

NOTE:

[Text in brackets and highlighted] are questions, information, options or new material.

Table of Contents

1400	Scope
1401	General Requirements
1402	Assembly/Disassembly – Selection of Manufacturer or Employer Procedures
1403	Assembly/Disassembly – General Requirements
1404	Assembly/Disassembly – Additional Requirements
1405	Assembly/Disassembly – Employer Procedures
1406	Operation – Procedures
1407	Authority to Stop Operation
1408	Signals – General Requirements
1409	Signals – Radio, telephone or other electronic transmission of signals
1410	Signals – Voice, additional requirements
1411	Hand signal chart
1412	Signal Person Qualifications
1413	Requirements for equipment with a manufacturer-rated hoisting/lifting capacity below 2,000 pounds
1414	Operational Aids
1415	Inspections
1416	Equipment Modifications
1417	Training
1418	Wire Rope – General Requirements
1419	Wire Rope – Inspection
1420	Wire Rope – Replacement
1421	Wire Rope – Maintenance
1422	Operator Qualifications
1423	Keeping Clear of the Load
1424	Fall Protection
1425	Hoisting Personnel
1426	Qualifications of Maintenance & Repair Workers
1427	Machine Guarding
1428	Environmental considerations & site conditions, ground conditions
1429	Work Zone Control (access/egress)
1430	Operation near power lines
1431	Derricks
1432	Verification criteria for structural adequacy
1433	Floating Cranes & Cranes on Barges
1434	Pile Drivers
1435	Free Fall/Power Down
1436	Critical Lifts/Engineered Lifts
1437	Tower Cranes
1438	Operator Cab Criteria
1439	Overhead & Gantry Cranes
1440	Definitions

## 1400 Scope

(a) This standard applies to power-operated equipment used in construction that can hoist, lower and horizontally move a suspended load. Such equipment includes, but is not limited to: articulating cranes (such as knuckle-boom cranes); crawler cranes; floating cranes; cranes on barges; locomotive cranes; mobile cranes (such as wheel-mounted, rough-terrain, all-terrain, commercial truck-mounted, and boom truck cranes); industrial (such as carry-deck cranes); service/mechanic trucks with a hoisting device; a crane on a monorail; tower cranes (such as fixed jib (“hammerhead boom”), luffing boom and self-erecting); pedestal cranes; portal cranes; overhead/bridge cranes; straddle cranes; side-boom tractors; derricks; and variations of such equipment, except for equipment listed in paragraph (c).

(b) *Attachments.* This standard applies to equipment included in paragraph (a) when used with attachments. Such attachments, whether crane-attached or suspended include, but are not limited to: hooks, magnets, grapples, clamshell buckets, orange peel buckets, concrete buckets, drag lines, personnel platforms, augers or drills and pile driving equipment.

(c) *Exclusions.* This Subpart does not cover:

(1) equipment included in paragraph (a) that has been converted or adapted for a non-hoisting/lifting use. Such conversions/adaptations include, but are not limited to, power shovels, excavators and concrete pumps.

(2) power shovels, backhoes and excavators.

(3) automotive wreckers and tow trucks when used to clear wrecks and haul vehicles.

(4) service trucks with mobile lifting devices designed specifically for use in the power line and electric service industries, such as digger derricks (radial boom derricks), when used in these industries for auguring holes and to set power and utility poles. [need explanation for why this is excluded]

(5) [equipment originally designed as] vehicle-mounted aerial devices (for lifting personnel) and self-propelled elevating work platforms.

(6) hydraulic jacking systems [we will re-evaluate this when we discuss gantry cranes]

(7) stacker cranes.

(8) powered industrial trucks (forklifts).

(9) mechanic’s truck with a hoisting device when used in activities related to equipment maintenance and repair.

(10) equipment that hoists by using a come-a-long or chainfall.

(11) dedicated pile drivers [?] [pending hearing from pile driver panel].

(12) dedicated drilling rigs [?] [pending discussion re drill rig and pile driver panel presentations].

(d) *Limited requirements.* The only requirements in this standard that apply to equipment with a manufacturer-rated hoisting/lifting capacity of 2000 pounds or less are in Section 1413.

#### **1401 General Requirements**

Sections 1402 – 14XX (and the sections they refer to) apply to all equipment except equipment with a manufacturer-rated hoisting/lifting capacity of 2000 pounds or less.

#### **1402 Assembly/Disassembly – Selection of Manufacturer or Employer Procedures**

When assembling and disassembling equipment (or attachments), the employer shall comply with either:

(a) all manufacturer procedures applicable to erecting and dismantling, or

(b) employer procedures for safe erecting 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 1405.

#### **1403 Assembly/Disassembly – General Requirements (applies to all assembly and disassembly operations)**

(a) *Oversight Supervision – Competent-qualified person.* Assembly/disassembly must be ~~overseen~~ 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 assembly/disassembly operation must understand the assembly/disassembly procedures.

(c) *Review of procedures.* The competent-qualified person/supervision team supervising the assembly/ disassembly operation must review the erecting/dismantling procedures immediately prior to the commencement of erecting/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.*

(1) Before commencing assembly/disassembly operations, the competent-qualified person supervising the assembly/disassembly operation must determine that the crew members understand all of the following:

- (i) Their tasks.
- (ii) The hazards associated with their tasks.
- (iii) The hazardous positions/locations that they need to avoid.

(2) During assembly/disassembly operations, before a crew member takes on a different task, or when adding new personnel during the operations, the requirements in paragraph (1)(i) through (iii) must be met with respect to the crew member's understanding regarding that task.

(e) *Protecting assembly/disassembly crew members out of operator view.*

(1) Before a crew member goes to a location that is out of view of the operator and is either: in, on or under the equipment, or near the equipment (or load) where the crew member could be injured by movement of the equipment (or load), the crew member must inform the operator that he/she is going to that location.

(2) Where the operator knows that a crew member went to a location covered by paragraph (1), the operator shall not move any aspect part of the equipment (or load) until the operator:

~~(1) Knows where the employees working on the assembly/disassembly operation are located.~~

(i) Gives a warning that is understood by the crew member as a signal that the equipment (or load) is about to be moved and allows time for the crew member to get to a safe position, or

(ii) Is informed in accordance with a pre-arranged system of communication that the crew member is in a safe position.

(f) *Working under the boom or other components.* When pins (or similar devices) are being removed, employees must not be under the boom or other components, except for: in-the-air assembly/disassembly operations. For in-the-air assembly/disassembly operations, the competent-qualified person/ supervision team must implement procedures that minimize the risk of unintended dangerous movement and minimize the duration and extent of exposure under the boom. [see Non-Mandatory Appendix \_\_ for an example].

(g) *Capacity limits.* During all phases of assembly/disassembly, 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 assembled/disassembled. [moved here from paragraph (h)]

(h) *Addressing specific hazards.* The competent-qualified person/ supervision team supervising the assembly/disassembly operation must address the 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 [discuss controlling contractor issue] for safe assembly/disassembly operations and to support the equipment during assembly/disassembly.

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

(3) *Proper location of blocking.* When used to support lattice booms, blocking must be appropriately placed to:

(i) Protect the structural integrity of the equipment, and

(ii) Prevent dangerous movement and collapse.

(4) *Calculating [identifying?] assist crane loads.* When using an assist crane, the loads that will be imposed on the assist crane at each phase of assembly/disassembly must be calculated [identified ?] before assembly/disassembly begins in order to prevent exceeding manufacturer instructions, recommendations, specifications and limitations for the assist crane.

(5) *Lattice boom and jib pick points.* The point(s) of attachment of rigging to a lattice boom (or lattice boom sections or jib or jib sections) must be suitable for preventing structural damage and facilitating safe handling of ~~boom/boom sections~~ these components.

(6) *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 AppendixXX for examples of techniques).

(7) *Stability upon pin-release removal.* The equipment or components must be rigged to maintain stability upon the removal of the pins.

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

(9) *Loss of backward stability.* Backward stability must be considered before swinging the upperworks and when attaching or removing equipment components.

[Insert illustration (without text) from pg 191 of Ontario Handbook]

(10) *Wind velocity.* Wind velocity must be considered so that the capacity safe assembly/disassembly of the equipment is not exceeded compromised.

(11) *Boom hoist brake failure.*

(i) Where reliance is placed on the boom hoist brake to prevent boom movement, determine if it is necessary to use a boom hoist pawl or other locking device/back-up braking device.

(ii) Where use of such a device is found to be necessary but the equipment lacks such a device, another method of preventing dangerous movement of the boom hoist from a boom hoist brake failure must be used.

~~(12) *Imbalance of take-up tension and braking.*~~

(i) [Reserved]

(j) *Cantilevered boom sections.* Manufacturer instructions, recommendations and limitations on the maximum amount of boom supported only by cantilevering shall not be exceeded.

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

(l) [Reserved]

(m) *Components and Configuration.*

(1) The selection of [structural?] components and configuration of the equipment [that affect the capacity or safe operation of the equipment], must be in accordance with:

(i) 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; or

(ii) Approved modifications that meet the requirements of section 1416 Equipment Modifications.

(2) *Post-assembly inspection.* Upon completion of assembly, the equipment must be inspected to ensure compliance with paragraph (1) (see section 1415(b) for post-assembly inspection requirements \_\_\_\_\_ )

(n) *Manufacturer prohibitions.* The employer must comply with all manufacturer prohibitions.

(o) *Shipping pins.* Reusable shipping pins, straps, links, and similar equipment must be removed and stowed in accordance with manufacturer instructions.

**1404 Assembly/Disassembly – Additional requirements for assembly/disassembly of booms and jibs (applies to both the use of manufacturer procedures and employer procedures).**

(a) *Dismantling (including shortening) booms and jibs.*

(1) None of the pins in the pendants are to be removed (partly or completely) when the pendants are in tension.

[Insert new diagram]

(2) None of the pins (top and bottom) on boom sections located between the pendant attachment points and the crane/derrick body are to be removed (partly or completely) when the pendants are in tension.

[Insert Diagrams A, B and C].

(3) None of the top pins on boom sections located on the cantilevered portion of the boom being removed (the portion being removed ahead of the pendant attachment points) are to be removed (partly or completely) until the cantilevered section to be removed is fully supported.

[Insert diagrams D and E]

(b) *Assembly of booms and jibs.*

(1) *Wind velocity.* Wind velocity must be considered before lifting the boom (or boom section or jib or jib section) off the ground.

### **1405 Assembly/Disassembly – Employer Procedures – General Requirements**

(a) When using employer procedures instead of manufacturer procedures for erecting or 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 assembly/disassembly process.
- (3) Position employees involved in the assembly/disassembly 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.

(c) *Documentation.* Employer procedures must be documented and signed by a qualified person.

[still under discussion]

### **1406 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 develop and ensure compliance with all procedures necessary for the safe operation of the equipment and attachments.
- (2) Procedures for the operational 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.

(e) *Posting of electrocution warnings.* In addition to the requirements in paragraph (d), electrocution hazard warnings must be conspicuously posted in the cab in so that it is in view of the operator. In addition, except for tower cranes and overhead gantry cranes, such warnings must be posted on all sides of the outside of the equipment.] [We will move to electrical hazards section]

#### **1407 Authority to stop operation**

~~The operator shall be responsible for those operations under the operator's direct control.~~ Whenever there is ~~any doubt~~ a concern as to safety, the operator shall have the authority to stop and refuse to handle loads until a qualified person has determined that safety has been assured.

#### **1408 Signals – General Requirements**

(a) A signal person must be provided when:

- (1) point of operation, meaning the load travel or the area near or at load placement is not in full view of the operator, or
- (2) due to site specific safety concerns, either the operator or the person handling the load determines that it is necessary.

[NOTE: Section on Operation will deal with whether/when signals must be obeyed].

(b) *Types of signals.* Signals to crane operators must be by hand, voice, audible, or new signals.

(c) Hand, voice, or audible signals.

(1) The Standard Method must be used (see Appendix \_\_\_ for hand; \_\_\_ for voice; \_\_\_ for audible).

(2) *Exception:* where use of the Standard Method for the type of signal selected is infeasible, or where an operation or use of an attachment is not covered in the Standard Method, Non-standard hand, voice or audible signals

may be used [See Appendix A for examples]. The following requirements apply to the use of non-standard signals:

- (i) *Non-standard signals.* The signal person, crane operator, and lift supervisor (where there is one) shall contact each other prior to the operation and agree on non-standard hand, voice or audible signals.
- (c) *New signals.* Signals other than hand, voice or audible signals may be used where the employer demonstrates that the following requirements are met:
  - (1) Provides at least equally effective communication as Standard Method signals, or
  - (2) There is an industry consensus standard for the new signal.
- (d) *Suitability.* The signals used (hand, voice, audible, or new), and means of transmitting the signals to the operator (such as direct line of sight, video, radio, etc.), must be appropriate for the site conditions.
- (e) During crane operations requiring signals, the ability to transmit signals between the crane operator and signal person shall be maintained. If that ability is interrupted at any time, the operator shall safely stop operations requiring signals until it is reestablished and a proper signal is given and understood.
- (f) If the operator becomes aware of a problem and needs to communicate with the signal person, the operator must safely stop operations. Operations shall not resume until the operator and signal person agree that the problem has been resolved.
- (g) Only one person gives signals to a crane/derrick at a time, except in circumstances covered by paragraph (h).
- (h) Anyone who becomes aware of a problem with a lift must alert the operator or signal person by giving the stop or emergency stop signal.
- (i) All directions given to the crane operator by the signal person shall be given from the operator's direction perspective.
- (j) *Communication with multiple cranes/derricks.* Where a signal person(s) 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 signal, prior to giving the ~~direction~~ function, the signal person shall identify the crane/derrick the signal is for, or
  - (ii) an equally effective method of identifying which crane/derrick the signal is for must be used.

**1409 Radio, telephone or other electronic transmission of signals.**

- (1) The equipment used to transmit signals shall be tested before beginning operations to ensure that the signal transmission is clear and reliable.
- (2) Signal transmission must be through a dedicated channel.
- (3) The operator's reception of signals must be by a hands-free system.

**1410 Voice signals – additional requirements**

- (1) Prior to beginning operations, the crane operator, signal person and lift supervisor (if there is one), 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) Function (such as hoist, boom, etc.).
  - (ii) Direction.
  - (iii) Distance and/or speed.
  - (iv) Stop command.

**1411 Hand signal chart.** Hand signal charts must be either posted on the equipment or readily available at the site.

**1412 Signal Person Qualifications**

- (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.
- (3) Know and understand the requirements of sections 1408 -- 1412 [signaling sections].

**1413 Requirements for equipment with a manufacturer-rated hoisting/lifting capacity below 2000 pounds.**

\_\_\_\_\_  
\_\_\_\_\_

**1414 Operational Aids**

\_\_\_\_\_  
\_\_\_\_\_

**1415 Inspections** [Changes from the October meeting are still being worked on; we will complete those and identify them in the next version]

(a) *New, modified and repaired equipment.* Prior to initial use, new equipment and equipment that has been modified must be inspected by a [qualified person?] [competent-qualified person?] to determine if it meets the requirements of [this section?] [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] [competent-qualified person] to determine if it is configured in accordance with manufacturer instructions, recommendations, limitations, and specifications. Where these are unavailable, the [qualified person] [competent-qualified 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.

[Should this paragraph be moved to the assembly/disassembly section?]

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

(c) *Pre-shift.*

(1) Equipment shall be visually inspected prior to each shift by a [competent person]; the inspection shall ~~include~~ [consist of] observation for [apparent] 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) Air, 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, ground water accumulation, or similar conditions.
- (x) The equipment for level position.
- (xi) The equipment for level position after each move and setup.

(xii) [Safety devices, including, but not limited to, boom angle indicators, boom stops, boom kick-out 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?)]

(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 1414 – Safety Devices/operational aids].

(4) Pre-shift inspections of the equipment’s wire rope shall be done in accordance with section 1419(b).

(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 1415(c) (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 1415(c) (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 and, if equipped, the jib).

(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 1414 [operational aids]).
- (viii) Gasoline, diesel, electric, or other power plants for performance [what is the safety concern on this?] and compliance with safety requirements [such as?]
- (ix) Excessive wear of chain drive sprockets and excessive chain stretch.
- (x) Travel steering, braking, and locking devices, for malfunction.
- (xi) Excessively worn or damaged tires.
- (xii) 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.

**1416 Equipment Modifications**

(a) Modifications or additions which affect the capacity or safe operation of the equipment are prohibited except where the requirements of paragraph (1), (2) or (3) are met.

(1) *Manufacturer review and approval.* The manufacturer approves the modifications/additions in writing.

(2) *Manufacturer refusal to review request.* The manufacturer is asked to approve the modification/addition but it declines to review the technical merits of the proposal, and all of the following are met:

(i) A registered professional engineer who is a qualified person with respect to crane design:

(A) Approves the modification/addition and specifies the crane/derrick configurations to which that approval applies, and

(B) Modifies load charts, instruction manuals/procedures and instruction plates/tags/decals as necessary to accord with the modification/addition.

(ii) The original safety factor of the equipment is not reduced.

(3) *Unavailable manufacturer.* The manufacturer is unavailable and the requirements of paragraph (2)(i) through (2)(iii) are met.

(b) Modifications or additions which affect the capacity or safe operation of the equipment are prohibited where the manufacturer, after a review of the technical merits of the proposed modification/addition, rejects the proposal.

#### **1417 Training**

[Training subject – keeping limbs out of holes and crush/pinch points]

#### **1418 Wire Rope - General Requirements**

The employer shall ensure that wire rope used on equipment within the scope of this standard is inspected, maintained and replaced in accordance with requirements set forth in Sections 1419 – 1421. However, where manufacturer [specifications] are more stringent than those specified in these sections, the manufacturer ~~guidelines~~ specifications shall control.  
[COE]

#### **1419 Wire Rope Inspection**

(a) *General Requirements.*

(1) *Action required.* ~~Daily~~ [preshift?], Frequent [monthly?], and Periodic [annual/periodic?] inspections of wire rope are required as set forth below in Sections 1419 (b), (c) and (d). The person(s) conducting a wire rope inspection shall determine whether any wire rope deficiencies [conditions?] exist that affect the safe operation of the equipment.

(i) If such a deficiency [condition] is located, that person(s) shall:

(A) initially determine whether wire rope replacement is required as specified in Section 1420, Wire Rope Replacement, and, if so, the employer must comply with those provisions; and

(B) in all other instances, the employer must prohibit the use of the wire rope until the deficiency is repaired corrected. [~~unless in the judgment of the person or persons performing the inspection, the wire rope can be safely used in operating the equipment until the end of the work shift. At that point, the wire rope must be repaired prior to the equipment being returned to service.~~]

(ii) If, in the opinion of the competent and qualified person, a deficiency is localized in an operating wire rope, and the section in question and related safety hazard can be eliminated by making a new attachment of wire rope, a partial removal is permissible rather than replacing the entire rope. [reworded from SAE]

(iii) Splicing of running ropes is prohibited. [Does this conflict with (ii)?]

(2) *Critical Review Items.* Certain critical items shall be included in each inspection. The extent of the examination shall be ~~limited by~~ in accordance with the type of inspection being conducted (daily, frequent or periodic). These items are:

(i) Rotation resistant wire rope in use.

(ii) Wire rope being used for boom hoists [how about others such as luffing hoists and load hoists].

(iii) Wire rope at flange points, crossover points and repetitive pickup points on drums.

(iv) Wire rope adjacent to end connections.

(3) *Inspection Records.* Required documentation reflecting inspections and wire rope replacement shall be available [at the project site][is this necessary?]. Wire rope replacement shall ~~always~~ be documented and reflect the date of replacement, and the size, construction, grade, length, safety factor and minimum breaking force of the wire rope replacement. [how long retained?] The remaining documentation requirements vary by the type of inspection as follows:

[deleted reference to documentation for daily]

(i) *Pre-shift.* Written records are required only where a rope is removed from service.

(ii) *Frequent.* Written records are required and shall reflect ~~at a minimum,~~ any deficiencies that are required to be considered in a Frequent Inspection. Other

deterioration observed shall also be noted, as well as corrective action taken.  
[retention period? should it parallel regular inspections?]

(iii) *Periodic*. Written records are required and shall reflect, ~~at a minimum~~, any deficiencies that are required to be considered in a Periodic Inspection. Other deficiencies observed shall also be noted, as well as corrective action taken for any deficiency. [retention period? should it parallel regular inspections?]

(4) *Wire rope on idle equipment*.

(i) The requirements in this section (wire rope inspections) do not apply to wire rope on equipment that is not in use.

(ii) All wire rope on equipment that has not been used [would this include unused rope on the drum?] for a month or more shall be inspected prior to return to service in accordance with Section 1419 (d) *Periodic Inspections*. [what about where rope is not in use but equipment is?]

~~(5) Visual inspections defined. For purposes of Sections \_\_\_\_\_, a visual inspection means an inspection limited to the external surfaces of wire rope. [see second to last sentence to (b) below]~~

(b) *Daily[Pre-shift?] Inspections*. Running wire ropes that are in use on equipment in continuous service shall be visually inspected on a daily basis for ~~visible deficiencies~~ deficiencies. This inspection shall be ~~limited to~~ of wire ropes that are reasonably likely to be in use on the day of the inspection and shall be ~~overseen~~ [conducted] by a competent person [or should this also include qualified person?]. Except for paragraph (5), untwisting of wire rope is not required as part of this inspection. Examples of visible deficiencies are:

- (1) Distortion of the rope structure such as kinking, crushing, unstranding, birdcaging, stretching or core protrusion.
- (2) Wire rope corrosion, particularly at socket and end connections.
- (3) Broken or cut strands.
- (4) Visible broken wires in accordance with the parameters set forth in Section 1420, Wire Rope Replacement per lay length [for] running ropes, pendants and standing ropes, or per diameters for rotation resistant rope.
- (5) Core failure in rotation resistant rope.
- (6) Reduction of rope diameter [from COE] (see section 1420 (Wire rope replacement)).

(7) Electric arc or heat damage.

(8) Corroded, cracked, bent, worn or improperly applied end connections.

(c) *Frequent[Monthly?] Inspections.* Frequent Inspections shall be conducted at least on a monthly basis and these inspections shall be ~~overseen~~ [why not “conducted”?] by a [competent and qualified person][?]. [These inspections shall be conducted more frequently based on usage.][parameters for this?] A visual inspection (as defined in paragraph (b)) for deficiencies of the types listed in 1419(b)(1) – (8) shall be conducted on [all wire ropes] [or: on the following:

(1) all running wire rope;

(2) counterweight wire ropes [from COE]; and

(3) load trolley wire ropes [from COE].

(4) [would it be appropriate to list pendant or standing ropes here?]]

(d) *Periodic Inspections.*

(1) *Frequency and Oversight.* Periodic Inspections shall be conducted at least annually, and shall be overseen [why not “conducted” ?] by a competent and qualified person. ~~The person overseeing the inspection may require inspections~~ competent and qualified person shall conduct this inspection more frequently depending upon such factors as the expected rope life, environment, and the size, type, frequency and severity of lifts (including exposure to shock loads) [last item from ANSI] [enforceability problems with this type of subjective trigger].

(2) *Review Required.* The inspection shall be complete and thorough, covering the surface of the entire length of the wire rope with particular attention given to those sections of wire rope that are normally hidden during daily and frequent visual inspections. An inspection for deficiencies of the types listed in 1419(b)(1) – ~~(7)~~ (8) shall be conducted on the following:

(i) all running wire rope;

(ii) counterweight wire ropes;

(iii) load trolley wire ropes;

(iv) wire rope in contact with saddles, equalizer sheaves or other sheaves where rope travel is limited;

(v) wire rope subject to reverse bends;

- (vi) wire rope passing over outer sheaves;
- (vii) wire rope at or near terminal ends; and
- (viii) all wire standing ropes [is this item repetitive?].

## 1420 Wire Rope Replacement

(a) ~~*Oversight. Action.*~~ Wire rope that exhibits ~~the deficiencies~~ any one of the deficiencies listed in 1419(b) shall be immediately removed from service, and replaced prior to the equipment's next use. ~~[However, an exception applies when a person or persons who meet the criteria for both a competent and qualified person determines that such wire rope is sufficiently safe for continued use on the equipment until the end of the work shift, at which point the wire rope must be replaced prior to the equipment being returned to service.]~~ [ANSI standard provides for this discretion]

(b) *Criteria.* Any one of the following deficiencies ~~are cause for~~ requires wire rope replacement:

(1) *Broken wires:*

(i) In running wire ropes: six randomly distributed broken wires in one lay or three broken wires in one strand in one lay, where a lay is the length along the rope in which one strand makes a complete revolution around the rope.

[illustration?]

(ii) In rotation resistant ropes: two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in 30 rope diameters.

(iii) In pendants or standing wire ropes: more than two broken wires in one lay located in rope beyond end connections and/or more than one broken wire in a lay located at an end connection.

~~(2) *Diameter reduction due to loss of core support*~~

~~(i) reductions of 1/64 in. (.4 mm) for diameters up to and including 5/16 in. (8 mm);~~

~~(ii) reductions of 1/32 in. (.8 mm) for diameters 3/8 in. (9.5 mm) to and including 1/2 in. (13 mm);~~

~~(iii) 3/64 in. (1.2 mm) for diameters 9/16 in. (14.5 mm) to and including 3/4 in. (19 mm);~~

~~(iv) 1/16 in. (1.6 mm) for diameters 7/8 in. (22 mm) to and including 1 1/8 in. (29 mm);~~

~~(v) 3/32 in. (2.4 mm) for diameters 1 1/4 in. (32 mm) to and including 1 1/2 in. (38 mm);~~

(2) Diameter reduction of more than 5% from the nominal rope diameter. [per Larry's group's suggestion]

~~(3) One third reduction of diameter due to wear of surface wires;~~ [How does this work with (2)? Also, Mr. Means suggested that this be deleted as it is hard to determine/enforce – note, however, that SAE, ANSI, ACCSH and the Rigging Manual have retained it]

(4) Heat damage from any source, including, but not limited to, welding, power line contact or lightning. [as elaborated by COE and ACCSH]

(5) Kinking, crushing, birdcaging or other distortion of the wire rope structure. [in ANSI]

(6) Wire rope stretch in excess of 6 inches per 100 feet in 6 stranded rope and 10 inches in an 8 stranded rope. [this came from Rigging Manual – include?]

(7) Core protrusion between the outer strands.

(8) [Larry: Severe] [Structural] Corrosion/rusting in the vicinity of attachments [Rigging Manual, SAE].

(c) *Wire Rope Selection and Disposal.*

(1) *Selection.* Replacement wire rope shall have a ~~strength rating~~ minimum breaking force of at least as great as the rope originally provided or recommended by the crane manufacturer. In addition, no deviation from the size, grade or construction of wire rope originally provided or recommended by the crane manufacturer shall be permitted without the prior written approval of the crane manufacturer, wire rope manufacturer or a qualified person.

~~(2)~~ [Partial removal paragraph moved to 1419(a)(1)(ii)]

(2) *Removal.*

(i) Wire rope removed from service due to a deficiency shall be cut up or plainly marked as unfit for further use.

(ii) Wire rope removed from service due to a deficiency may be reused if the section of the wire rope containing the deficiency is cut off. The cut-off

section with the deficiency must then be cut up or plainly marked as unfit for further use.

## 1421 Wire Rope Maintenance

### (a) *General Requirements.*

(1) Maintenance of wire rope, including preventative maintenance and repairs, shall be in accordance with the crane and/or wire rope manufacturer's recommendations.

(2) Maintenance records shall be documented and available at the project site [why is this necessary?].

(b) *On site storage.* Where it is reasonably anticipated that wire rope on site will not be installed within \_\_\_ [days or hours], the wire rope must be stored in coils or on reels ~~preferably indoors, or, if outdoors, covered,~~ and in conditions that are removed from moisture, ~~heat~~ [why heat? how hot is too hot?], steam, and direct contact with ~~concrete or ash~~ ~~floors~~ the ground or floors. In addition, coils and reels stored outdoors must be covered. [we need a definition of storage. We could use the approach we are now using for gas cylinders (see first sentence above)].

### (c) *Lubrication.*

(1) Wire ropes shall be properly lubricated at all times, in accordance with the wire rope or crane manufacturer's recommendations. Lubricants shall be compatible with the original lubricant and shall not hinder visual inspection of the wire rope.

(2) Sections of wire rope that are hidden or obscured ~~during inspections or~~ ~~maintenance,~~ such as areas over sheaves, shall be lubricated as required by the crane or wire rope manufacturer even if access is difficult. ~~or absence from view.~~

(d) *Use.* [the following provisions appear in ANSI; do these all apply to rigging "above the hook?"]

(1) During installation, wire rope shall not be dragged in dirt or otherwise brought in contact with surfaces or objects that may scrape, nick, crush, or create sharp bends in the rope.

(2) *Seizing.* Prior to cutting a wire rope, seizings shall be placed on each side of the point to be cut. The minimum length of each seizing must be equal to or exceed the diameter of the wire rope to which the seizing is applied. The required number of seizings ~~to be placed on each side of the cut~~ follow:

(i) on preformed rope, one seizing on each side;

(ii) on nonpreformed ropes of 7/8 in. (22 mm) diameter or smaller, two seizings on each side; and

(iii) on nonpreformed rope of 1 in. (26 mm) or larger, three seizings on each side. [Mr. Means suggested that due to the disappearance of nonpreformed rope from the market, these numbers should be left off and a qualified person should determine the number of seizings, or alternatively uniformly require three for nonpreformed rope]

(3) The reeling, unreeling and uncoiling of rope shall be performed in accordance with wire rope manufacturer recommendations.

[Do we need to add provisions on the following (from ANSI and Workgroup draft)?]:

(4) Wire rope clips used in conjunction with wedge sockets shall be attached to the unloaded dead end of the rope only, except that the use of devices specifically designed for dead-ending rope in a wedge socket is permitted.

(5) Socketing shall be done in the manner specified by the manufacturer of the wire rope or fitting.

(6) Wire rope safety factors shall be in accordance with ANSI B 30.5-2000 or SAE J959-1991.

(7) Rotation resistant rope and fiber core ropes shall not be used for boom hoist reeving.

**1422 Operator Qualifications.** The employer must ensure that, prior to operating any equipment included in 1400 (a) and (b), the operator meets the physical examination and certification requirements in this section.

(a) *Physical examination.*

(1) Operators must pass a physical examination that meets the criteria of the U.S. Department of Transportation for operators of \_\_\_\_\_ (49 CFR 391.41 through 391.49) at least [once every three years].

[Discuss substance abuse provision – incorporation of DOT 49 CFR 382.105 and Part 40 of \_\_\_\_]

[Should the physical be a separate requirement (as here) or a prerequisite for getting certification?]

(b) *Operator Certification.*

(1) Beginning [1 year after the effective date of this standard], until (and including) [4 years after the effective date of this standard], the operator must be certified by either the employer (in accordance with paragraph (d)), or by an accredited testing organization (in accordance with paragraph (e)).

(2) From [4 years after the effective date of this standard], the operator must be certified by an accredited testing organization (in accordance with paragraph (e)) once the operator's certification under paragraph (1) expires.

(3) Certifications under paragraph (d) are valid for no more than [three years]. Certifications under paragraph (e) are valid for no more than [five years].

(4) *Re-certification:* [different tests than for initial certification?].

(c) *Certification criteria.* Certification must be based, at a minimum, on the following:

(1) A determination through a written test that:

(i) The individual knows the information necessary for safe operation of the specific equipment the individual will operate, 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, including on configurations typically used by the employer.

(C) Procedures for responding to: loss of stability, control malfunction, power line contact, and fire.

(D) This Subpart, including applicable incorporated materials, and the applicable American Society of Mechanical Engineers (ASME) standard regarding the equipment.

(ii) The individual is able to read and locate relevant information in the equipment manual and materials referred to in paragraph (i).

(2) A determination through a practical test that the individual has the skills necessary for safe operation of the equipment, including the following:

- (i) Ability to recognize, from visual and audible observation, the items listed in section 1415(c) (pre-shift inspection).
- (ii) Operational and maneuvering skills.
- (iii) Application of load chart information.
- (iv) Application of safe shut-down and securing procedures.

(d) *Certification by the employer.*

(NOTE: From [date], operator certifications must be issued by an accredited testing organization).

(1) To certify an operator for the equipment, the employer must make the determinations specified in paragraph (c).

(2) *Use of another entity to administer tests.*

(i) Although the employer must make the determination as to whether to certify the operator for the equipment, the employer may use another entity to administer the tests in paragraphs (c) (1) and (2) if that entity is qualified to administer those tests.

(ii) The employer must base its determination on whether to certify the individual, at a minimum, on:

(A) A review of the test records from the entity that administered the tests.

(B) Observation of the employee operating the equipment in test lifts prior to determining whether to certify the individual.

(3) *Certification by another employer is not transferable.* The employer of the operator must make its own determination as to whether to certify the employee to operate the equipment, although it may use tests administered by another employer where the requirements of paragraph (d)(2) are met in assessing the operator.

(5) *Revocation.* If the employer has reason to believe that the operator may not be qualified to operate the equipment, the employer must [immediately] revoke the certification. The operator must not be permitted to operate the equipment unless he/she is recertified.

(6) *Records.* The employer must retain the current test records for each operator it has certified throughout that operator's employment with the employer. This

requirement applies irrespective of whether the employer or another entity administers the tests.

NOTE: After [4 years after effective date of the standard], employers will no longer be permitted to meet the certification requirement by certifying operators themselves; at that point, certification must be by an accredited testing organization.

(e) *Certification by an accredited testing organization.*

(1) For a testing organization to be considered accredited to certify operators under this Subpart, it must:

(i) Be accredited by a nationally recognized accrediting agency based on that agency's determination that industry recognized criteria for written testing materials, practical examinations, grading, facilities/equipment and personnel have been met.

(ii) Administer written and practical tests that assess the operator applicant regarding, at a minimum, the knowledge and skills listed in (c)(1) and (2).

(2) For an operator to be considered certified by an accredited testing organization, the operator must have a current certification to operate the equipment from a testing organization that meets the requirements in paragraph (e)(1).

(3) Where the employer is an accredited testing organization, the operator must have a current certification to operate the equipment from an accredited testing organization other than the employer.

(4) If the employer has reason to believe that the operator may not be qualified, the employer must prohibit the employee from operating the equipment unless he/she is recertified.

(5) *Records.* Documentation verifying the operator's certification from an accredited testing organization must be available to the Secretary.

(f) *Licensing by state or local governments.* Nothing in this section shall preempt a state or local government from enforcing operator licensing requirements that are more stringent than the requirements in this section. [Note that we are still examining the legal viability of this paragraph].

- 1423 Keeping Clear of the Load**
- 1424 Fall Protection**
- 1425 Hoisting Personnel**
- 1426 Qualifications of Maintenance & Repair Workers**
- 1427 Machine Guarding**
- 1428 Environmental considerations & site conditions, ground conditions**
- 1429 Work Zone Control (access/egress)**
- 1430 Operation Near Power Lines**
- 1431 Derricks**
- 1432 Verification criteria for structural adequacy**
- 1433 Floating Cranes & Cranes on Barges**
- 1434 Pile Drivers**
- 1435 Free Fall/Power Down**
- 1436 Critical Lifts/Engineered Lifts**
- 1437 Tower Cranes**
- 1438 Operator Cab Criteria**
- 1439 Overhead & Gantry Cranes**

## 1440 Definitions

*Assembly/*

*disassembly* means assembly and disassembly (also referred to as erecting and dismantling)

*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.

*Chainfall* see come-a-long.

*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.

*Competent  
Person*

*Crew Leader* A worker who is both a competent person and a qualified person, who oversees an erecting/dismantling operation.

*Crossover  
points*

*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.

*Dismantling* includes partial dismantling (such as dismantling to shorten a boom or substitute a different component).

*Flange  
points*

*Hoist* A mechanical device for lifting and lowering heavy loads usually by winding rope onto or of a drum.

*Hoisting* The act of raising or lowering a load in a vertical direction [~~through the use of some type of rope and sheave system~~] [?].

*In-the-air assembly operations* [Need definition]

*Nationally recognized accrediting agency* is an organization that, due to its independence and expertise, is widely recognized as competent to accredit testing organizations.

*Operation* \_\_\_\_\_

*Operational aids* [Need definition]

*Operational controls* levers, switches, pedals and other devices for controlling [crane] [equipment] operation

*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.

*Repetitive pickup points*

*Running wire rope* [need definition]

*Section* means a section of this Subpart unless otherwise specified.

*Standard* means this Subpart unless otherwise specified.

*Storage* means that it is reasonably anticipated that the material will not be used within \_\_\_ hours (overnight hours included).

*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.

## APPENDIX A – USE OF NON-STANDARD SIGNALS

The follow is an example of a situation where the use of the Standard Method for hand signals is infeasible: Due to background lighting conditions behind the signal person, there is insufficient contrast between the person's hand and the sky color. This prevents the operator from being able to clearly see the signal person's hand when extended out to either side.