified Person* means a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, successfully demonstrated the ability to solve/resolve problems relating to the subject matter, the work, or the project.
- Section* means a section of this Subpart unless otherwise specified.
- Standard* means this Subpart unless otherwise specified.
- Special hazard Warnings* means warnings of site-specific hazards (for example, proximity of power lines)
- Standard Methods* means the protocols in Appendices for hand, voice and audible signals.
- Unavailable procedures* means procedures that are no longer available from the manufacturer or have not been supplied by the manufacturer.
- Equipment* means equipment covered by this subpart.

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