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C-DAC CONSENSUS DOCUMENT

NOTE:

- **Highlighted** text are changes.
- Sections have been re-ordered and re-numbered.

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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); multi-purpose machines when configured to hoist and lower (by means of a winch or hook) and horizontally move a suspended load; industrial cranes (such as carry-deck cranes); dedicated pile drivers; 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 and gantry cranes; straddle cranes; side-boom tractors; derricks; and variations of such equipment. However, items listed in paragraph 1400(c) are excluded from the scope of this standard.

(b) *Attachments.* This standard applies to equipment included in paragraph 1400(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 1400(a) while it 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, excavators, wheel loaders, backhoes, loader backhoes, track loaders. This machinery is also excluded when used with chains, slings or other rigging to lift suspended loads.

(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 to set power and utility poles, or handling associated materials to be installed or removed from utility poles.

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

(6) Hydraulic jacking systems, including telescopic/hydraulic gantries [We need a picture/drawing of this].

(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 drilling rigs.

(12) Gin poles used for the erection of communication towers.

(13) Tree trimming and tree removal work.

(14) Anchor handling with a vessel or barge using an affixed A-frame.

(15) Roustabouts.

(d) All Sections of this standard apply to the equipment covered by this standard unless specified otherwise.

(e) The duties of controlling entities under this subpart include, but are not limited to, the duties specified in Sections 1402(c), 1402(e) and 1424(b).

(f) Where provisions of this standard direct an operator, crewmember, or other employee to take certain actions, the employer shall establish, effectively communicate to the relevant persons, and enforce work rules, to ensure compliance with such provisions.

1401 Definitions

<i>A/D Supervisor</i>	means an individual who meets this standard’s requirements for an A/D supervisor, irrespective of the person’s formal job title or whether the person is non-management or management personnel.
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<i>Alongside</i>	means the part of the fall zone that is outside the area directly under the load.
<i>Appointed Person</i>	Means a person assigned specific responsibilities by the employer or by the employer's representative.
<i>Articulating crane</i>	a crane whose boom consists of a series of folding, pin connected structural members, typically manipulated to extend or retract by power from hydraulic cylinders.
<i>Assist crane</i>	A crane used to assist in assembling or disassembling a crane.
<i>Attachments</i>	means any device that expands the range of tasks that can be done by the equipment. Examples include, but are not limited to: an auger, drill, magnet, pile-driver, and boom-attached personnel platform.
<i>Audible signal</i>	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.
<i>Blind pick</i>	A lift in which the operator's view of the load is obstructed.
<i>Blocking</i>	(also referred to as "cribbing") is wood or other material used to support equipment or a component and distribute loads to the ground. Typically used to support latticed boom sections during assembly/ disassembly and under outrigger floats.
<i>Boatswain's chair</i>	A single-point adjustable suspension scaffold consisting of a seat or sling (which may be incorporated into a full body harness) designed to support one employee in a sitting position.
<i>Bogie</i>	See "travel bogie."
<i>Boom (equipment other than tower crane)</i>	an inclined spar, strut, or other long structural member which supports the upper hoisting tackle on a crane or derrick. Typically, the length and vertical angle of the boom can be varied to achieve increased height or height and reach when lifting loads. Booms can usually be grouped into general categories of hydraulically extendible, cantilevered type, latticed section, cable supported type or articulating type.
<i>Boom (tower cranes)</i>	On tower cranes: if the "boom" (i.e., principle horizontal structure) is fixed, it is referred to as a jib; if it is

	moveable up and down, it is referred to as a boom.
<i>Boom angle indicator</i>	A device which measures the angle of the boom relative to horizontal.
<i>Boom hoist limiting device</i>	includes boom hoist disengaging device, boom hoist shut-off, boom hoist disconnect, boom hoist hydraulic relief, boom hoist kick-outs, automatic boom stop device, or derricking limiter. This type of device disengages boom hoist power when the boom reaches a predetermined operating angle. It also sets brakes or closes valves to prevent the boom from lowering after power is disengaged.
<i>Boom length indicator</i>	indicates the length of the permanent part of the boom (such as ruled markings on the boom) or, as in some computerized systems, the length of the boom with extensions/attachments.
<i>Boom stop</i>	includes boom stops, (belly straps with struts/standoff), telescoping boom stops, attachment boom stops, and backstops. These devices restrict the boom from moving above a certain maximum angle and toppling over backward.
<i>Boom suspension systems</i>	A system of pendants, running ropes, sheaves, and other hardware which supports the boom tip and controls the boom angle.
<i>Builder</i>	means an employer builder/constructor of equipment.
<i>Calculate</i>	includes use of a calculator.
<i>Center of gravity</i>	The center of gravity of any object is the point in the object around which its weight is evenly distributed. If you could put a support under that point, you could balance the object on the support.
<i>Certified welder</i>	A welder who meets nationally recognized certification requirements applicable to the task being performed.
<i>Climbing</i>	The process in which a tower crane is raised to a new working height, either by adding additional tower sections to the top of the crane (top climbing), or by a system in which the entire crane is raised inside the structure (inside climbing).
<i>Come-a-long</i>	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.
<i>Competent Person</i>	means on who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous

	to employees, and who has authorization to take prompt corrective measures to eliminate them.
<i>Controlled load lowering</i>	means lowering a load by means of a mechanical hoist drum device that allows a hoisted load to be lowered with maximum control using the gear train or hydraulic components of the hoist mechanism. Controlled load lowering requires the use of the hoist drive motor, rather than the load hoist brake, to lower the load.
<i>Controlling Entity</i>	means a prime contractor, general contractor, construction manager or any other legal entity which has the overall responsibility for the construction of the project – its planning, quality and completion.
<i>Counterweight</i>	Weight used to supplement the weight of equipment in providing stability for lifting loads by counterbalancing those loads.
<i>Crane/derrick</i>	Includes all equipment covered by this Subpart.
<i>Crawler crane</i>	Equipment that has a type of base mounting which incorporates a continuous belt of sprocket driven track.
<i>Crossover points</i>	Locations on a wire rope which is spooled on a drum where one layer of rope climbs up on and crosses over the previous layer. This takes place at each flange of the drum as the rope is spooled onto the drum, reaches the flange, and begins to wrap back in the opposite direction.
<i>Dedicated Channel</i>	A line of communication assigned by the employer who controls the communication system to only one signal person and crane/derrick or to a coordinated group of cranes/derricks/signal person(s).
<i>Dedicated pile-driver</i>	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.
<i>Dedicated spotter (power lines)</i>	In order to be considered a dedicated spotter, the requirements of Section 1428 (signal person requirements) must be met and his/her sole responsibility is to watch the separation between the power line and: the equipment, load line and load (including rigging and lifting accessories), and ensure through communication with the operator that the applicable minimum approach distance is not breached.
<i>Directly under the load</i>	means a part or all of an employee is directly beneath the

	load.
<i>Dismantling</i>	includes partial dismantling (such as dismantling to shorten a boom or substitute a different component).
<i>Drum rotation indicator</i>	A device on a crane or hoist which indicates in which direction and at what relative speed a particular hoist drum is turning.
<i>Electrical contact</i>	When a person, object, or equipment makes contact or comes in close proximity with an energized conductor or equipment that allows the passage of current.
<i>Employer-made equipment</i>	means equipment designed and built by an employer for its own use.
<i>Encroachment</i>	is where any part of the crane, load line or load (including rigging and lifting accessories) breaches a minimum clearance distance that this Subpart requires to be maintained from a power line.
<i>Equipment</i>	means equipment covered by this subpart.
<i>Equipment criteria</i>	means instructions, recommendations, limitations and specifications.
<i>Fall protection equipment</i>	means guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems.
<i>Fall restraint system</i>	means a fall protection system that prevents the user from falling any distance. The system is comprised of either a body belt or body harness, along with an anchorage, connectors and other necessary equipment. The other components typically include a lanyard, and may also include a lifeline and other devices.
<i>Fall zone</i>	means the area (including but not limited to the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended materials could fall in the event of an accident.
<i>Flange points</i>	A point of contact between rope and drum flange where the rope changes layers.
<i>Floating cranes/derricks</i>	means equipment designed by the manufacturer (or employer) for marine use by permanent attachment to a barge, pontoons, vessel or other means of flotation.
<i>For example</i>	means “one example, although there are others.”
<i>Free fall (of the load line)</i>	Where only the brake is used to regulate the descent of the load line (the drive mechanism is not used to drive the load down faster or retard its lowering).
<i>Free surface effect</i>	Uncontrolled transverse movement of liquids in

	compartments which reduce a vessel's transverse stability.
<i>Hoist</i>	A mechanical device for lifting and lowering loads by winding rope onto or off a drum.
<i>Hoisting</i>	The act of raising, lowering or otherwise moving a load in the air with equipment covered by this standard. As used in this standard, "hoisting" can be done by means other than wire rope/ hoist drum equipment.
<i>Include/including</i>	means "including, but not limited to"
<i>Insulating link/device</i>	an insulating device approved by a Nationally Recognized Testing Laboratory.
<i>Jib stop</i>	also referred to as a jib backstop, is the same type of device as a boom stop but is for a fixed or luffing jib.
<i>Land crane/derrick</i>	Equipment not originally designed by the manufacturer for marine use by permanent attachment to barges, pontoons, vessels, or other means of floatation.
<i>List</i>	Angle of inclination about the longitudinal axis of a barge, pontoons, vessel or other means of floatation.
<i>Load</i>	the weight of the object being lifted or lowered, including the weight of the load-attaching equipment such as the load block, ropes, slings, shackles, and any other ancillary attachment.
<i>Load moment (or rated capacity) indicator</i>	A system which aids the equipment operator by sensing the overturning moment on the equipment, i.e. load X radius. It compares this lifting condition to the equipment's rated capacity, and indicates to the operator the percentage of capacity at which the equipment is working. Lights, bells, or buzzers may be incorporated as a warning of an approaching overload condition.
<i>Load moment (or rated capacity) limiter</i>	A system which aids the equipment operator by sensing the overturning moment on the equipment, i.e. load X radius. It compares this lifting condition to the equipment's rated capacity, and when the rated capacity is reached, it shuts off power to those equipment functions which can increase the severity of loading on the equipment, e.g., hoisting, telescoping out, or luffing out. Typically, those functions which decrease the severity of loading on the equipment remain operational, e.g.,

	lowering, telescoping in, or luffing in.
<i>Locomotive crane</i>	a crane mounted on a base or car equipped for travel on a railroad track.
<i>Luffing Jib limiting device</i>	is similar to a boom hoist limiting device, except that it limits the movement of the luffing jib.
<i>Marine hoisted personnel transfer device</i>	a device, such as a “transfer net”, that is designed to protect the employees being hoisted during a marine transfer and to facilitate rapid entry into and exit from the device. Such devices do not include boatswain’s chairs when hoisted by equipment covered by this standard.
<i>Marine worksite</i>	a construction worksite located in, on or above the water.
<i>Mobile Cranes</i>	A lifting device incorporating a cable suspended latticed boom or hydraulic telescopic boom designed to be moved between operating locations by transport over the road. These are referred to in Europe as a crane mounted on a truck carrier.
<i>Moving point-to-point</i>	Means the times during which an employee is in the process of going to or from a work station.
<i>Multi-purpose machine</i>	means a machine that is designed to be configured in various ways, at least one of which allows it to hoist (by means of a winch or hook) and horizontally move a suspended load. For example, a machine that can rotate and can be configured with removable tongs (for use as a forklift) or with a winch pack, jib (with a hook at the end) or jib used in conjunction with a winch. When configured with the tongs, it is not covered by this Subpart. When configured with a winch pack, jib (with a hook at the end) or jib used in conjunction with a winch, it is covered by this Subpart.
<i>Nationally recognized accrediting agency</i>	is an organization that, due to its independence and expertise, is widely recognized as competent to accredit testing organizations.
<i>Nonconductive</i>	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).
<i>Operational Controls</i>	levers, switches, pedals and other devices for controlling equipment operation
<i>Operational aids</i>	devices that assist the operator in the safe operation of the crane by providing information or automatically taking control of a crane function. These include, but are not limited to, the devices listed in Section 1416 (“listed operational aids”).
<i>Operator</i>	is a person who is operating the equipment.
<i>Overhead and gantry cranes</i>	includes overhead/bridge cranes, semigantry, cantilever gantry, wall cranes, storage bridge cranes, launching gantry cranes, and similar equipment, irrespective of whether it travels on tracks, wheels, or other means.
<i>Paragraph</i>	refers to a paragraph in the same section of this Subpart that the word “paragraph” is used, unless otherwise specified.
<i>Pendants</i>	includes both wire and bar types. Wire type: a fixed length of wire rope with mechanical fittings at both ends for pinning segments of wire rope together. Bar type: instead of wire rope, a bar is used. Pendants are typically used in a latticed boom crane system to easily change the length of the boom suspension system without completely changing the rope on the drum when the boom length is increased or decreased.
<i>Personal fall arrest system</i>	means a system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, a body harness and may include a lanyard, deceleration device, lifeline, or suitable combination of these.
<i>Portal Cranes</i>	A type of crane consisting of a rotating upperstructure, hoist machinery, and boom mounted on top of a structural gantry which may be fixed in one location or have travel capability. The gantry legs or columns usually have portal openings in between to allow passage of traffic beneath the gantry.
<i>Power down</i>	see “controlled load lowering”

<i>Power lines</i>	electrical distribution and electrical transmission lines.
<i>Procedures</i>	include, but are not limited to: instructions, diagrams, recommendations, warnings, specifications, protocols and limitations.
<i>Proximity alarm</i>	a device that provides a warning of proximity to a power line that has been approved by a Nationally Recognized Testing Laboratory.
<i>Qualified evaluator (not a third party)</i>	means a person employed by the signal person's employer who, has demonstrated that he/she is competent in accurately assessing whether individuals meet the Qualification Requirements in this Subpart for a signal person.
<i>Qualified Person</i>	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.
<i>Qualified Rigger</i>	is a rigger who meets the criteria for a qualified person.
<i>Rated capacity</i>	The maximum working load permitted by the manufacturer under specified working conditions. Such working conditions typically include a specific combination of factors such as equipment configuration, radii, boom length, and other parameters of use.
<i>Rated capacity indicator</i>	See load moment indicator
<i>Rated capacity limiter</i>	See load moment limiter
<i>Range control warning device</i>	A device that can be set by an equipment operator to warn that the boom or jib tip is at a plane or multiple planes.
<i>Repetitive pickup points</i>	When operating on a short cycle operation, the rope being used on a single layer and being spooled repetitively over a short portion of the drum.
<i>Running wire rope</i>	a wire rope that moves over sheaves or drums.
<i>Section</i>	means a section of this Subpart, unless otherwise specified.
<i>Side-boom tractor</i>	is synonymous with "side-boom crane."
<i>Special hazard warnings</i>	means warnings of site-specific hazards (for example, proximity of power lines).

<i>Stability</i>	means the tendency of a barge, pontoons, vessel or other means of floatation to return to an upright position after having been inclined by an external force.
<i>Standard Method</i>	means the protocol in Appendices for hand signals.
<i>Such as</i>	means “such as, but not limited to”
<i>Superstructure</i>	See: Upperstructure.
<i>Taglines</i>	A rope (usually fiber) attached to a lifted load for purposes of controlling load spinning and pendular motions or used to stabilize a bucket or magnet during material handling operations.
<i>Tender</i>	An individual responsible for monitoring and communicating with a diver.
<i>Tilt up or tilt down operation</i>	raising/lowering a load from the horizontal to vertical or vertical to horizontal.
<i>Tower Crane</i>	A type of lifting structure which utilizes a vertical mast or tower to support a working boom (jib) suspended from the working boom. While the working boom may be fixed horizontally or have luffing capability, it can always rotate about the tower center to swing loads. The tower base may be fixed in one location or ballasted and moveable between locations.
<i>Travel bogie (tower cranes)</i>	An assembly of two or more axles arranged to permit vertical wheel displacement and equalize the loading on the wheels.
<i>Trim</i>	Angle of inclination about the transverse axis of a barge, pontoons, vessel or other means of floatation.
<i>Two blocking</i>	means a condition in which a component that is uppermost on the hoist line such as the load block, hook block, overhaul ball, or similar component, comes in

	contact with the boom tip, fixed upper block or similar component. This binds the system and continued application of power can cause failure of the hoist rope or other component.
<i>Unavailable procedures</i>	means procedures that are no longer available from the manufacturer, or have never been available, from the manufacturer.
<i>Upperstructure</i>	See upperworks.
<i>Upperworks</i>	The revolving frame of equipment on which the engine and operating machinery are mounted along with the operator's cab. The counterweight is typically supported on the rear of the upperstructure and the boom or other front end attachment is mounted on the front.
<i>Up to</i>	means "up to and including"
<i>Wire rope</i>	means rope made of wire.

1402 Ground conditions.

(a) *Definitions.*

(1) "Ground conditions" means the ability of the ground to support the equipment (including slope, compaction and firmness).

(2) "Supporting materials" means blocking, mats, cribbing, marsh buggies (in marshes/wetlands), or similar supporting materials or devices.

(b) The equipment shall not be assembled or used unless ground conditions are firm, drained (except for marshes/wetlands), 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.

(c) The controlling entity shall:

(1) Ensure that ground preparations necessary to meet the requirements in paragraph (b) are provided.

(2) Inform the user of the equipment and the operator of the location of hazards beneath the equipment set-up area (such as voids, tanks, utilities) that are identified in documents (such as site drawings, as-built drawings, and soil analyses) if they are available to the controlling entity.

(d) If there is no controlling entity for the project, the requirement in paragraph (c)(1) shall be met by the employer that has authority at the site to make or arrange for ground preparations needed to meet paragraph (b).

(e) If the individual supervising the equipment assembly or the operator determines that ground conditions do not meet the requirements in paragraph (b), that person's employer shall have a discussion with the controlling entity regarding the ground preparations that are needed so that, with the use of suitable supporting materials/devices (if necessary), the requirements in paragraph (b) can be met.

1403 Assembly/Disassembly – Selection of Manufacturer or Employer Procedures

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

- (a) Manufacturer procedures applicable to assembly and disassembly, or
- (b) Employer procedures for assembly and disassembly. Employer procedures may be used only where the employer can demonstrate that the procedures used meet the requirements in section 1406.

1404 Assembly/Disassembly – General Requirements (applies to all assembly and disassembly operations)

(a) *Supervision – Competent-qualified person.*

(1) Assembly/disassembly must be supervised by a person who meets the criteria for both a competent person and a qualified person, or by a competent person who is assisted by one or more qualified persons (“A/D supervisor”).

(2) Where the assembly/disassembly is being performed by only one person, that person must meet the criteria for both a competent person and a qualified person. For purposes of this standard, that person is considered the A/D supervisor.

(b) *Knowledge of procedures.* The A/D supervisor must understand the applicable assembly/disassembly procedures.

(c) *Review of procedures.* The A/D supervisor must review the applicable assembly/disassembly procedures immediately prior to the commencement of assembly/disassembly unless the A/D supervisor has applied them to the same type and configuration of equipment (including accessories, if any) so that they are already known and understood.

(d) *Crew instructions.*

(1) Before commencing assembly/disassembly operations, the A/D supervisor must determine that the crew members understand 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 paragraphs (d)(1)(i) through (d)(1)(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 shall 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 1404(e)(1), the operator shall not move any part of the equipment (or load) until the operator:

- (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, jib or other components.*

(1) When pins (or similar devices) are being removed, employees must not be under the boom, jib or other components, except where the requirements of paragraph 1404(f)(2) are met.

(2) *Exception.* Where the employer demonstrates that site constraints require one or more employees to be under the boom, jib or other components when pins (or similar devices) are being removed, the A/D supervisor 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, rated capacity limits for loads imposed on the equipment, equipment components (including rigging), lifting lugs and equipment accessories must be met for the equipment being assembled/disassembled.

(h) *Addressing specific hazards.* The A/D supervisor supervising the assembly/disassembly operation must address the hazards associated with the operation with methods to protect the employees from them, **as follows**:

(1) *Site and ground bearing conditions.* Site and ground conditions must be adequate for safe assembly/disassembly operations and to support the equipment during assembly/disassembly **(see Section 1402 for ground condition requirements)**.

(2) *Blocking material.* The size, amount, **condition** 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 or components, blocking must be appropriately placed to:

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

(ii) Prevent dangerous movement and collapse.

(4) *Verifying 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 verified in accordance with Section 1417(o)(3) before assembly/disassembly begins in order to prevent exceeding rated capacity limits for the assist crane.

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

(6) *Center of gravity.*

(i) The center of gravity of the load must be identified if that is necessary 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).

(7) *Stability upon pin removal.* The boom sections, boom suspension systems (such as gantry A-frames and jib struts) or components must be rigged or supported to maintain stability upon the removal of the pins.

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

(9) *Struck by counterweights*. The potential for unexpected movement from inadequately supported counterweights and from hoisting counterweights.

(10) *Boom hoist brake failure*. Where reliance is placed on the boom hoist brake to prevent boom movement during assembly/disassembly, the brake shall be tested to determine if it sufficient to prevent boom movement. If it is not sufficient, a boom hoist pawl, other locking device/back-up braking device, or another method of preventing dangerous movement of the boom (such as blocking or using an assist crane) from a boom hoist brake failure shall be used.

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

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

(12) *Wind speed and weather*. Wind speed and weather must be considered so that the safe assembly/ disassembly of the equipment is not compromised.

(i) [Reserved]

(j) *Cantilevered boom sections*. Manufacturer limitations on the maximum amount of boom supported only by cantilevering shall not be exceeded. Where these are unavailable, a registered professional engineer familiar with the type of equipment involved shall determine this limitation in writing, which 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 components and configuration of the equipment that affect the capacity or safe operation of the equipment must be in accordance with:

(i) Manufacturer instructions, 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 1434 (Equipment Modifications).

(2) *Post-assembly inspection.* Upon completion of assembly, the equipment must be inspected to ensure compliance with paragraph 1404(m)(1) (see section 1412(c) for post-assembly inspection requirements).

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

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

(p) *Pile driving.* Equipment used for pile driving shall not have a jib attached during pile driving operations.

(q) *Outriggers.* When the load to be handled and the operating radius require the use of outriggers, or at any time when outriggers are used, the following requirements shall be met:

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

(2) The outriggers shall be set to remove the equipment weight from the wheels, except for locomotive cranes (see paragraph 1404(q)(6) for use of outriggers on locomotive cranes).

(3) When outrigger floats are used, they shall be attached to the outriggers.

(4) Each outrigger shall be visible to the operator or to a signal person during extension and setting.

(5) **Outrigger** blocking shall:

(i) Meet the requirements in paragraph 1404(h)(2) and 1404(h)(3).

(ii) Be placed only under the outrigger float/pad of the outrigger jack or, where the outrigger is designed without a jack, under the outer bearing surface of the extended outrigger beam.

(6) For locomotive cranes, when using outriggers to handle loads, the manufacturer's procedures shall be followed. When lifting loads without using outriggers, the manufacturer's procedures shall be met regarding truck wedges or screws.

1405 Disassembly – Additional requirements for disassembly of booms and jibs (applies to both the use of manufacturer procedures and employer procedures).

Dismantling (including dismantling for changing the length of) booms and jibs.

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

[Insert new diagram]

(b) 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].

(c) None of the pins (top and bottom) on boom sections located between the uppermost boom section and the crane/derrick body are to be removed (partly or completely) when the boom is being supported by the uppermost boom section resting on the ground (or other support).

[Insert Diagram per Dave R.]

(d) 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]

1406 Assembly/Disassembly – Employer Procedures – General Requirements

(a) When using employer procedures instead of manufacturer procedures for assembling or disassembling, 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.

(b) *Qualified person.* Employer procedures must be developed by a qualified person.

1407 Power line safety (up to 350 kV) – assembly and disassembly

(a) Before assembling or disassembling a crane, the employer must determine if any part of the crane, load line or load (including rigging and lifting accessories) could get, in the direction or area of assembly, within 20 feet of a power line during the assembly/disassembly

process. If so, the employer must meet the requirements in Option (1), Option (2), or Option (3), as follows:

(1) *Option (1) – Deenergize and ground.* Confirm from the utility owner/operator that the power line has been deenergized and visibly grounded at the worksite.

(2) *Option (2) – 20 foot clearance.* Ensure that no part of the crane, load line or load (including rigging and lifting accessories), gets within 20 feet of the power line by implementing the measures specified in (b).

(3) *Option (3) – Table A clearance.*

(i) Determine the line’s voltage and the minimum approach distance permitted under Table A.

(ii) Determine if any part of the crane, load line or load (including rigging and lifting accessories), could get within the minimum approach distance of the power line permitted under Table A. If so, then the employer must follow the requirements in paragraph (b).

(b) *Preventing encroachment/electrocution.* Where encroachment precautions are required under Option (2), or Option (3), the following requirements must be met:

(1) Conduct a planning meeting with the competent-qualified person who will supervise the assembly/disassembly process, operator, assembly/disassembly crew and the other workers who will be in the assembly/disassembly area to review the location of the power line(s) and the steps that will be implemented to prevent encroachment/electrocution.

(2) If tag lines are used, they must be non-conductive.

(3) At least one of the following additional measures must be in place:

(i) Use a dedicated spotter who is in continuous contact with the crane operator. The spotter must:

(A) Be equipped with a visual aid to assist in identifying the minimum clearance distance. Examples of a visual aid include, but are not limited to: a line painted on the ground; a clearly visible line on stanchions; a set of clearly visible line-of-sight landmarks (such as a fence post behind the spotter and a building corner ahead of the spotter).

(B) Be positioned to effectively gauge the clearance distance.

(C) Where necessary, use equipment that enables the spotter to communicate directly with the crane operator, in accordance with Section 1420 (Radio, telephone, or other electronic transmission of signals).

(D) Give timely information to the crane operator so that the required clearance distance can be maintained.

(ii) A proximity alarm set to give the operator sufficient warning to prevent encroachment.

(iii) A device that automatically warns the operator when to stop movement, such as a range control warning device. Such a device must be set to give the operator sufficient warning to prevent encroachment.

(iv) A device that automatically limits range of movement, set to prevent encroachment.

(v) An elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings.

(c) *Assembly/disassembly below power lines prohibited.* No part of a crane, load line or load (including rigging and lifting accessories), whether partially or fully assembled, is allowed below a power line unless the employer has confirmed that the utility owner/operator has deenergized and (at the worksite) visibly grounded the power line.

(d) *Assembly/disassembly inside Table A clearance prohibited.* No part of a crane, load line or load (including rigging and lifting accessories), whether partially or fully assembled, is allowed within the minimum approach distance under Table A of a power line unless the employer has confirmed that the utility owner/operator has deenergized and (at the worksite) visibly grounded the power line.

(e) *Voltage information.* Where Option (3) is used, owner/operators of power lines must provide the requested voltage information within two working days of the employer's request.

(f) *Power lines presumed energized.* The employer must assume that all power lines are energized unless the utility owner/operator confirms that the power line has been and continues to be deenergized and visibly grounded at the worksite.

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

1408 Power line safety (up to 350 kV) – crane operations

(a) *Hazard assessments and precautions inside the work zone.* Before beginning crane operations, the employer must:

(1) *Identify the work zone.*

(i) Define a work zone by demarcating boundaries (such as with flags, or a device such as a range limit device or range control warning device) and prohibit the operator from operating the crane past those boundaries, or

(ii) Define the work zone as the area 360 degrees around the crane, up to the crane's maximum working radius.

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

(i) *Option (1) – Deenergize and ground.* Confirm from the utility owner/operator that the power line has been deenergized and visibly grounded at the worksite.

(ii) *Option (2) – 20 foot clearance.* Ensure that no part of the crane, load line or load (including rigging and lifting accessories), gets within 20 feet of the power line by implementing the measures specified in (b).

(iii) *Option (3) – Table A clearance.*

(A) Determine the line's voltage and the minimum approach distance permitted under Table A.

(B) Determine if any part of the crane, load line or load (including rigging and lifting accessories), while operating up to the crane's maximum working radius in the work zone, could get within the minimum approach distance of the power line permitted under Table A. If so, then the employer must follow the requirements in paragraph (b).

(b) *Preventing encroachment/electrocution.* Where encroachment precautions are required under Option (2), or Option (3), the following requirements must be met:

(1) Conduct a planning meeting with the operator and the other workers who will be in the area of the crane or load to review the location of the power line(s), and the steps that will be implemented to prevent encroachment/electrocution.

(2) If tag lines are used, they must be non-conductive.

(3) Erect and maintain an elevated warning line, barricade, or line of signs, in view of the crane operator, equipped with flags or similar high-visibility markings, at 20 feet from the power line (if using Option (2)) or at the minimum approach distance under Table A (if using Option (3)).

(4) Implement at least one of the following measures:

(i) A proximity alarm set to give the operator sufficient warning to prevent encroachment.

(ii) A dedicated spotter who is in continuous contact with the crane operator. Where this measure is selected, the spotter must:

(A) Be equipped with a visual aid to assist in identifying the minimum clearance distance. Examples of a visual aid include, but are not limited to: a line painted on the ground; a clearly visible line on stanchions; a set of clearly visible line-of-sight landmarks (such as a fence post behind the spotter and a building corner ahead of the spotter).

(B) Be positioned to effectively gauge the clearance distance.

(C) Where necessary, use equipment that enables the spotter to communicate directly with the crane operator.

(D) Give timely information to the crane operator so that the required clearance distance can be maintained.

(iii) A device that automatically warns the operator when to stop movement, such as a range control warning device. Such a device must be set to give the operator sufficient warning to prevent encroachment.

(iv) A device that automatically limits range of movement, set to prevent encroachment.

(v) An insulating link/device installed at a point between the end of the load line (or below) and the load.

(5) The requirements of paragraph (b)(4) do not apply to work covered by 29 CFR 1926 Subpart V.

(c) *Voltage information.* Where Option (3) is used, operators of power lines must provide the requested voltage information within two working days of the employer's request.

(d) *Operations below power lines.*

(1) No part of a crane, load line or load (including rigging and lifting accessories) is allowed below a power line unless the employer has confirmed that the utility owner/operator has deenergized and (at the worksite) visibly grounded the power line, except where one of the exceptions in (d)(2) applies.

(2) *Exceptions.* Paragraph (d)(1) is inapplicable where the employer demonstrates that one of the following applies:

(i) The work is covered by 29 CFR 1926 Subpart V.

(ii) For equipment with non-extensible booms: The uppermost part of the equipment, with the boom at true vertical, would be more than 20 feet below the plane of the power line or more than the Table A minimum clearance distance below the plane of the power line.

(iii) For equipment with articulating or extensible booms: The uppermost part of the equipment, with the boom in the fully extended position, at true vertical, would be more than 20 feet below the plane of the power line or more than the Table A minimum clearance distance below the plane of the power line.

(iv) The employer demonstrates that compliance with paragraph (d)(1) is infeasible and meets the requirements of Section 1410.

(e) *Power lines presumed energized.* The employer must assume that all power lines are energized unless the utility owner/operator confirms that the power line has been and continues to be deenergized and visibly grounded at the worksite.

(f) When working near transmitter/communication towers where the equipment is close enough for an electrical charge to be induced in the equipment or materials being handled, the transmitter shall be de-energized or the following precautions shall be taken when necessary to dissipate induced voltages:

(1) The equipment shall be provided with an electrical ground.

(2) **Non-conductive** rigging or an insulating link/device shall be used.

(g) *Training.*

(1) Operators and crew assigned to work with the equipment shall be trained on the following:

(i) The procedures to be followed in the event of electrical contact with a power line. Such training shall include:

- (A) Information regarding the danger of electrocution from the operator simultaneously touching the equipment and the ground.
- (B) The importance to the operator’s safety of remaining inside the cab except where there is an imminent danger of fire, explosion, or other emergency that necessitates leaving the cab.
- (C) The safest means of evacuating from equipment that may be energized.
- (D) The **danger** of the potentially energized zone around the equipment.
- (E) The need for crew in the area to avoid approaching or touching the equipment.
- (F) Safe clearance distance from power lines.
 - (ii) Power lines are presumed to be energized unless the utility owner/operator confirms that the line has been and continues to be deenergized, and visibly grounded at the worksite.
 - (iii) Power lines are presumed to be uninsulated unless the utility owner/operator or a registered engineer who is a qualified person with respect to electrical power transmission and distribution confirms that a line is insulated.
 - (iv) The limitations of an insulating link/device, proximity alarm, and range control (and similar) device, if used.
- (2) Employees working as dedicated spotters shall be trained to enable them to effectively perform their task, including training on the applicable requirements of this Section.

(h) Devices originally designed by the manufacturer for use as: a safety device (see Section 1415), operational aid, or a means to prevent power line contact or electrocution, when used to comply with this Section, shall meet the manufacturer’s procedures for use and conditions of use.

Table A – Minimum Clearance Distances

Voltage (nominal, kV, alternating current)	Minimum clearance distance (feet)
up to 50	10

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over 50 to 200	15
over 200 to 350	20
over 350 to 500	25
over 500 to 750	35
over 750 to 1000	45
over 1000	(as established by the power line owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution)

1409 Power line safety (over 350 kV)

The requirements of sections 1407 and 1408 apply to power lines over 350 kV, except “50 feet” applies instead of “20 feet”.

1410 Power line safety (all voltages) – crane operations inside the Table A zone

Crane operations in which any part of the crane, load line or load (including rigging and lifting accessories) is within the minimum approach distance under Table A of an energized power line is prohibited, except where the employer demonstrates that the following requirements are met:

- (a) The employer determines that it is infeasible to do the work without breaching the minimum approach distance under Table A.
- (b) The employer determines that, after consultation with the utility owner/operator, it is infeasible to deenergize and ground the power line or relocate the power line.
- (c) *Minimum clearance distance.*
 - (1) The power line owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution determines the minimum clearance distance that must be maintained to prevent electrical contact in light of the on-site conditions. The factors that must be considered in making this determination include, but are not limited to: conditions affecting atmospheric conductivity; time necessary to bring the equipment, load line and load (including rigging and lifting accessories) to a complete stop; wind conditions; degree of sway in the power line; lighting conditions, and other conditions affecting the ability to prevent electrical contact.

(2) Paragraph (c)(1) does not apply to work covered by 1926 Subpart V; instead, for such work, the minimum clearance distances specified in 1926.950 Table V-1 apply.

(d) A planning meeting with the employer and power line operator (or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution) is held to determine the procedures that will be followed to prevent electrical contact and electrocution. At a minimum these procedures shall include:

(1) If the power line is equipped with a device that automatically reenergizes the circuit in the event of a power line contact, the automatic reclosing feature of the circuit interrupting device must be made inoperative before work begins.

(2) A dedicated spotter who is in continuous contact with the crane operator. The spotter must:

(i) Be equipped with a visual aid to assist in identifying the minimum clearance distance. Examples of a visual aid include, but are not limited to: a line painted on the ground; a clearly visible line on stanchions; a set of clearly visible line-of-sight landmarks (such as a fence post behind the spotter and a building corner ahead of the spotter).

(ii) Be positioned to effectively gauge the clearance distance.

(iii) Where necessary, use equipment that enables the spotter to communicate directly with the crane operator.

(iv) Give timely information to the crane operator so that the required clearance distance can be maintained.

(3) An elevated warning line, or barricade (not attached to the crane), in view of the operator (either directly or through video equipment), equipped with flags or similar high-visibility markings, to prevent electrical contact. However, this provision does not apply to work covered by 1926 Subpart V.

(4) *Insulating link/device.*

(i) An insulating link/device installed at a point between the end of the load line (or below) and the load.

(ii) For work covered by 1926 Subpart V, the requirement in paragraph (d)(4)(i) applies only when working inside the 1926.950 Table V-1 clearance distances.

(5) Non-conductive rigging if the rigging may be within the Table A distance during the operation.

(6) If the crane is equipped with a device that automatically limits range of movement, it must be used and set to prevent any part of the crane, load line or load

(including rigging and lifting accessories) from breaching the minimum approach distance established under paragraph (c).

(7) If a tag line is used, it must be of the non-conductive type.

(8) Barricades forming a perimeter at least 10 feet away from the equipment to prevent unauthorized personnel from entering the work area. In areas where obstacles prevent the barricade from being at least 10 feet away, the barricade shall be as far from the equipment as feasible.

(9) Workers other than the crane operator must be prohibited from touching the load line above the insulating link/device and crane.

(10) Only personnel essential to the operation shall be permitted to be in the area of the crane and load.

(11) The crane must be properly grounded.

(12) Insulating line hose or cover-up shall be installed by the utility owner/operator except where such devices are unavailable for the line voltages involved.

(e) The procedures developed to comply with paragraph (d) are documented and immediately available on-site.

(f) The crane user and utility owner/operator meet with the crane operator and the other workers who will be in the area of the crane or load to review the procedures that will be implemented to prevent breaching the minimum approach distance established in paragraph (c) and prevent electrocution.

(g) The procedures developed to comply with paragraph (d) are implemented.

(h) The utility owner/operator and all employers of employees involved in the work shall identify one person who will direct the implementation of the procedures. The person identified in accordance with this paragraph shall direct the implementation of the procedures and shall have the authority to stop work at any time to ensure safety.

(i) [Reserved]

(j) If a problem occurs implementing the procedures being used to comply with paragraph (d), or indicating that those procedures are inadequate to prevent electrocution, the employer shall safely stop operations and either develop new procedures to comply with paragraph (d) or have the utility owner/operator deenergized and visibly ground or relocate the power line before resuming work.

(k) Devices originally designed by the manufacturer for use as: a safety device (see Section 1415), operational aid, or a means to prevent power line contact or electrocution, when used

to comply with this Section, shall meet the manufacturer’s procedures for use and conditions of use.

1411 Power line safety – equipment while traveling

(a) This section applies to equipment while traveling under a power line on the construction site with no load and the boom/mast and boom/mast support system lowered sufficiently to meet the requirements of paragraph (b).

(b) The employer shall ensure that:

- (1) The clearances specified in paragraph (c), Table T, are maintained.
- (2) The effects of speed and terrain on equipment movement (including movement of the boom/mast) are considered so that those effects do not cause the clearances to be reduced below those specified in Table T.
- (3) *Dedicated spotter.* If any part of the equipment while traveling will get within 20 feet of the power line, the employer shall ensure that a dedicated spotter who is in continuous contact with the crane operator is used. The spotter must:
 - (i) Be positioned to effectively gauge the clearance distance.
 - (ii) Where necessary, use equipment that enables the spotter to communicate directly with the crane operator.
 - (iii) Give timely information to the crane operator so that the required clearance distance can be maintained.

(4) *Additional precautions for traveling in poor visibility.* When traveling at night, or in conditions of poor visibility, in addition to the measures specified in paragraphs (b)(1)-(3), the employer shall ensure that:

- (i) The power lines are illuminated or another means of identifying the location of the lines shall be used.
- (ii) A safe path of travel is identified.

**Table T – Minimum Clearance Distances While Traveling
With No Load And Boom/Mast Lowered**

Voltage (nominal, kV, alternating current)	While Traveling – Minimum clearance
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	distance (feet)
up to 0.75	4 (while traveling/boom lowered)
over .75 to 50	6 (while traveling/boom lowered)
over 50 to 345	10 (while traveling/boom lowered)
over 345 to 750	16 (while traveling/boom lowered)
over 750 to 1000	20 (while traveling/boom lowered)
over 1000	(as established by the power line owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution)

1412 Inspections

(a) *Modified equipment.*

(1) Equipment that has had modifications or additions which affect the safe operation of the equipment (such as modifications or additions involving a safety device or operator aid, critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism) or capacity shall be inspected by a qualified person after such modifications/additions have been completed, prior to initial use. The inspection shall meet the following requirements:

- (i) The inspection shall assure that the modifications have been done in accordance with the approval obtained pursuant to Section 1434 (Equipment Modifications).
- (ii) The inspection shall include functional testing.

(2) Equipment shall not be used until an inspection under this paragraph demonstrates that the requirements of paragraph (a)(1)(i) have been met.

(b) *Repaired/adjusted equipment.*

(1) Equipment that has had a repair or adjustment that relates to safe operation (such as: a repair or adjustment to a safety device or operator aid, or to a critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism), shall be inspected by a qualified person after such a repair or adjustment has been completed, prior to initial use. The inspection shall meet the following requirements:

- (i) The qualified person shall determine if the repair/adjustment meets manufacturer equipment criteria (where applicable and available).

(ii) Where manufacturer equipment criteria are unavailable or inapplicable, the qualified person shall:

(A) Determine if a registered professional engineer (RPE) is needed to develop criteria for the repair/adjustment. If an RPE is not needed, the employer shall ensure that the criteria are developed by the qualified person. If an RPE is needed, the employer shall ensure that they are developed by an RPE.

(B) Determine if the repair/adjustment meets the criteria developed in accordance with subparagraph (A).

(iii) The inspection shall include functional testing.

(4) Equipment shall not be used until an inspection under this paragraph demonstrates that the repair/adjustment meets the requirements of paragraph (b)(1)(i) (or, where applicable, (b)(1)(ii)).

(c) *Post-assembly.*

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

(2) Where manufacturer equipment criteria are unavailable, a qualified person shall:

(i) Determine if a registered professional engineer (RPE) familiar with the type of equipment involved is needed to develop criteria for the equipment configuration. If an RPE is not needed, the employer shall ensure that the criteria are developed by the qualified person. If an RPE is needed, the employer shall ensure that they are developed by an RPE.

(ii) Determine if the equipment meets the criteria developed in accordance with subparagraph (2)(i).

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

(d) *Each Shift.*

(1) A competent person shall begin a visual inspection prior to each shift, which shall be completed before or during that shift. The inspection shall consist of observation for apparent deficiencies. 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. Determinations made in conducting the inspection shall be reassessed in light of observations made during operation. At a minimum the inspection shall include the following:

- (i) Control mechanisms for maladjustments interfering with proper operation.
- (ii) Control and drive mechanisms for apparent 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) Hydraulic system for proper fluid level.
- (v) Hooks and latches for deformation, cracks, excessive wear, or damage such as from chemicals or heat.
- (vi) Wire rope reeving for compliance with the manufacturer's specifications.
- (vii) Wire rope, in accordance with section 1413(a).
- (viii) Electrical apparatus for malfunctioning, signs of apparent excessive deterioration, dirt or moisture accumulation.
- (ix) Tires (when in use) for proper inflation and condition.
- (x) Ground conditions around the equipment for proper support, including ground settling under and around outriggers and supporting foundations, ground water accumulation, or similar conditions.
- (xi) The equipment for level position, both shift and after each move and setup.
- (xii) Operator cab windows for significant cracks, breaks, or other deficiencies that would hamper the operator's view.
- (xiii) Rails, rail stops, rail clamps and supporting surfaces when the equipment has rail traveling.
- (xiv) Safety devices and operational aids for proper operation.

(2) If any deficiency in (i) through (xiii) (or in additional inspection items required to be checked for specific types of equipment in accordance with other Sections of this standard) is identified, an immediate determination shall be made by the competent person as to whether the deficiency constitutes a safety hazard. If the deficiency is

determined to constitute a safety hazard, the equipment shall be removed from service until it has been corrected.

(3) If any deficiency in (xiv)(safety devices/operational aids) is identified, the action specified in section 1415/1416 shall be taken prior to using the equipment.

(e) *Monthly.*

(1) Each month the equipment is in service it shall be inspected in accordance with paragraph (d) (shift inspections).

(2) Equipment shall not be used until an inspection under this paragraph demonstrates that no corrective action under paragraphs (d)(2) and (3) is required.

(3) *Documentation.*

(i) The following information shall be documented **by the employer that conducts the inspection:**

(A) The items checked and the results of the inspection.

(B) The name and signature of the person who conducted the inspection and the date.

(ii) This document shall be retained for a minimum of three months.

(f) *Annual/comprehensive.*

(1) At least every 12 months the equipment shall be inspected by a qualified person in accordance with paragraph (d) (shift inspections).

(2) In addition, at least every 12 months, the equipment shall be inspected by a qualified person for the following:

(i) Equipment structure (including the boom and, if equipped, the jib):

(A) Structural members: deformed, cracked, or significantly corroded.

(B) Bolts, rivets and other fasteners: loose, failed or significantly corroded.

(C) Welds for cracks.

(ii) Sheaves and drums for cracks or significant wear.

- (iii) Parts such as pins, bearings, shafts, gears, rollers and locking devices for distortion, cracks or significant wear.
- (iv) Brake and clutch system parts, linings, pawls and ratchets for excessive wear.
- (v) Safety devices and operational aids for proper operation (including significant inaccuracies).
- (vi) Gasoline, diesel, electric, or other power plants for safety-related problems (such as leaking exhaust and emergency shut-down feature), condition and proper operation.
- (vii) Chains and chain drive sprockets for excessive wear of sprockets and excessive chain stretch.
- (viii) Travel steering, brakes, and locking devices, for proper operation.
- (ix) Tires for damage or excessive wear.
- (x) Hydraulic, pneumatic and other pressurized hoses, fittings and tubing, as follows:
 - (A) Flexible hose or its junction with the fittings for indications of leaks.
 - (B) Threaded or clamped joints for leaks.
 - (C) Outer covering of the hose for blistering, abnormal deformation or other signs of failure/impending failure.
 - (D) Outer surface of a hose, rigid tube, or fitting for indications of excessive abrasion or scrubbing.
- (xi) Hydraulic and pneumatic pumps and motors, as follows:
 - (A) Performance indicators: unusual noises or vibration, low operating speed, excessive heating of the fluid, low pressure.
 - (B) Loose bolts or fasteners.
 - (C) Shaft seals and joints between pump sections for leaks.
- (xiv) Hydraulic and pneumatic valves, as follows:

- (A) Spools: sticking, improper return to neutral, and leaks.
 - (B) Leaks.
 - (C) Valve housing cracks.
 - (D) Relief valves: failure to reach correct pressure (if there is a manufacturer procedure for checking pressure, it must be followed).
- (xv) Hydraulic and pneumatic cylinders, as follows:
- (A) Drifting caused by fluid leaking across the piston.
 - (B) Rod seals and welded joints for leaks.
 - (D) Cylinder rods for scores, nicks, or dents.
 - (E) Case (barrel) for significant dents.
 - (F) Rod eyes and connecting joints: loose or deformed.
- (xvi) Outrigger pads/floats and slider pads for excessive wear or cracks.
- (xvii) Electrical components and wiring for cracked or split insulation and loose or corroded terminations.
- (xviii) Warning labels and decals required under this standard: missing or unreadable.
- (xix) Operator seat: missing or unusable.
- (xx) Originally equipped steps, ladders, handrails, guards: missing.
- (xxi) Steps, ladders, handrails, guards: in unusable/unsafe condition.
- (3) This inspection shall include functional testing to determine that the equipment as configured in the inspection is functioning properly.
- (4) If any deficiency is identified, an immediate determination shall be made by the qualified person as to whether the deficiency constitutes a safety hazard or, though not yet a safety hazard, needs to be monitored in the monthly inspections.
- (5) If the qualified person determines that a deficiency is a safety hazard, the equipment shall be removed from service until it has been corrected.

(6) If the qualified person determines that, though not presently a safety hazard, the deficiency needs to be monitored, the employer shall ensure that the deficiency is checked in the monthly inspections.

(7) *Documentation of annual/comprehensive inspection.* The following information shall be documented and maintained by the employer that conducts the inspection:

- (i) The items checked and the results of the inspection.
- (ii) The name and signature of the person who conducted the inspection and the date.
- (iii) This document shall be retained for a minimum of 12 months.

(g) *Severe Service.* Where the severity of use/conditions is such that there is a reasonable probability of damage or excessive wear (such as loading that may have exceeded rated capacity, shock loading that may have exceeded rated capacity, prolonged exposure to a corrosive atmosphere), the employer shall stop using the equipment and a qualified person shall:

- (1) Inspect the equipment for structural damage.
- (2) Determine whether any items/conditions listed in paragraph (f) need to be inspected; if so, the qualified person shall inspect those items/conditions.
- (3) If a deficiency is found, the employer shall follow the requirements in paragraphs (f)(4)-(6).

(h) *Equipment not in regular use.* Equipment that has been idle for 3 months or more shall be inspected by a qualified person in accordance with the requirements of paragraph 1412(e)(Monthly) before initial use.

(i) [Reserved]

(j) Any part of a manufacturer's procedures regarding inspections that relate to safe operation (such as to a safety device or operator aid, critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism) that is more comprehensive or has a more frequent schedule than the requirements of this section shall be followed. Additional documentation requirements by the manufacturer are not required.

1413 Wire Rope – Inspection

(a) *Shift Inspection.*

(1) A competent person shall begin a visual inspection prior to each shift, which shall be completed before or during that shift. The inspection shall consist of observation of wire ropes (running and standing) that are reasonably likely to be in use during the shift for apparent deficiencies, including those listed in paragraph (a)(2). Untwisting (opening) of wire rope or booming down is not required as part of this inspection.

(2) *Apparent deficiencies.*

(i) *Category I.* Apparent deficiencies in this category include the following:

(A) Significant distortion of the wire rope structure such as kinking, crushing, unstranding, birdcaging, signs of core failure or steel core protrusion between the outer strands.

(B) Significant corrosion.

(C) Electric arc (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).

(ii) *Category II.* Apparent deficiencies in this category are:

(A) Visible broken wires, as follows:

(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, where a rope lay is the length along the rope in which one strand makes a complete revolution around the rope.

[illustration?]

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

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

(B) A diameter reduction of more than 5% from nominal diameter.

(iii) *Category III.* Apparent deficiencies in this category include the following:

- (A) In rotation resistant wire rope, core protrusion or other distortion indicating core failure.
- (B) Electrical contact with a power line.
- (C) A broken strand.

(3) *Critical Review Items.* The competent person shall give particular attention to:

- (i) Rotation resistant wire rope in use.
- (ii) Wire rope being used for boom hoists and luffing hoists, particularly at reverse bends [see diagram in Appendix ___].
- (iii) Wire rope at flange points, crossover points and repetitive pickup points on drums.
- (iv) Wire rope adjacent to end connections.
- (v) Wire rope at and on equalizer sheaves.

(4) *Removal from service.*

(i) If a deficiency in Category I is identified, an immediate determination shall be made by the competent person as to whether the deficiency constitutes a safety hazard. If the deficiency is determined to constitute a safety hazard, operations involving use of the wire rope in question shall be prohibited until:

- (A) The wire rope is replaced, or
- (B) If the deficiency (other than power line contact) is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited. Repair of wire rope that contacted an energized power line is also prohibited.

(ii) If a deficiency in Category II is identified, the employer shall comply with *Option A or Option B*, as follows:

(A) *Option A.* Consider the deficiency to constitute a safety hazard where it meets the wire rope manufacturer's established criterion for removal from service or meets a different criterion that the wire rope manufacturer has approved in writing for that specific wire rope. If the deficiency is considered a safety hazard, operations involving use of the wire rope in question shall be prohibited until the wire rope is

replaced, or the damage is removed in accordance with paragraph (4)(i)(B).

(B) *Option B.* Institute the alternative measures specified in paragraph (4)(iii).

(iii) *Alternative measures for a Category II deficiency.* The wire rope may continue to be used if the employer ensures that the following measures are implemented:

(A) A qualified person assesses the deficiency in light of the load and other conditions of use and determines it is safe to continue to use the wire rope as long as the conditions established under this paragraph are met.

(B) A qualified person establishes the parameters for the use of the equipment with the deficiency, including a reduced maximum rated load.

(C) A qualified person establishes a specific number of broken wires, broken strands, or diameter reduction that, when reached, will require the equipment to be taken out of service until the wire rope is replaced or the damage is removed in accordance with paragraph (4)(i)(A) or (B).

(D) A qualified person sets a time limit, not to exceed 30 days from the date the deficiency is first identified, by which the wire rope must be replaced, or the damage removed in accordance with paragraph (4)(i)(B).

(E) The workers who will conduct the shift inspections are informed of this deficiency and the measures taken under this paragraph.

(F) The qualified person's findings and procedures in paragraphs (A)–(D) are documented.

(iv) If a deficiency in Category III is identified, operations involving use of the wire rope in question shall be prohibited until:

(A) The wire rope is replaced, or

(B) If the deficiency (other than power line contact) is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited. Repair of wire rope that contacted an energized power line is also prohibited.

(v) Where a wire rope is required to be removed from service under this Section, either the equipment (as a whole) or the hoist with that wire rope shall be tagged-out, in accordance with Section 1417(f)(1), until the wire rope is repaired or replaced.

(b) *Monthly inspection.*

(1) Each month an inspection shall be conducted in accordance with paragraph 1413(a) (wire rope shift inspection).

(2) Wire ropes on equipment shall not be used until an inspection under this paragraph demonstrates that no corrective action under paragraph 1413(a)(3) is required.

(3) The inspection shall be documented according to paragraph 1412(e)(3) (monthly inspection documentation).

(c) *Annual/comprehensive*

(1) At least every 12 months, wire ropes in use on equipment shall be inspected by a qualified person in accordance with paragraph 1413(a) (shift inspection).

(2) In addition, at least every 12 months, the wire ropes in use on equipment shall be inspected by a qualified person, as follows:

(i) The inspection shall be for deficiencies of the types listed in paragraph (a)(2).

(ii) The inspection shall be complete and thorough, covering the surface of the entire length of the wire ropes, with particular attention given to:

(A) Critical review items listed in paragraph (a)(2).

(B) Those sections that are normally hidden during shift and monthly inspections.

(C) Wire rope in contact with saddles, equalizer sheaves or other sheaves where rope travel is limited.

(D) Wire rope subject to reverse bends.

(E) Wire rope passing over sheaves.

(F) Wire rope at or near terminal ends.

(iii) *Exception:* In the event an inspection under paragraph (c)(2) is not feasible due to existing set-up and configuration of the equipment (such as where an assist crane is needed) or due to site conditions (such as a dense urban setting), such inspections shall be conducted as soon as it becomes feasible, but no longer than an additional 6 months for running ropes and, for standing ropes, at the time of disassembly.

- (3) If a deficiency is identified, an immediate determination shall be made by the qualified person as to whether the deficiency constitutes a safety hazard.
- (i) If the deficiency is determined to constitute a safety hazard, operations involving use of the wire rope in question shall be prohibited until:
 - (A) The wire rope is replaced, or
 - (B) If the deficiency is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited.
 - (ii) If the qualified person determines that, though not presently a safety hazard, the deficiency needs to be monitored, the employer shall ensure that the deficiency is checked in the monthly inspections.
- (4) The inspection shall be documented according to paragraph 1412 (f)(7) (annual/comprehensive inspection documentation).
- (d) Rope lubricants that are of the type that hinder inspection shall not be used.

1414 Wire Rope – Selection and installation criteria

- (a) Selection of replacement wire rope shall be in accordance with the recommendations of the wire rope manufacturer, the equipment manufacturer, or a qualified person.
- (b) *Boom hoist reeving.*
- (1) Fiber core ropes shall not be used for boom hoist reeving, except for derricks.
 - (2) Rotation resistant ropes shall be used for boom hoist reeving only where the requirements of paragraph (c) are met.
- (c) *Rotation resistant ropes.*
- (1) *Definitions.*
 - (i) *Type I rotation resistant wire rope (“Type I”).* Type I rotation resistant rope is stranded rope constructed to have little or no tendency to rotate or, if guided, transmits little or no torque. It has at least 15 outer strands and comprises an assembly of at least three layers of strands laid helically over a center in two operations. The direction of lay of the outer strands is opposite to that of the underlying layer.
 - (ii) *Type II rotation resistant wire rope (“Type II”).* Type II rotation resistant rope is stranded rope constructed to have significant resistance to rotation. It has at least 10 outer strands and comprises an assembly of two or more layers

of strands laid helically over a center in two or three operations. The direction of lay of the outer strands is opposite to that of the underlying layer.

(iii) *Type III rotation resistant wire rope (“Type III”)*. Type III rotation resistant rope is stranded rope constructed to have limited resistance to rotation. It has no more than nine outer strands, and comprises an assembly of two layers of strands laid helically over a center in two operations. The direction of lay of the outer strands is opposite to that of the underlying layer.

(2) *Requirements.*

(i) Types II and III with an operating design factor of less than 5 shall not be used for duty cycle or repetitive lifts.

(ii) Rotation resistant ropes (including Types I, II and III) shall have an operating design factor of no less than 3.5.

(iii) Type I shall have an operating design factor of no less than 5, except where the wire rope manufacturer and the equipment manufacturer approves the design factor, in writing.

(iv) Types II and III shall have an operating design factor of no less than 5, except where the requirements of paragraph (c)(3) are met.

(3) When Types II and III with an operating design factor of less than 5 are used (for non-duty cycle, non-repetitive lifts), the following requirements shall be met for each lifting operation:

(i) A qualified person shall inspect the rope in accordance with Section 1413(a). The rope shall be used only if the qualified person determines that there are no deficiencies constituting a hazard. In making this determination, more than one broken wire in any one rope lay shall be considered a hazard.

(ii) Operations shall be conducted in such a manner and at such speeds as to minimize dynamic effects.

(iii) Each lift made under these provisions shall be recorded in the monthly and annual inspection documents. Such prior uses shall be considered by the qualified person in determining whether to use the rope again.

(4) *Additional requirements for rotation resistant ropes for boom hoist reeving.*

(i) Rotation resistant ropes shall not be used for boom hoist reeving, except where the requirements of paragraph (ii) are met.

(ii) Rotation resistant ropes may be used as boom hoist reeving when load hoists are used as boom hoists for attachments such as luffing attachments or boom and mast attachment systems. Under these conditions, the following requirements shall be met:

(A) The drum shall provide a first layer rope pitch diameter of not less than 18 times the nominal diameter of the rope used.

(B) The requirements in 1426(b) (irrespective of the date of manufacture of the equipment), and 1426(c).

(C) The requirements in ASME B30.5 (2000) Section 5-1.3.2 (a), (a)(2) – (a)(4), (b) – (d).

(D) All sheaves used in the boom hoist reeving system shall have a rope pitch diameter of not less than 18 times the nominal diameter of the rope used.

(E) The design factor for the boom hoist reeving system shall be not less than five.

(F) The design factor for these ropes shall be the total minimum breaking force of all parts of rope in the system divided by the load imposed on the rope system when supporting the static weights of the structure and the crane rated load.

(d) 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.

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

(f) Prior to cutting a wire rope, seizings shall be placed on each side of the point to be cut. The length and number of seizings shall be in accordance with the wire rope manufacturer's instructions.

1415 Safety Devices

(a) *Safety devices.* The following safety devices are required on all equipment covered by this Subpart, unless otherwise specified:

(1) *Crane level indicator.*

(i) The equipment shall have a crane level indicator that is either built into the equipment or is available on the equipment.

(ii) If a built-in crane level indicator is not working properly, it shall be tagged-out or removed.

(iii) This requirement does not apply to portal cranes, derricks, floating cranes/derricks and cranes/derricks on barges, pontoons, vessels or other means of flotation.

(2) Boom stops, except for derricks and hydraulic booms.

(3) Jib stops (if a jib is attached), except for derricks.

(4) Equipment with foot pedal brakes shall have locks, except for portal cranes and floating cranes.

(5) Hydraulic outrigger jacks shall have an integral holding device/check valve.

(6) Equipment on rails shall have rail clamps and rail stops, except for portal cranes.

(b) *Proper operation required.* Operations shall not begin unless the devices listed in this section are in proper working order. If a device stops working properly during operations, the operator shall safely stop operations. Operations shall not resume until the device is again working properly. Alternative measures are not permitted to be used.

1416 Operational Aids

(a) The devices listed in this section (“**listed** operational aids”) are required on all equipment covered by this Subpart, unless otherwise specified.

(b) Operations shall not begin unless the **listed** operational aids are in proper working order, except where the employer meets the specified temporary alternative measures. More protective alternative measures specified by the crane/derrick manufacturer, if any, shall be followed.

(c) If a listed operational aid stops working properly during operations, the operator shall 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 and is not considered a modification under Section 1434.

(d) *Category I operational aids and alternative measures.* Operational aids listed in this paragraph that are not working properly shall be repaired no later than 7 days after the deficiency occurs. *Exception:* If the employer documents that it has ordered the necessary

parts within 7 days of the occurrence of the deficiency, the repair shall be completed within 7 days of receipt of the parts.

(1) *Boom hoist limiting device.*

(i) For equipment manufactured after December 16, 1969, a boom hoist limiting device is required. *Temporary alternative measures (use at least one):*

(A) Use a boom angle indicator.

(B) Clearly mark the boom hoist cable (so that it can easily be seen by the operator) at a point that will give the operator sufficient time to stop the hoist to keep the boom within the minimum allowable radius. In addition, install mirrors or remote video cameras and displays if necessary for the operator to see the mark.

(C) Clearly mark the boom hoist cable (so that it can easily be seen by a spotter) at a point that will give the spotter sufficient time to signal the operator and have the operator stop the hoist to keep the boom within the minimum allowable radius.

(ii) If the equipment was manufactured on or before December 16, 1969, and was not originally equipped with a boom hoist limiting device, at least one of the measures in paragraphs 1416(d)(1)(i)(A)-(C) shall be used, on a permanent basis.

(2) *Luffing jib limiting device.*

(i) Equipment with a luffing jib shall have a luffing jib limiting device. Temporary alternative measures are the same as in paragraph 1416(d)(1)(i), except to limit the movement of the luffing jib.

(3) *Anti two-blocking device.*

(i) Telescopic boom cranes manufactured after February 28, 1992, shall be equipped with a device which automatically prevents damage from contact between the load block, overhaul ball, or similar component, and the boom tip (or fixed upper block or similar component). The device(s) must prevent such damage at all points where two-blocking could occur. *Temporary alternative measures:* Clearly mark the cable (so that it can easily be seen by the operator) at a point that will give the operator sufficient time to stop the hoist to prevent two-blocking, **and use a spotter when extending the boom.**

(ii) *Lattice boom cranes.*

(A) Lattice boom cranes manufactured after Feb 28, 1992, shall be equipped with a device that either automatically prevents damage and load failure from contact between the load block, overhaul ball, or similar component, and the boom tip (or fixed upper block or similar component), or warns the operator in time for the operator to prevent two-blocking. The device(s) must prevent such damage/failure or provide adequate warning for all points where two-blocking could occur.

(B) Lattice boom cranes, and derricks, manufactured one year after the effective date of this standard shall be equipped with a device which automatically prevents damage and load failure from contact between the load block, overhaul ball, or similar component, and the boom tip (or fixed upper block or similar component). The device(s) must prevent such damage/failure at all points where two-blocking could occur.

(C) *Exception.* The requirements in paragraphs 1416(d)(3)(ii)(A) and (B) do not apply to such lattice boom equipment when used for dragline, clamshell (grapple), magnet, drop ball, container handling, concrete bucket, marine operations, and pile driving work.

(D) *Temporary alternative measures.* Clearly mark the cable (so that it can easily be seen by the operator) at a point that will give the operator sufficient time to stop the hoist to prevent two-blocking, or use a spotter.

(e) *Category II operational aids and alternative measures.* Operational aids listed in this paragraph that are not working properly shall be repaired no later than 30 days after the deficiency occurs. *Exception:* If the employer documents that it has ordered the necessary parts within 7 days of the occurrence of the deficiency, and the part is not received in time to complete the repair in 30 days, the repair shall be completed within 7 days of receipt of the parts.

(1) *Boom angle or radius indicator.* The equipment shall have a boom angle or radius indicator readable from the operator's station. *Temporary alternative measures:* Radii or boom angle shall be determined by measuring the radii or boom angle with a measuring device.

(2) *Jib angle indicator* if the equipment has a luffing jib. *Temporary alternative measures:* Radii or jib angle shall be determined by ascertaining the main boom angle and then measuring the radii or jib angle with a measuring device.

(3) *Boom length indicator* if the equipment has a telescopic boom, except where the load rating is independent of the boom length. *Temporary alternative measures:* One of the following methods shall be used:

- (i) Mark the boom with measured marks to calculate boom length; or
- (ii) Calculate boom length from boom angle and radius measurements; or
- (iii) Measure the boom with a measuring device.

(4) *Load weighing and similar devices.* Equipment (other than derricks) manufactured after March 29, 2003 with a rated capacity over 6,000 pounds shall have at least one of the following: load weighing device, load moment indicator, rated capacity indicator, or rated capacity limiter. *Temporary alternative measures:* The weight of the load shall be determined from a reliable source (such as the load's manufacturer), by a reliable calculation method (such as calculating a steel beam from measured dimensions and a known per foot weight), or by other equally reliable means. This information shall be provided to the operator prior to the lift.

(5) The following devices are required on equipment manufactured after January 1, 2008:

- (i) Outrigger position (horizontal beam extension) sensor/monitor if the equipment has outriggers. *Temporary alternative measures:* the operator shall verify that the position of the outriggers is correct (in accordance with manufacturer procedures) before beginning operations requiring outrigger deployment.
- (ii) Hoist drum rotation indicator if the drum is not visible from the operator's station. *Temporary alternative measures:* Mark the drum. In addition, install mirrors or remote video cameras and displays if necessary for the operator to see the mark.

1417 Operation

- (a) The employer shall comply with all manufacturer procedures applicable to the operational functions 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.

(c) *Accessibility of procedures.*

(1) The 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.

(2) 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.

(d) The operator shall not engage in any practice that diverts his/her attention while actually engaged in operating the crane, such as the use of cell phones (other than when used for signal communications) or other attention-diverting activities.

(e) *Leaving the equipment unattended.*

(1) The operator shall not leave the controls while the load is suspended, except where the following are met:

(i) The operator remains adjacent to the equipment and is not engaged in any other duties.

(ii) The load is to be held suspended for a period of time exceeding normal lifting operations.

(iii) The competent person determines that it is safe to do so and implements measures necessary to restrain the boom hoist and telescoping, load, swing, and outrigger functions.

(iv) Barricades or caution lines, and notices, are erected to prevent all employees from entering the fall zone. No employees, including those listed in Section 1425(b)(1)-(3), 1425(d) or 1425(e), shall be permitted in the fall zone.

(2) *Storm warning.* When a local storm warning has been issued, the competent person shall determine whether it is necessary to implement manufacturer recommendations for securing the equipment.

(3) The provisions in paragraph 1417(e) do not apply to working gear (such as slings, spreader bars, ladders, and welding machines) where the load is not suspended over an entrance or exit.

(f) *Tag-out.*

(1) *Tagging out of service equipment/functions.* Where **the employer** has taken the equipment out of service, a tag shall be placed in the cab stating that the equipment is out of service and is not to be used. Where **the employer** has taken a function(s) out of service, a tag shall be placed **in a conspicuous position** stating that the function is out of service and not to be used.

(2) *Response to “do not operate”/ tag-out signs.*

(i) If there is a warning (tag-out or maintenance/do not operate) sign on the equipment or starting control, the operator shall not activate the switch or start the equipment until the sign has been removed by a person authorized to remove it, or until the operator has verified that:

(A) No one is servicing, working on, or otherwise in a dangerous position on the machine.

(B) The equipment has been repaired and is working properly.

(ii) If there is a warning (tag-out or maintenance/do not operate) sign on any other switch or control, the operator shall not activate that switch or control until the sign has been removed by a person authorized to remove it, or until the operator has verified that the requirements in paragraphs (2)(i)(A) and (B) have been met.

(g) Before starting the engine, the operator shall verify that all controls are in the **proper starting** position and that all personnel are in the clear.

(h) [Delete]

(i) [Reserved]

(j) The operator shall be familiar with the equipment and its proper operation. If adjustments or repairs are necessary, the operator shall promptly inform the person designated by the employer to receive such information and, where there are successive shifts, to the next operator.

(k) Safety devices and operational aids shall not be used as a substitute for the exercise of professional judgment by the operator.

(l) [Reserved]

(m) If **the competent person determines that** there is a slack rope condition **requiring re-spooling of the rope**, it shall be verified (before starting to lift) that the rope is seated on the drum and in the sheaves as the slack is removed.

- (n) The competent person shall consider the effect of wind, ice, and snow on equipment stability and rated capacity.
- (o) *Compliance with rated capacity.*
- (1) The equipment shall not be operated in excess of its rated capacity.
 - (2) The operator shall not be required to operate the equipment in a manner that would violate paragraph (o)(1).
 - (3) *Load weight.* The operator shall verify that the load is within the rated capacity of the equipment by at least one of the following methods:
 - (i) The weight of the load shall be determined from a reliable source (such as the load's manufacturer), by a reliable calculation method (such as calculating a steel beam from measured dimensions and a known per foot weight), or by other equally reliable means. In addition, when requested by the operator, this information shall be provided to the operator prior to the lift; or
 - (ii) The operator shall begin hoisting the load to determine, using a load weighing device, load moment indicator, rated capacity indicator, or rated capacity limiter, if it exceeds 75 percent of the maximum rated capacity at the longest radius that will be used during the lift operation. If it does, the operator shall not proceed with the lift until he/she verifies the weight of the load in accordance with paragraph (o)(3)(i).
- (p) The boom or other parts of the equipment shall not contact any obstruction.
- (q) The equipment shall not be used to drag or pull loads sideways.
- (r) On wheel-mounted equipment, no loads shall be lifted over the front area, except as permitted by the manufacturer.
- (s) The operator shall test the brakes each time a load that is 90% or more of the maximum line pull is handled by lifting the load a few inches and applying the brakes. In duty cycle and repetitive lifts where each lift is 90% or more of the maximum line pull, this requirement applies to the first lift but not to successive lifts.
- (t) Neither the load nor the boom shall be lowered below the point where less than two full wraps of rope remain on their respective drums.
- (u) *Traveling with a load.*
- (1) Traveling with a load is prohibited if the practice is prohibited by the manufacturer.

(2) Where traveling with a load, the employer shall ensure that:

(i) A competent person supervises the operation, determines if it is necessary to reduce crane ratings, and makes determinations regarding load position, boom location, ground support, travel route, overhead obstructions, and speed of movement necessary to ensure safety.

(ii) The determinations of the competent person required in paragraph (u)(2)(i) are implemented.

(iii) For equipment with tires, tire pressure specified by the manufacturer is maintained.

(v) Rotational speed of the equipment shall be such that the load does not swing out beyond the radius at which it can be controlled.

(w) A tag or restraint line shall be used if necessary to prevent rotation of the load that would be hazardous.

(x) The brakes shall be adjusted in accordance with manufacturer procedures to prevent unintended movement.

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

(z) *Swinging locomotive cranes.* A locomotive crane shall not be swung into a position where it is reasonably foreseeable that railway cars on an adjacent track could strike it, until it is determined that cars are not being moved on the adjacent track and that proper flag protection has been established.

(aa) *Counterweight/ballast.*

(1) The following applies to equipment other than tower cranes:

(i) Equipment shall not be operated without the counterweight or ballast in place as specified by the manufacturer.

(ii) The maximum counterweight or ballast approved by the manufacturer for the equipment shall not be exceeded.

(2) Counterweight/ballast requirements for tower cranes are specified in Section 1435(b)(8).

1418 Authority to stop operation

Whenever there is 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.

1419 Signals – General Requirements

- (a) A signal person must be provided in each of the following situations:
- (1) The point of operation, meaning the load travel or the area near or at load placement, is not in full view of the operator.
 - (2) When the equipment is traveling, the view in the direction of travel is obstructed.
 - (3) Due to site specific safety concerns, either the operator or the person handling the load determines that it is necessary.
- (b) *Types of signals.* Signals to crane operators must be by hand, voice, audible, or new signals.
- (c) *Hand signals.*
- (1) When using hand signals, the Standard Method must be used (see Appendix __). *Exception:* where use of the Standard Method for hand signals is infeasible, or where an operation or use of an attachment is not covered in the Standard Method, Non-standard hand signals may be used [See Appendix A for examples] in accordance with paragraph 1419(c)(2). The following requirements apply to the use of non-standard hand signals:
 - (2) *Non-standard hand signals.* When using non-standard hand signals, the signal person, crane operator, and lift supervisor (where there is one) shall contact each other prior to the operation and agree on the non-standard hand signals that will be used.
- (d) *New signals.* Signals other than hand, voice or audible signals may be used where the employer demonstrates that:
- (1) The new signals provide at least equally effective communication as voice, audible, or Standard Method hand signals, or
 - (2) There is an industry consensus standard for the new signals.
- (e) *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.
- (f) 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.

(g) If the operator becomes aware of a safety 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.

(h) Only one person gives signals to a crane/derrick at a time, except in circumstances covered by paragraph 1419(j).

(i) [Reserved].

(j) Anyone who becomes aware of a safety problem must alert the operator or signal person by giving the stop or emergency stop signal. (NOTE: 1417(y) requires the operator to obey a stop or emergency stop signal).

(k) All directions given to the crane operator by the signal person shall be given from the operator's direction perspective.

(l) [Reserved].

(m) *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 function/direction, 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.

1420 Signals – Radio, telephone or other electronic transmission of signals.

(1) The device(s) used to transmit signals shall be tested on site before beginning operations to ensure that the signal transmission is clear and reliable.

(2) Signal transmission must be through a dedicated channel. *Exception:* Multiple cranes/derricks and one or more signal persons may share a dedicated channel for the purpose of coordinating operations.

(3) The operator's reception of signals must be by a hands-free system.

1421 Signals – 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 agree on the signals that will be used.

Once the signals are agreed upon, these workers need not meet again to discuss signals unless another worker is substituted, there is confusion about the signals, or a signal is to be changed.

(2) Each voice signal shall contain the following three elements, given in the following order: function (such as hoist, boom, etc.), direction; distance and/or speed; function, stop command.

(3) The crane operator, signal person and lift supervisor (if there is one), shall be able to effectively communicate in the language used.

1422 Signals – Hand signal chart. Hand signal charts must be either posted on the equipment or readily available at the site.

1423 Fall Protection

(a) *Application.*

(1) Paragraphs (b), (c)(2), (d) and (e) apply to all equipment covered by this Subpart except tower cranes.

(2) Paragraph (c)(1), (f) and (h) applies to all equipment covered by this Subpart.

(3) Paragraph (g) applies only to tower cranes.

(b) *Boom walkways.*

(1) Equipment manufactured after January 1, 2008 with lattice booms shall be equipped with walkways on the boom(s) if the vertical profile of the boom (from cord centerline to cord centerline) is 6 or more feet.

(2) *Boom walkway criteria.*

(a) The walkways shall be at least 12 inches wide.

(b) *Guardrails, railings and other permanent fall protection attachments along walkways are:*

(i) Not required.

(ii) Prohibited on booms supported by pendant ropes or bars if the guardrails/railings/attachments could be snagged by the ropes or bars.

(iii) Prohibited if of the removable type (designed to be installed and removed each time the boom is assembled/disassembled).

(iv) Where not prohibited, guardrails or railings may be of any height up to, but not more than, 45 inches.

(c) *Steps, handholds, grabrails and railings.*

(1) The employer shall maintain originally-equipped steps, handholds, ladders and guardrails/railings/grabrails in good condition.

(2) Equipment manufactured one year after the effective date of this standard shall be equipped so as to provide safe access and egress between the ground and the operator work station(s), including the forward and rear positions, by the provision of devices such as steps, handholds, ladders, and guardrails /railings/grabrails. These shall meet the following criteria:

(i) Steps, ladders and guardrails/railings/ grabrails shall meet the requirements of SAE J185 (May, 2003) or ISO 11660-2 (1994) [we will change these if necessary to versions in effect on date of publication of this standard], except where infeasible.

(ii) Walking/stepping surfaces, except for crawler treads, shall have slip-resistant features/properties (such as diamond plate metal, strategically placed grip tape, expanded metal, or slip-resistant paint).

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

(1) When moving point-to-point:

(i) On non-lattice booms (whether horizontal or not horizontal).

(ii) On lattice booms that are not horizontal.

(2) While at a work station on any part of the equipment (including the boom, of any type), except when the employee is at or near draw-works (when the equipment is running), in the cab, or on the deck.

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

(f) *Anchorage criteria.*

(1) *Anchorage for fall arrest and positioning device systems.*

(i) Personal fall arrest systems and positioning systems shall be anchored to any apparently substantial part of the equipment unless a competent person, from a visual inspection, without an engineering analysis, would conclude that the applicable criteria in 1926.502 would not be met.

(ii) Attachable anchor devices (portable anchor devices that are attached to the equipment) shall meet the applicable anchorage criteria in 1926.502.

(2) *Anchorage for restraint systems.* Restraint systems shall be anchored to any part of the equipment that is capable of withstanding twice the maximum load that a worker may impose on it during reasonably anticipated conditions of use.

(g) *Tower cranes.*

(1) For non-erecting/dismantling work, the employer shall provide and ensure the use of fall protection equipment for employees who are on a walking/working surface with an unprotected side or edge more than 6 feet above a lower level, except when the employee is at or near draw-works (when the equipment is running), in the cab, or on the deck.

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

(h) *Anchoring to the load line.* A fall arrest system is permitted to be anchored to the crane/derrick's hook (or other part of the load line) where the following requirements are met:

(1) A qualified person has determined that the set-up and rated capacity of the crane/derrick (including the hook, load line and rigging) meets or exceeds the requirements in 1926.502 (d)(15).

(2) The equipment operator shall be at the work site and informed that the equipment is being used for this purpose.

1424 Work Area Control

(a) *Swing radius hazards.*

(1) The requirements in paragraph (a)(2) apply where there are accessible areas in which the equipment's rotating superstructure (whether permanently or temporarily mounted) poses a reasonably foreseeable risk of:

(i) Striking and injuring an employee; or

(ii) Pinching/crushing an employee against another part of the equipment or another object.

(2) To prevent employees from entering these hazard areas, the employer shall:

(i) Instruct employees assigned to work on or near the equipment (“authorized personnel”) in how to recognize struck-by and pinch/crush hazard areas posed by the rotating superstructure.

(ii) Erect and maintain control lines, warning lines, railings or similar barriers to mark the boundaries of the hazard areas. *Exception:* where it is neither feasible to erect such barriers on the ground nor on the equipment, the hazard areas shall be clearly marked by a combination of warning signs (such as “Danger – Swing/Crush Zone” or “Danger – This Thing’s Gonna Swing and Crunch You – Zone”) and high visibility markings on the equipment that identify the hazard areas. In addition, the employer shall train the employees to understand what these markings signify.

(3) *Protecting workers in the hazard area.*

(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 that he/she is going to that location.

(ii) Where the operator knows that an employee went to a location covered by paragraph (1), the operator shall not rotate the superstructure until the operator:

(A) Gives a warning that is understood by the employee as a signal that the superstructure is about to be rotated and allows time for the employee to get to a safe position, or

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

(b) *Multiple equipment coordination.* Where any part of a crane/derrick is within the working radius of another crane/derrick, the controlling entity shall institute a system to coordinate operations. If there is no controlling entity, the employers shall institute such a system.

1425 Keeping Clear of the Load

(a) Where available, hoisting routes that minimize the exposure of workers to hoisted loads shall be used, to the extent consistent with public safety.

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

- (1) Engaged in hooking, unhooking or guiding a load, or
- (2) Engaged in the initial attachment of the load to a component or structure, or
- (3) Operating a concrete hopper or concrete bucket.

(c) When employees are engaged in hooking, unhooking, or guiding the load, or in the initial connection of a load to a component or structure and are within the fall zone, the following criteria shall be met:

- (1) The materials being hoisted shall be rigged to prevent unintentional displacement.
- (2) Hooks with self-closing latches or their equivalent shall be used. *Exception:* “J” hooks are permitted to be used for setting wooden trusses.
- (3) The materials shall be rigged by a qualified rigger.

(d) *Receiving a load.* Only employees needed to receive a load shall be permitted to be within the fall zone when a load is being landed.

(e) During a tilt-up or tilt-down operation:

- (1) No employee shall be directly under the load.
- (2) Only employees essential to the operation shall be in the fall zone (but not directly under the load).

NOTE: Boom free fall is prohibited when an employee is in the fall zone of the boom or load, and load line free fall is prohibited when an employee is directly under the load; see Section 1426.

1426 Free fall and controlled load lowering

(a) *Boom free fall prohibitions.*

(1) The use of equipment in which the boom is designed to free fall (live boom) is prohibited in each of the following circumstances:

- (i) An employee is in the fall zone of the boom or load.
- (ii) An employee is being hoisted.

- (iii) The load or boom is directly over a power line, or over the area extending the Table A clearance distance to each side of the power line.
- (iv) The load is over a shaft.
- (v) The load is over a cofferdam, except where there are no workers in the fall zone.
- (vi) Lifting operations are taking place in a refinery or tank farm.

(2) The use of cranes in which the boom is designed to free fall (live boom) is permitted only where none of the circumstances listed in paragraph (1) are present and:

- (i) The equipment was manufactured prior to October 31, 1984, or
- (ii) The equipment is a floating crane/derrick or is on pontoons, a barge or a vessel.

(b) *Preventing boom free fall.* Where the use equipment with a boom that is designed to free fall (live boom) is prohibited (see paragraph (a)(1)), the boom hoist shall have a secondary mechanism or device designed to prevent the boom from falling in the event the primary system used to hold or regulate the boom hoist fails, as follows:

(1) Friction drums shall have:

- (i) A friction clutch and, in addition, a braking device, to allow for controlled boom lowering.
- (ii) A secondary braking or locking device, which is manually or automatically engaged, to back-up the primary brake while the boom is held (such as a secondary friction brake or a ratchet and pawl device).

(2) Hydraulic drums shall have an integrally mounted holding device or internal static brake to prevent boom hoist movement in the event of hydraulic failure.

(3) Neither clutches nor hydraulic motors shall be considered brake or locking devices for purposes of this Subpart.

(4) Hydraulic boom cylinders shall have an integrally mounted holding device.

(c) *Preventing uncontrolled retraction.* Hydraulic telescoping booms shall have an integrally mounted holding device to prevent boom movement in the event of hydraulic failure.

(d) *Load line free fall.* In each of the following circumstances, controlled load lowering is required and free fall of the load line hoist is prohibited:

- (1) An employee is directly under the load.
- (2) An employee is being hoisted.
- (3) The load is directly over a power line, or over the area extending the Table A clearance distance to each side of the power line.
- (4) The load is over a shaft or cofferdam.

1427 Operator qualification and certification.

(a) The employer must ensure that, prior to operating any equipment covered under Section 1400, the operator is either qualified or certified to operate the equipment in accordance with one of the Options in paragraphs (b) – (e), or is operating the equipment during a training period in accordance with paragraph (f).

(b) *Option (1): Certification by an accredited crane/derrick operator 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, test administration, grading, facilities/equipment and personnel have been met.

(ii) Administer written and practical tests that:

(A) Assess the operator applicant regarding, at a minimum, the knowledge and skills listed in (j)(1) and (2).

(B) Provide different levels of certification based on equipment capacity and type.

(iii) Have procedures for operators to re-apply and be re-tested in the event an operator applicant fails a test or is decertified.

(iv) Have testing procedures for re-certification designed to ensure that the operator continues to meet the technical knowledge and skills requirements in (j)(1) and (2).

(v) Have its accreditation reviewed by the nationally recognized accrediting agency at least every three years.

(2) A certification issued under this Option is portable.

(3) A certification issued under this paragraph is valid for 5 years.

(c) *Option (3): Qualification by an audited employer program.* The employer's qualification of its employee shall meet the following requirements:

(1) The written and practical tests shall be either:

(i) Developed by an accredited crane/derrick operator testing organization (see paragraph (b)), or

(ii) Approved by an auditor in accordance with the following requirements:

(A) The auditor is certified to evaluate such tests by an accredited crane/derrick operator testing organization (see paragraph (b)).

(B) The auditor is not an employee of the employer.

(C) The approval shall be based on the auditor's determination that the written and practical tests meet nationally recognized test development criteria and are valid and reliable in assessing the operator applicants regarding, at a minimum, the knowledge and skills listed in (j)(1) and (2).

(2) *Administration of tests.*

(i) The written and practical tests shall be administered under circumstances approved by the auditor as meeting nationally recognized test administration standards.

(ii) The auditor shall be certified to evaluate the administration of the written and practical tests by an accredited crane/derrick operator testing organization (see paragraph (b)).

(iii) The auditor shall not be an employee of the employer.

(iv) The audit shall be conducted in accordance with nationally recognized auditing standards.

(3) The employer program shall be audited within 3 months of the beginning of the program and every 3 years thereafter.

(4) The employer program shall have testing procedures for re-certification designed to ensure that the operator continues to meet the technical knowledge and skills requirements in (j)(1) and (2). The re-certification procedures shall be audited in accordance with paragraph (c)(1) and (2).

(5) *Deficiencies.* If the auditor determines that there is a significant deficiency (“deficiency”) in the program, the employer shall ensure that:

- (i) No operator is qualified until the auditor confirms that the deficiency has been corrected.
- (ii) The program is audited again within 180 days of the confirmation that the deficiency was corrected.
- (iii) The auditor files a documented report of the deficiency to the appropriate Regional Office of the Occupational Safety and Health Administration within 15 days of the auditor’s determination that there is a deficiency.
- (iv) Records of the audits of the employer’s program are maintained by the auditor for three years and are made available by the auditor to the Secretary of Labor or her designated representative upon request.

(6) A qualification under this paragraph is:

- (i) Not portable.
- (ii) Valid for 5 years.

(d) *Option (4). Qualification by the U.S. military.*

(1) For purposes of this Section, an operator is considered qualified if he/she has a current operator qualification issued by the U.S. military for operation of the equipment.

(2) A qualification under this paragraph is:

- (i) Not portable.
- (ii) Valid for the period of time stipulated by the issuing entity.

(e) *Option (5). Licensing by a government entity.*

(1) For purposes of this Section, a government licensing department/office that issues operator licenses for operating equipment covered by this standard is considered a government accredited crane/derrick operator testing organization if the criteria in paragraph (e)(2) are met.

(2) *Licensing criteria.*

- (i) The requirements for obtaining the license include an assessment, by written and practical tests, of the operator applicant regarding, at a minimum, the knowledge and skills listed in (j)(1) and (2).
- (ii) The testing meets industry recognized criteria for written testing materials, practical examinations, test administration, grading, facilities/equipment and personnel.
- (iii) The government authority that oversees the licensing department/office, has determined that the requirements in paragraphs (e)(2)(i) and (ii) have been met.
- (iv) The licensing department/office has testing procedures for re-certification designed to ensure that the operator continues to meet the technical knowledge and skills requirements in (j)(1) and (2).

(3) A license issued by a government accredited crane/derrick operator testing organization that meets the requirements of this Option:

- (i) Meets the operator qualification requirements of this Section for operation of equipment only within the jurisdiction of the government entity.
- (ii) Is valid for the period of time stipulated by the licensing department/office, but no longer than 5 years.

(f) *Pre-qualification/certification training period.*

- (1) An employee who is not qualified or certified under this Section is permitted to operate equipment where the requirements of paragraph (f)(2) are met.
- (2) An employee who has passed neither the written nor practical tests required under this Section is permitted to operate equipment as part of his/her training where the following requirements are met:
 - (i) The employee (“trainee/apprentice”) shall be provided with sufficient training prior to operating the equipment to enable the trainee to operate the equipment safely under limitations established by this Section (including continuous supervision) and any additional limitations established by the employer.
 - (ii) The tasks performed by the trainee/apprentice while operating the equipment shall be within the trainee’s ability.
 - (iii) *Supervisor.* While operating the equipment, the trainee/apprentice shall be continuously supervised by an individual (“operator’s supervisor”) who meets the following requirements:

- (A) The operator's supervisor is an employee or agent of the trainee's/apprentice's employer.
- (B) The operator's supervisor is either a certified operator under this Section, or has passed the written portion of a certification test under one of the Options in paragraphs (b) - (e), and is familiar with the proper use of the equipment's controls.
- (C) While supervising the trainee/apprentice, the operator's supervisor performs no tasks that detract from the supervisor's ability to supervise the trainee/apprentice.
- (D) For equipment other than tower cranes: the operator's supervisor and the trainee/apprentice shall be in direct line of sight of each other. In addition, they shall communicate verbally or by hand signals. **For tower cranes: the operator's supervisor and the trainee/apprentice shall be in direct communication with each other.**

(iv) *Continuous supervision.* The trainee/apprentice shall be supervised by the operator's supervisor at all times, except for short breaks where the following are met:

- (A) The break lasts no longer than 15 minutes and there is no more than one break per hour.
- (B) Immediately prior to the break the operator's supervisor informs the trainee/apprentice of the specific tasks that the trainee/apprentice is to perform and limitations that he/she is to adhere to during the operator supervisor's break.
- (C) The specific tasks that the trainee/apprentice will perform during the operator supervisor's break are within the trainee's/apprentice's abilities.

(v) The trainee/apprentice shall not operate the equipment in any of the following circumstances:

- (A) If any part of the crane, load line or load (including rigging and lifting accessories), if operated up to the crane's maximum working radius in the work zone (see paragraph 1408(a)(1)), could get within 20 feet of a power line that is up to 350 kV, or within 50 feet of a power line that is over 350 kV.
- (B) If the equipment is used to hoist personnel.

- (C) In multiple-crane lifts.
- (D) If the equipment is used over a shaft, cofferdam, or in a tank farm.
- (E) For multiple-lift rigging, except where the operator's supervisor determines that the trainee's/apprentice's skills are sufficient for this high-skill work.

(g) Under this Section, a testing entity is permitted to provide training as well as testing services as long as the criteria of the applicable accrediting agency (in the Option selected) for an organization providing both services are met.

(h) Written tests under this Section are permitted to be administered verbally, with answers given verbally, where the operator candidate:

- (1) Passes a written demonstration of literacy relevant to the work.
- (2) Demonstrates the ability to use the type of written manufacturer procedures applicable to the class/type of equipment for which the candidate is seeking certification.

(i) [Reserved].

(j) *Certification criteria.* Qualifications and certifications 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 type of equipment the individual will operate, including the following:

- (A) The controls and operational/performance characteristics.
- (B) Use of, and the ability to calculate (manually or with a calculator), 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 subject matter criteria listed in Appendix Q applicable to the specific type of equipment the individual will operate. Use of the Appendix Q criteria meets the requirements of this provision.

(E) Technical knowledge applicable to:

(1) The suitability of the supporting ground and surface to handle expected loads.

(2) Site hazards.

(3) Site access.

(D) This Subpart, including applicable incorporated materials.

(ii) The individual is able to read and locate relevant information in the equipment manual and other materials containing information referred to in paragraph (j)(1)(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 1412(d) (shift inspection).

(ii) Operational and maneuvering skills.

(iii) Application of load chart information.

(iv) Application of safe shut-down and securing procedures.

(k) *Phase-in.*

(1) As of the effective date of this standard, until four years after the effective date of the standard, the following requirements apply:

(i) Operators of equipment covered by this standard are required to be competent to operate the equipment safely.

(ii) Where an employee assigned to operate machinery does not have the required knowledge or ability to operate the equipment safely, the employee shall be provided with the necessary training prior to operating the equipment. The employer shall ensure that the operator is evaluated to confirm that he/she understands the information provided in the training.

(2) The effective date of paragraphs (a) – (j) and (m) is [4 years after the effective date of the standard].

(l) [Reserved].

(m) *Definitions.*

(1) “*Portable.*” Any employer of an operator with a certification that is portable under this Section meets the requirements of paragraph (a) with respect to that operator.

(2) “*Not portable.*” Where an operator has a qualification that is not portable under this Section, the qualification meets the requirements of paragraph (a) only where the operator is employed by (and operating the equipment for) the employer that issued the qualification.

1428 Signal Person Qualifications

(a) The employer of the signal person shall ensure that each signal person meets the Qualification Requirements (paragraph 1428(c)) prior to giving any signals. This requirement shall be met by using either Option (1) or Option (2).

(1) *Option (1) – Third party qualified evaluator.* The signal person has documentation from a third party qualified evaluator showing that the signal person meets the Qualification Requirements (see paragraph 1428(c)).

(2) *Option (2) – Employer’s qualified evaluator.* The employer has its qualified evaluator assess the individual and determine that the individual meets the Qualification requirements (see paragraph 1428(c)). An assessment by an employer’s qualified evaluator under this Option is not portable – other employers are not permitted to use it to meet the requirements of this Section.

(3) The documentation for whichever Option is used shall be available while the signal person is employed by the employer.

(b) If subsequent actions by the signal person indicate that the individual may not meet the Qualification Requirements (see paragraph 1428(c)), the employer must not allow the individual to continue working as a signal person until re-training is provided and a re-assessment is made in accordance with paragraph 1428(a) that confirms that the individual meets the Qualification Requirements.

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

(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.

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

(3) Have a basic understanding of crane operation and limitations, including the crane dynamics involved in swinging and stopping loads and boom deflection from hoisting loads.

(4) Know and understand the relevant requirements of sections 1419 – 1422 and 1428.

(5) Demonstrate that he/she meets the requirements in paragraph 1428(c)(1) – (4) through a verbal or written test, and through a practical test.

1429 Qualifications of Maintenance & Repair Workers

(a) Maintenance, inspection and repair personnel are permitted to operate the equipment only where the following requirements are met:

(1) The operation is limited to those functions necessary to perform maintenance, inspect or verify the performance of the equipment.

(2) The personnel either:

(i) Operate the equipment under the direct supervision of an operator who meets the requirements of section 1427 (Operator Qualification and Certification), or

(ii) Are familiar with the operation, safe limitations, characteristics and hazards associated with the type of equipment.

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

1430 Training

The employer shall provide training as follows:

(a) *Overhead powerlines.* Employees specified in Section 1408(g)(Power line safety; training) shall be trained in accordance with the requirements of that paragraph.

(b) *Signal persons.* Employees who will be assigned to work as signal persons who do not meet the requirements of Section 1428(c) shall be trained in the areas addressed in that paragraph.

(c) *Operators.*

(1) Operators who are not qualified or certified under Section 1427 shall be trained in the areas addressed in Section 1427(j). Retraining shall be provided if necessary for re-qualification or re-certification or if the operator does not pass a qualification or certification test.

(2) In addition to training in the areas addressed in Section 1427(j), operators shall be trained in the following practices:

- (i) On friction equipment, whenever moving a boom off a support, first raise the boom a short distance (sufficient to take the load of the boom) to determine if the boom hoist brake needs to be adjusted. On other types of equipment, the same practice is applicable, except that typically there is no means of adjusting the brake; if the brake does not hold, a repair is necessary.
- (ii) Where available, the manufacturer's emergency procedures for halting unintended equipment movement.

(d) *Competent persons and qualified persons.* Competent persons and qualified persons shall be trained regarding the requirements of this Subpart applicable to their respective roles.

(e) *Crush/pinch points.* Employees who work with the equipment shall be instructed to keep clear of holes, and crush/pinch points and the hazards addressed in Section 1424 (Work area control).

(f) *Tag-out.* Operators and other employees authorized to start/energize equipment or operate equipment controls (such as maintenance and repair workers), shall be trained in the tag-out procedures in Section 1417(f).

(g) *Training administration.*

(1) The employer shall ensure that employees required to be trained under this Subpart are evaluated to confirm that they understand the information provided in the training.

(2) Refresher training in relevant topics shall be provided when, based on the conduct of the employee or an evaluation of the employee's knowledge, there is an indication that retraining is necessary.

1431 Hoisting Personnel

The requirements of this section are supplemental to the other requirements in this Subpart and apply when one or more employees are hoisted.

(a) The use of equipment to hoist employees is prohibited except where the employer demonstrates that the erection, use, and dismantling of conventional means of reaching the worksite, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform, or scaffold, would be more hazardous, or is not possible because of the project's structural design or worksite conditions. This paragraph does not apply to work covered by Subpart R (Steel Erection).

(b) *Use of personnel platform.*

(1) When using equipment to hoist employees, the employees shall be in a personnel platform that meets the requirements of paragraph (e).

(2) *Exceptions:* A personnel platform is not required for hoisting employees:

(i) Into and out of drill shafts that are up to and including 8 feet in diameter (see paragraph (o) for requirements for hoisting these workers).

(ii) In pile driving operations (see paragraph (p) for requirements for hoisting these workers).

(iii) Solely for transfer to or from a marine worksite in a marine hoisted personnel transfer device (see paragraph (r) for requirements for hoisting these workers).

(c) *Equipment set-up.*

(1) The equipment shall be uniformly level, within one percent of level grade, and located on footing that a qualified person has determined to be sufficiently firm and stable.

(2) Equipment with outriggers shall have them all extended and locked. The amount of extension shall be the same for all outriggers and in accordance with manufacturer procedures and load charts.

(d) *Equipment criteria.*

(1) *Capacity: use of suspended personnel platforms.* The total load (with the platform loaded, including the hook, load line and rigging) shall not exceed 50 percent of the rated capacity for the radius and configuration of the equipment, except during proof testing.

(2) *Capacity: use of boom-attached personnel platforms.* The total weight of the loaded personnel platform shall not exceed 50 percent of the rated capacity for the radius and configuration of the equipment (except during proof testing).

(3) When the occupied personnel platform is in a stationary working position, the load and boom hoist brakes, swing brakes, and operator actuated secondary braking and locking features (such as pawls or dogs) or automatic secondary brakes shall be engaged.

(4) *Devices.*

(i) Equipment (except for derricks) with a variable angle boom shall be equipped with:

(A) A boom angle indicator, readily visible to the operator.

(B) A boom hoist limiting device.

(ii) Equipment with a luffing jib shall be equipped with:

(A) A jib angle indicator, readily visible to the operator.

(B) A jib hoist limiting device.

(iii) Equipment with telescoping booms shall be equipped with a device to indicate the boom's extended length clearly to the operator, or has measuring marks on the boom.

(iv) *Anti-two-block.* A device which automatically prevents damage and load failure from contact between the load block, overhaul ball, or similar component, and the boom tip (or fixed upper block or similar component) shall be used. The device(s) must prevent such damage/failure at all points where two-blocking could occur. *Exception:* this device is not required when hoisting personnel in pile driving operations.

(v) *Controlled load lowering.* The load line hoist drum shall have a system, other than the load line hoist brake, which regulates the lowering rate of speed of the hoist mechanism. This system or device must be used when hoisting personnel.

(NOTE: free fall of the load line hoist is prohibited (see 1426(d)); the use of equipment in which the boom hoist mechanism can free fall is also prohibited (see 1426(a)(1)).

(v) *Proper operation required.* Personnel hoisting operations shall not begin unless the devices listed in this section are in proper working order. If a device stops working properly during such operations, the operator shall safely stop operations. Personnel hoisting operations shall not resume until the device is again working properly. Alternative measures are not permitted.

(5) Direct attachment of a personnel platform to a luffing jib is prohibited.

(e) *Personnel platform criteria.*

(1) The personnel platform and attachment/suspension system shall be designed for hoisting personnel by a qualified person familiar with structural design.

(2) The system used to connect the personnel platform to the equipment shall allow the platform to remain within 10 degrees of level, regardless of boom angle.

- (3) The suspension system shall be designed to minimize tipping of the platform due to movement of employees occupying the platform.
 - (4) The personnel platform itself (excluding the guardrail system and personal fall arrest system anchorages), shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load.
 - (5) All welding of the personnel platform and its components shall be performed by a certified welder familiar with the weld grades, types and material specified in the platform design.
 - (6) The personnel platform shall be equipped with a guardrail system which meets the requirements of 1926 Subpart M, and shall be enclosed at least from the toeboard to mid-rail with either solid construction material or expanded metal having openings no greater than ½ inch (1.27cm). Points to which personal fall arrest systems are attached must meet the anchorage requirements in 1926 subpart M.
 - (7) A grab rail shall be installed inside the entire perimeter of the personnel platform except for access gates/doors.
 - (8) *Access gates/doors.* If installed, access gates/doors of all types (including swinging, sliding, folding, or other types) shall:
 - (i) Not swing outward.
 - (ii) Be equipped with a device that prevents accidental opening.
 - (9) Headroom shall be sufficient to allow employees to stand upright in the platform.
 - (10) In addition to the use of hard hats, employees shall be protected by overhead protection on the personnel platform when employees are exposed to falling objects. The platform overhead protection shall not obscure the view of the operator or platform occupants (such as wire mesh that has up to ½ inch openings), unless full protection is necessary.
 - (11) All edges exposed to employee contact shall be smooth enough to prevent injury.
 - (12) The weight of the platform and its rated load capacity shall be conspicuously posted on the platform with a plate or other permanent marking.
- (f) *Personnel platform loading.*
- (1) The personnel platform shall not be loaded in excess of its rated load capacity.
 - (2) *Use.*

(i) Personnel platforms shall be used only for employees, their tools, and the materials necessary to do their work. Platforms shall not be used to hoist materials or tools when not hoisting personnel.

(ii) *Exception:* materials and tools to be used during the lift, if secured and distributed in accordance with (e)(3) and (e)(4), may be in the platform for trial lifts.

(3) Materials and tools shall be:

(i) Secured to prevent displacement.

(ii) Evenly distributed within the confines of the platform while it is suspended.

(4) The number of employees occupying the personnel platform shall not exceed the maximum number the platform was designed to hold or the number required to perform the work, whichever is less.

(g) *Attachment and rigging.*

(1) *Hooks and other detachable devices.*

(i) Hooks used in the connection between the hoist line and the personnel platform (including hooks on overhaul ball assemblies, lower load blocks, bridle legs, or other attachment assemblies or components) shall be:

(A) Of a type that can be closed and locked, eliminating the throat opening.

(B) Closed and locked when attached.

(ii) Shackles used in place of hooks must of the alloy anchor type, with either:

(A) A bolt, nut and retaining pin, in place, or

(B) Of the screw type, with the screw pin secured from accidental removal.

(iii) Where other detachable devices are used, they must be of the type that can be closed and locked to the same extent as the devices addressed in paragraphs (i) and (ii). Such devices must be closed and locked when attached.

(2) *Rope bridle.* When a rope bridle is used to suspend the personnel platform, each bridle leg shall be connected to a master link or shackle (see paragraph (g)) in a manner that ensures that the load is evenly divided among the bridle legs.

(3) Rigging hardware (including wire rope, shackles, rings, master links, and other rigging hardware) and hooks must be capable of supporting, without failure, at least five times the maximum intended load applied or transmitted to that component.

(4) Eyes in wire rope slings shall be fabricated with thimbles.

(5) Bridles and associated rigging for suspending the personnel platform shall be used only for the platform and the necessary employees, their tools and materials necessary to do their work, and shall not be used for any other purpose when not hoisting personnel.

(h) *Trial lift and inspection.*

(1) A trial lift with the unoccupied personnel platform loaded at least to the anticipated lightweight shall be made from ground level, or any other location where employees will enter the platform, to each location at which the platform is to be hoisted and positioned. Where there is more than one location to be reached from a single set-up position, either individual trial lifts for each location, or a single trial lift for all locations, shall be performed.

(2) The trial lift shall be performed immediately prior to each shift in which personnel will be hoisted. In addition, the trial lift shall be repeated prior to hoisting employees in each of the following circumstances:

(i) The equipment is moved and set up in a new location or returned to a previously used location.

(ii) The lift route is changed, unless the competent person determines that the new route presents no new factors affecting safety.

(3) The competent person shall determine that:

(i) Safety devices and operational aids required by this section are activated and functioning properly. Other safety devices and operational aids must meet the requirements of section 1415 and 1416.

(ii) Nothing interferes with the equipment or the personnel platform in the course of the trial lift.

(iii) The lift will not exceed 50 percent of the equipment's rated capacity at any time during the lift.

- (iv) The load radius to be used during the lift has been accurately determined.
- (4) Immediately after the trial lift, the competent person shall:
 - (i) Conduct a visual inspection of the equipment, base support or ground, and personnel platform, to determine whether the trial lift has exposed any defect or problem or produced any adverse effect.
 - (ii) Confirm that, upon the completion of the trial lift process, the test weight has been removed.
- (5) Immediately prior to each lift:
 - (i) The platform shall be hoisted a few inches and inspected by a competent person to ensure that it is secure and properly balanced.
 - (ii) The following conditions must be determined by a competent person to exist before the lift of personnel proceeds:
 - (A) Hoist ropes shall be free of deficiencies in accordance with paragraph 1413(a).
 - (B) Multiple part lines shall not be twisted around each other.
 - (C) The primary attachment shall be centered over the platform.
 - (D) If the load rope is slack, the hoisting system shall be inspected to ensure that all ropes are properly seated on drums and in sheaves.
- (6) Any condition found during the trial lift and subsequent inspection(s) that fails to meet a requirement of this standard or otherwise creates a safety hazard shall be corrected before hoisting personnel.
- (i) [Reserved]
- (j) *Proof testing.*
 - (1) At each jobsite, prior to hoisting employees on the personnel platform, and after any repair or modification, the platform and rigging shall be proof tested to 125 percent of the platform's rated capacity. The proof test may be done concurrently with the trial lift.
 - (2) The platform shall be lowered by controlled load lowering, braked and held in a suspended position for a minimum of five minutes with the test load evenly distributed on the platform.

(3) After proof testing, a competent person shall inspect the platform and rigging to determine if the test has been passed. If any deficiencies are found that pose a safety hazard, the platform and rigging shall not be used to hoist personnel unless the deficiencies are corrected, the test is repeated, and a competent person determines that the test has been passed.

(4) Personnel hoisting shall not be conducted until the competent person determines that the platform and rigging have successfully passed the proof test.

(k) *Work practices.*

(1) Hoisting of the personnel platform shall be performed in a slow, controlled, cautious manner, with no sudden movements of the equipment or the platform.

(2) Platform occupants shall:

(i) Keep all parts of the body inside the platform during raising, lowering, and horizontal movement. This provision does not apply to an occupant of the platform when necessary to position the platform or while performing the duties of a signal person.

(ii) Not stand, sit on, or work from the top or intermediate rail or toeboard, or use any other means/device to raise their working height.

(iii) Not pull the platform out of plumb in relation to the hoisting equipment.

(3) Before employees exit or enter a hoisted personnel platform that is not landed, the platform shall be secured to the structure where the work is to be performed, unless securing to the structure would create a greater hazard.

(4) If the platform is tied to the structure, the operator shall not move the platform until the operator receives confirmation that it is freely suspended.

(5) Tag lines shall be used when necessary to control the platform.

(6) *Platforms without controls.* Where the platform is not equipped with controls, the equipment operator shall remain at the equipment controls at all times while the platform is occupied.

(7) *Platforms with controls.* Where the platform is equipped with controls, the following must be met at all times while the platform is occupied:

(i) The occupant using the controls in the platform must be a qualified person with respect to their use, including the safe limitations of the equipment and hazards associated with its operation.

(ii) The equipment operator must be at the equipment controls, or in the personnel platform, or on site and in view of the equipment.

(iii) The platform operating manual must be in the platform or on the equipment.

(8) *Environmental conditions.*

(i) *Wind.* When wind speed (sustained or gusts) exceeds 20 mph at the personnel platform, a qualified person shall determine if, in light of the wind conditions, it is not safe to lift personnel. If it is not, the lifting operation shall not begin (or, if already in progress, shall be terminated).

(ii) *Other weather and environmental conditions.* A qualified person shall determine if, in light of indications of dangerous weather conditions, or other impending or existing danger, it is not safe to lift personnel. If it is not, the lifting operation shall not begin (or, if already in progress, shall be terminated).

(9) Employees being hoisted shall remain in direct communication with the signal person (where used), or the operator.

(10) *Fall protection.*

(i) Except over water, employees occupying the personnel platform shall be provided and use a personal fall arrest system. The system shall be attached to a structural member within the personnel platform.

(ii) The fall arrest system, including the attachment point (anchorage) used to comply with paragraph (i), shall meet the requirements in 1926.502.

NOTE: When working over water, the requirements of 1926.106 apply.

(11) *Other load lines.*

(i) No lifts shall be made on any other of the equipment's load lines while personnel are suspended on a platform, except in pile driving operations.

(ii) *Factory-produced boom-mounted personnel baskets that incorporate a winch as original equipment:* loads are permitted to be hoisted by such a winch while employees occupy the personnel platform only where the load on the winch line does not exceed 500 pounds and does not exceed the rated capacity of the winch and platform.

(12) *Traveling – equipment other than derricks.*

(i) Hoisting of employees while the equipment is traveling is prohibited, except for:

(A) Equipment that travels on fixed rails, or

(B) Where the employer demonstrates that there is no less hazardous way to perform the work. This exception does not apply to rubber-tired equipment.

(ii) Where employees are hoisted while the equipment is traveling, the following criteria shall be met:

(A) Crane travel shall be restricted to a fixed track or runway.

(B) Where a runway is used, it shall be a firm, level surface designed, prepared and designated as a path of travel for the weight and configuration of the equipment being used to lift and travel with the personnel platform. An existing surface may be used as long as it meets these criteria.

(C) Travel shall be limited to boom length.

(D) The boom shall be parallel to the direction of travel, except where it is safer to do otherwise.

(E) A complete trial run shall be performed to test the route of travel before employees are allowed to occupy the platform. This trial run can be performed at the same time as the trial lift required by paragraph (g) which tests the lift route.

(13) *Traveling -- derricks.* Derricks are prohibited from traveling while personnel are hoisted.

(l) [Reserved]

(m) *Pre-lift meeting.* A pre-lift meeting shall be:

(1) Held to review the applicable requirements of this section and the procedures that will be followed.

(2) Attended by the equipment operator, signal person (if used for the lift), employees to be hoisted, and the person responsible for the task to be performed.

(3) Held prior to the trial lift at each new work location, and shall be repeated for any employees newly assigned to the operation.

(n) *Hoisting personnel near power lines.* Hoisting personnel within 20 feet of a power line that is up to 350 kV, and hoisting personnel within 50 feet of a power line that is over 350 kV, is prohibited, except for work covered by 1926 Subpart V (Power Transmission and Distribution).

(o) *Hoisting personnel in drill shafts.* When hoisting employees into and out of drill shafts that are up to and including 8 feet in diameter, the following requirements shall be met:

- (1) The employee shall be in either a personnel platform or on a boatswain's chair.
- (2) If using a personnel platform, paragraphs (a) through (n) apply.
- (3) If using a boatswain's chair:
 - (i) The following paragraphs of §1431 apply: (a), (c), (d)(1), (d)(3), (d)(4), (e)(1), (e)(2), (e)(3), (f)(1), (f)(2)(i), (f)(3)(i), (g), (h), (k)(1), (k)(6), (k)(8), (k)(9), (k)(11)(i), (m), (n). Where the terms "personal platform" or "platform" are used in these paragraphs, substitute them with "boatswain's chair."
 - (ii) A signal person shall be stationed at the shaft opening.
 - (iii) The employee shall be hoisted in a slow, controlled decent and ascent.
 - (iv) The employee shall use personal fall protection equipment, including a full body harness, attached independent of the crane/derrick.
 - (v) The fall protection equipment shall meet the applicable requirements in 1926.502.
 - (vi) The boatswain's chair itself (excluding the personal fall arrest system anchorages), shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load.
 - (vii) No more than one person shall be hoisted at a time.

(p) *Hoisting personnel for pile driving operations.* When hoisting an employee in pile driving operations, the following requirements shall be met:

- (1) The employee shall be in a personnel platform or **boatswain's chair**.
- (2) Clearly mark the cable (so that it can easily be seen by the operator) at a point that will give the operator sufficient time to stop the hoist to prevent two-blocking, or use a spotter.
- (3) If using a personnel platform, paragraphs (b) through (n) apply.
- (4) If using a boatswain's chair:
 - (i) The following paragraphs of §1431 apply: (a), (c), (d)(1), (d)(3), (d)(4), (e)(1), (e)(2), (e)(3), (f)(1), (f)(2)(i), (f)(3)(i), (g), (h), (j), (k)(1), (k)(6), (k)(8),

(k)(9), (k)(11)(i), (m), and (n). Where the terms “personal platform” or “platform” are used in these paragraphs, substitute them with “boatswains chair.”

(ii) The employee shall be hoisted in a slow, controlled decent and ascent.

(iii) The employee shall use personal fall protection equipment, including a full body harness, independently attached to the lower load block or overhall ball.

(iv) The fall protection equipment shall meet the applicable requirements in 1926.502.

(q) [Reserved].

(r) *Hoisting personnel for marine transfer.* When hoisting employees solely for transfer to or from a marine worksite, the following requirements shall be met:

(1) The employee shall be in either a personnel platform or a marine hoisted personnel transfer device.

(2) If using a personnel platform, paragraphs (a) through (n) apply.

(3) If using a marine hoisted personnel transfer device:

(i) The following paragraphs of §1431 apply: (a), (c)(2), (d)(1), (d)(3), (d)(4), (e)(1) - (5), (e)(12), (f)(1), (g), (h), (j), (k)(1), (k)(8), (k)(9), (k)(10)(ii), (k)(11)(i), (k)(12), (m), and (n). Where the terms “personal platform” or “platform” are used in these paragraphs, substitute them with “marine hoisted personnel transfer device.”

(ii) The transfer device shall be used only for transferring workers.

(iii) The number of workers occupying the transfer device shall not exceed the maximum number it was designed to hold.

(iv) Each employee shall wear a U.S. Coast Guard personal flotation device approved for industrial use.

(s) *Hoisting personnel for storage tank (steel and concrete), shaft and chimney operations.* When hoisting an employee in storage tank (steel and concrete), shaft and chimney operations, the following requirements shall be met:

(1) The employee shall be in a personnel platform except where use of a personnel platform is infeasible; in such a case, a boatswain’s chair shall be used.

- (2) If using a personnel platform, paragraphs (a) through (n) apply.
- (3) If using a boatswain's chair:
 - (i) The following paragraphs of §1431 apply: (a), (c), (d)(1), (d)(3), (d)(4), (e)(1), (e)(2), (e)(3), (f)(1), (f)(2)(i), (f)(3)(i), (g), (h), (k)(1), (k)(6), (k)(8), (k)(9), (k)(11)(i), (m), (n). Where the terms "personal platform" or "platform" are used in these paragraphs, substitute them with "boatswains chair."
 - (ii) The employee shall be hoisted in a slow, controlled decent and ascent.
 - (iii) The employee shall use personal fall protection equipment, including a full body harness, attached independent of the crane/derrick.
 - (iv) The fall protection equipment shall meet the applicable requirements in 1926.502.
 - (v) The boatswain's chair itself (excluding the personal fall arrest system anchorages), shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load.
 - (vi) No more than one person shall be hoisted at a time.

1432 Multiple-crane/derrick lifts -- supplemental requirements

(a) *Plan development.* Before beginning a crane/derrick operation in which more than one crane/derrick will be supporting the load, the operation must be planned. The planning must meet the following requirements:

- (1) The plan must be developed by a qualified person.
- (2) The plan must be designed to ensure that the requirements of this Subpart are met.
- (3) Where the qualified person determines that engineering expertise is needed for the planning, the employer must ensure that it is provided.

(b) *Plan implementation.*

- (1) The multiple-crane/derrick lift must be supervised by a person who meets the criteria for both a competent person and a qualified person, or by a competent person who is assisted by one or more qualified persons.
- (2) The supervisor must review the plan with all workers who will be involved with the operation.

1433 Design, construction and testing.

The following requirements apply to equipment that has a manufacturer-rated hoisting/lifting capacity of 2000 pounds or more.

(a) Crawler, truck and locomotive cranes manufactured prior to [effective date of 1926.1400] shall meet the applicable requirements for design, construction, and testing as prescribed in ANSI B30.5 – 1968, Safety Code for Crawler, Locomotive, and Truck Cranes, PCSA #2, the requirements in paragraph (b), or the applicable DIN standards that were in effect at the time of manufacture.

(b) Mobile (including crawler and truck) and locomotive cranes manufactured on or after [effective date of the standard] shall meet the following portions of ASME B30.5 – 2000 with addenda ASME B30.5a – 2002 Safety Code for Mobile and Locomotive Cranes, as applicable:

- (1) In section 5-1.1.1 (“Load Ratings – Where Stability Governs Lifting Performance”), paragraphs (a) – (d) (including subparagraphs).
- (2) In section 5-1.1.2 (“Load Ratings – Where Structural Competence Governs Lifting Performance”), paragraph (b).
- (3) Section 5-1.2 (“Stability (Backward and Forward)”).
- (4) In section 5-1.3.1 (“Boom Hoist Mechanism”), paragraphs (a), (b)(1) and (b)(2), except that when using rotation resistant rope, Section 1414(c)(4)(ii)(A) applies.
- (5) In section 5-1.3.2 (“Load Hoist Mechanism”), paragraphs (a), (a)(2) – (a)(4) (including subparagraphs), (b) – (d) (including subparagraphs).
- (6) Section 5-1.3.3 (“Telescoping Boom”).
- (7) Section 5-1.4 (“Swing Mechanism”).
- (8) In section 5-1.5 (“Crane Travel”), all provisions except 5-1.5.3(d).
- (9) In section 5-1.6 (“Controls”), all provisions except 5-1.6.1 (c).
- (10) Section 5-1.7.4 (“Sheaves”).
- (11) Section 5-1.7.5 (“Sheave sizes”).
- (12) In section 5-1.9.1 (“Booms”), paragraph (f).
- (13) Section 5-1.9.3 (“Outriggers”).

(14) Section 5-1.9.4 (“Locomotive Crane Equipment”).

(15) Section 5-1.9.7 (“Clutch and Brake Protection”).

(16) In section 5-1.9.12 (“Miscellaneous equipment”), paragraphs (a), (c), (e), and (f).

(c) Prototype testing: crawler, truck and locomotive cranes manufactured prior to [effective date of 1926.1400] shall meet the applicable requirements for prototype testing as prescribed in ANSI B30.5 – 1968, Safety Code for Crawler, Locomotive, and Truck Cranes.

(d) Prototype testing: mobile (including crawler and truck) and locomotive cranes manufactured on or after [effective date of the standard] shall meet the prototype testing requirements in Test Option A or Test Option B.

(1) *Test Option A.*

(i) The following applies to equipment with cantilevered booms (such as hydraulic boom cranes): All the tests listed in SAE J 1063, Table 1, shall be performed to load all critical structural elements to their respective limits. All the strength margins listed in SAE J 1063 table 2 shall be met.

(ii) The following applies to equipment with pendant supported lattice booms: All the tests listed in SAE J-987, Table 1, shall be performed to load all critical structural elements to their respective limits. All the strength margins listed in SAE J 987 table 2 shall be met.

(2) *Test Option B.* The testing and verification requirements of CEN’s EN 13000 (2004) shall be met. In applying the CEN standard, the following additional requirements shall be met:

(i) The following applies to equipment with cantilevered booms (such as hydraulic boom cranes): The analysis methodology (computer modeling) must demonstrate that all load cases listed in SAE J1063 meet the strength margins listed in SAE J1063 Table 2.

(ii) The following applies to equipment with pendant supported lattice booms: The analysis methodology (computer modeling) must demonstrate that all load cases listed in SAE J987 meet the strength margins listed in SAE J987 Table 2.

(iii) *Analysis verification.* The physical testing requirements under SAE J1063 and SAE J987 must be met unless the reliability of the analysis methodology (computer modeling) has been demonstrated by a documented history of verification through strain gauge measuring or strain gauge measuring in combination with other physical testing.

(e) All equipment covered by this Subpart shall meet the following requirements:

(1) *Load capacity/ratings and related information.* The information available in the cab (see Section 1417 (c)) regarding load capacity/ratings and related information shall include, at a minimum, the following information:

- (i) A complete range of the manufacturer's equipment load ratings, as follows:
 - (A) At all manufacturer approved operating radii, boom angles, work areas, boom lengths and configurations, jib lengths and angles (or offset).
 - (B) Alternate ratings for use and nonuse of option equipment which affects load ratings, such as outriggers and extra counterweights.
- (ii) A work area chart for which capacities are listed in the load rating chart. (Note: an example of this type of chart is in ASME B30.5-2000, Section 5-1.1.3, Figure 11).
- (iii) The work area figure and load rating chart shall clearly indicate the areas where no load is to be handled.
- (iv) Recommended reeving for the hoist lines shall be shown.
- (v) Recommended parts of hoist reeving, size, and type of wire rope for various equipment loads.
- (vi) Recommended boom hoist reeving diagram, where applicable; size, type and length of wire rope.
- (vii) Tire pressure (where applicable).
- (viii) Caution or warnings relative to limitations on equipment and operating procedures, including an indication of the least stable direction.
- (ix) Position of the gantry and requirements for intermediate boom suspension (where applicable).
- (x) Instructions for boom erection and conditions under which the boom, or boom and jib combinations, may be raised or lowered.
- (xi) Whether the hoist holding mechanism is automatically or manually controlled, whether free fall is available, or any combination of these.
- (xii) The maximum telescopic travel length of each boom telescopic section.

(xiii) Whether sections are telescoped manually or with power.

(xix) The sequence and procedure for extending and retracting the telescopic boom section.

(xx) Maximum loads permitted during the boom extending operation, and any limiting conditions or cautions.

(xxi) Hydraulic relief valve settings specified by the manufacturer.

(2) Load hooks (including latched and unlatched types), ball assemblies and load blocks shall be of sufficient weight to overhaul the line from the highest hook position for boom or boom and jib lengths and the number of parts of the line in use.

(3) Hook and ball assemblies and load blocks shall be marked with their rated capacity and weight.

(4) *Latching hooks.*

(i) Hooks shall be equipped with latches, except where the requirements of paragraph (ii) are met.

(ii) Hooks without latches, or with latches removed or disabled, shall not be used unless:

(A) A qualified person has determined that it is safer to hoist and place the load without latches (or with the latches removed/tied-back).

(B) Routes for the loads are pre-planned to ensure that no employee is required to work in the fall zone except for employees necessary for the hooking or unhooking of the load.

(iii) The latch shall close the throat opening and be designed to retain slings or other lifting devices/accessories in the hook when the rigging apparatus is slack.

(5) *Posted warnings.* Posted warnings required by this Subpart as well as those originally supplied with the equipment by the manufacturer shall be maintained in legible condition.

(6) An accessible fire extinguisher shall be on the equipment.

(7) *Cabs.* Equipment with cabs shall meet the following requirements:

- (i) Cabs shall be designed with a form of adjustable ventilation and method for clearing the windshield for maintaining visibility and air circulation. Examples of means for adjustable ventilation include air conditioner or window that can be opened (for ventilation and air circulation); examples of means for maintaining visibility include heater (for preventing windshield icing), defroster, fan, windshield wiper.
- (ii) Cab doors (swinging, sliding) shall be designed to prevent inadvertent opening or closing while traveling or operating the machine. Swinging doors adjacent to the operator shall open outward. Sliding operator doors shall open rearward.
- (iii) *Windows.*
 - (A) The cab shall have windows in front and on both sides of the operator. Forward vertical visibility shall be sufficient to give the operator a view of the boom point at all times.
 - (B) Windows may have sections designed to be opened or readily removed. Windows with sections designed to be opened shall be designed so that they can be secured to prevent inadvertent closure.
 - (C) Windows shall be of safety glass or material with similar optical and safety properties, that introduce no visible distortion or otherwise obscure visibility that interferes with the safe operation of the equipment.
- (iv) A clear passageway shall be provided from the operator's station to an exit door on the operator's side.
- (v) Areas of the cab roof that serve as a workstation for rigging, maintenance or other equipment-related tasks shall be capable of supporting 250 pounds without permanent distortion.
- (8) Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, and other parts or components that reciprocate, rotate or otherwise move shall be guarded where contact by employees (except for maintenance and repair workers) is possible in the performance of normal duties.
- (9) All exhaust pipes, turbochargers, and charge air coolers shall be insulated or guarded where contact by employees (except for maintenance and repair workers) is possible in the performance of normal duties.
- (10) Hydraulic and pneumatic lines shall be protected from damage to the extent feasible.

(11) The equipment shall be designed so that exhaust fumes are not discharged in the cab and are discharged in a direction away from the operator.

(12) *Friction mechanisms.* Where friction mechanisms (such as brakes and clutches) are used to control the boom hoist or load line hoist, they shall be:

(i) Of a size and thermal capacity sufficient to control all rated loads with the minimum recommended reeving.

(ii) Adjustable to permit compensation for lining wear to maintain proper operation.

(13) *Hydraulic load hoists.* Hydraulic drums shall have an integrally mounted holding device or internal static brake to prevent load hoist movement in the event of hydraulic failure.

(f) The employer's obligations under paragraphs (a) – (d) and (e)(7) – (13) are met where the equipment has not changed (except in accordance with Section 1434 (Equipment modifications)) and it can refer to documentation from the manufacturer showing that the equipment has been designed, constructed and tested in accordance with those paragraphs.

1434 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 provided a detailed description of the proposed modification, is asked to approve the modification/addition, but it declines to review the technical merits of the proposal or fails, within 30 days, to acknowledge the request or initiate the review, and all of the following are met:

(i) A registered professional engineer who is a qualified person with respect to the equipment involved:

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

(B) Modifies load charts, procedures, instruction manuals 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 1434(a)(2)(i) and (2)(ii) 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 safety merits of the proposed modification/addition, rejects the proposal and explains the reasons for the rejection in a written response.

(c) The provisions in paragraphs 1434(a) and 1434(b) do not apply to modifications made or approved by the U.S. military.

1435 Tower Cranes

(a) This Section contains supplemental requirements for tower cranes; all Sections of this Subpart apply to tower cranes unless specified otherwise.

(b) *Erecting, climbing and dismantling.*

(1) Sections 1403 (Assembly/disassembly – selection of manufacturer or employer procedures), 1404 (Assembly/disassembly – general requirements), and 1405 (Disassembly – additional requirements for disassembly of booms and jibs), apply to tower cranes (except as otherwise specified), except that the term “assembly/disassembly” is replaced by “erecting, climbing and dismantling,” and the term “disassembly” is replaced by “dismantling.”

(2) *Dangerous areas (self-erecting tower cranes).* In addition to the requirements in 1404(e), for self-erecting tower cranes, the following applies: Employees shall 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, unless the manufacturer’s instructions direct otherwise and only the necessary personnel are permitted in this area.

(3) *Addressing specific hazards.* The requirements in 1404(h)(1)-(9) apply. In addition, the A/D supervisor shall address the following:

(i) *Foundations and structural supports.* Tower crane foundations and structural supports shall be designed by the manufacturer or a registered professional engineer.

(ii) *Loss of backward stability.* Backward stability must be considered before swinging self erecting cranes or cranes on traveling or static undercarriages.

(iii) *Wind speed.* Wind must not exceed the speed recommended by the manufacturer or, where manufacturer does not specify this information, the speed determined by a qualified person.

(4) *Signs.* The size and location of signs installed on tower cranes must be in accordance with manufacturer procedures. 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.

(5) *Plumb tolerance.* Towers shall be erected plumb to the manufacturer's tolerance and verified by a qualified person. Where the manufacturer does not specify plumb tolerance, the crane tower shall be plumb to a tolerance of at least 1:500 (approximately 1 inch in 40 feet).

(6) *Multiple tower crane jobsites.* On jobsites where more than one fixed jib (hammerhead) tower crane is installed, the cranes shall be located so such that no crane may come in contact with the structure of another crane. Cranes are permitted to pass over one another.

(7) *Climbing procedures.* Prior to, and during, all climbing procedures (including inside climbing and top climbing), the employer shall:

(i) Comply with all manufacturer prohibitions.

(ii) Have a registered professional engineer verify that the host structure is strong enough to sustain the forces imposed through the braces, brace anchorages and supporting floors.

(iii) Ensure that no part of the climbing procedure takes place when wind exceeds the speed recommended by the manufacturer or, where the manufacturer does not specify this information, the speed determined by a qualified person.

(8) Counterweight/ballast.

(i) Equipment shall not be erected, dismantled or operated without the amount and position of counterweight or ballast in place as specified by the manufacturer or a professional engineer familiar with the equipment.

(ii) The maximum counterweight or ballast approved by the manufacturer or professional engineer familiar with the equipment shall not be exceeded.

(c) *Safety devices.*

(1) Section 1415 does not apply to tower cranes.

(2) The following safety devices are required on all tower cranes unless otherwise specified:

- (i) Boom stops on luffing boom type tower cranes.
- (ii) Jib stops on luffing boom type tower cranes if equipped with a jib attachment.
- (iii) Travel rail end stops at both ends of travel rail.
- (iv) Travel rail clamps on all travel bogies.
- (v) Integrally mounted check valves on all load supporting hydraulic cylinders.
- (vi) Hydraulic system pressure limiting device.
- (vii) The following brakes, which shall automatically set in the event of pressure loss or power failure, are required:
 - (A) A hoist brake on all hoists.
 - (B) Swing brake.
 - (C) Trolley brake.
 - (D) Rail travel brake.
- (viii) Deadman control or forced neutral return control (hand) levers.
- (ix) Emergency stop switch at the operator's station.

(3) *Proper operation required.* Operations shall not begin unless the devices listed in this section are in proper working order. If a device stops working properly during operations, the operator shall safely stop operations. Operations shall not resume until the device is again working properly. Alternative measures are not permitted to be used.

(d) *Operational aids.*

- (1) Section 1416 does not apply to tower cranes.
- (2) The devices listed in this section (“operational aids”) are required on all tower cranes covered by this Subpart, unless otherwise specified.

(3) Operations shall not begin unless the operational aids are in proper working order, except where the employer meets the specified temporary alternative measures. More protective alternative measures specified by the tower crane manufacturer, if any, shall be followed.

(4) If an operational aid stops working properly during operations, the operator shall 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 and is not considered a modification under Section 1434.

(5) *Category I operational aids and alternative measures.* Operational aids listed in this paragraph that are not working properly shall be repaired no later than 7 days after the deficiency occurs. *Exception:* If the employer documents that it has ordered the necessary parts within 7 days of the occurrence of the deficiency, the repair shall be completed within 7 days of receipt of the parts.

(i) *Trolley travel limiting device.* The travel of the trolley shall be restricted at both ends of the jib by a trolley travel limiting device to prevent the trolley from running into the trolley end stops. *Temporary alternative measures:*

(A) *Option A.* The trolley rope shall be marked (so it can be seen by the operator) at a point that will give the operator sufficient time to stop the trolley prior to the end stops.

(B) *Option B.* A spotter shall be used when operations are conducted within 10 feet of the outer or inner trolley end stops.

(ii) *Boom hoist limiting device.* The range of the boom shall be limited at the minimum and maximum radius. *Temporary alternative measures:* Clearly mark the cable (so it can be seen by the operator) at a point that will give the operator sufficient time to stop the boom hoist within the minimum and maximum boom radius, or use a spotter.

(iii) *Anti two-blocking device.* The tower crane shall be equipped with a device which automatically prevents damage from contact between the load block, overhaul ball, or similar component, and the boom tip (or fixed upper block or similar component). The device(s) must prevent such damage at all points where two-blocking could occur. *Temporary alternative measures:* Clearly mark the cable (so it can be seen by the operator) at a point that will give the operator sufficient time to stop the hoist to prevent two-blocking, or use a spotter.

(iv) *Hoist drum lowering device.* Tower cranes manufactured after January 1, 2008, shall be equipped with a device that prevents the last 2 wraps of hoist cable from being spooled off the drum. *Temporary alternative measures:*

Mark the cable (so it can be seen by the operator) at a point that will give the operator sufficient time to stop the hoist prior to last 2 wraps of hoist cable being spooled off the drum, or use a spotter.

(v) *Load moment limit device.* The tower crane shall have a device that prevents moment overloading. *Temporary alternative measures:* A radius indicating device shall be used (if the tower crane is not equipped with a radius indicating device, the radius shall be measured to ensure the load is within the rated capacity of the crane). In addition, the weight of the load shall be determined from a reliable source (such as the load's manufacturer), by a reliable calculation method (such as calculating a steel beam from measured dimensions and a known per foot weight), or by other equally reliable means. This information shall be provided to the operator prior to the lift.

(vi) *Hoist line pull limiting device.* The capacity of the hoist shall be limited to prevent overloading, including each individual gear ratio if equipped with a multiple speed hoist transmission. *Temporary alternative measures:* The operator shall ensure that the weight of the load does not exceed the capacity of the hoist (including for each individual gear ratio if equipped with a multiple speed hoist transmission).

(vii) *Rail travel limiting device.* The travel distance in each direction shall be limited to prevent the travel bogies from running into the end stops or buffers. *Temporary alternative measures:* A spotter shall be used when operations are conducted within 10 feet of the either end of the travel rail end stops.

(viii) *Boom hoist drum positive locking device.* The boom hoist drum shall be equipped with a device to positively lock the boom hoist drum. *Temporary alternative measures:* The device shall be manually set when required if an electric, hydraulic or automatic type is not functioning.

(6) *Category II operational aids and alternative measures.* Operational aids listed in this paragraph that are not working properly shall be repaired no later than 30 days after the deficiency occurs. *Exception:* If the employer documents that it has ordered the necessary parts within 7 days of the occurrence of the deficiency, and the part is not received in time to complete the repair in 30 days, the repair shall be completed within 7 days of receipt of the parts.

(i) *Boom angle or hook radius indicator.*

(A) Luffing boom tower cranes shall have a boom angle indicator readable from the operator's station.

(B) Hammerhead tower cranes manufactured after January 1, 2008, shall have a hook radius indicator readable from the operator's station.

(C) *Temporary alternative measures:* Hook radii or boom angle shall be determined by measuring the hook radii or boom angle with a measuring device.

(ii) *Trolley travel deceleration device.* The trolley speed shall be automatically reduced prior to the trolley reaching the end limit in both directions. *Temporary alternative measure:* The operator shall reduce the trolley speed when approaching the trolley end limits.

(iii) *Boom hoist deceleration device.* The boom speed shall be automatically reduced prior to the boom reaching the minimum or maximum radius limit. *Temporary alternative measure:* The operator shall reduce the boom speed when approaching the boom maximum or minimum end limits.

(iv) *Load hoist deceleration device.* The load speed shall be automatically reduced prior to the hoist reaching the upper limit. *Temporary alternative measure:* The operator shall reduce the hoist speed when approaching the upper limit.

(v) *Wind speed indicator.* A device shall be provided to display the wind speed and shall be mounted above the upper rotating structure on tower cranes. On self erecting cranes, it shall be mounted at or above the jib level. *Temporary alternative measures:* Use of wind speed information from a properly functioning indicating device on another tower crane on the same site, or a qualified person estimates the wind speed.

(vi) *Load indicating device.* Cranes manufactured after January 1, 2008, shall have a device that displays the magnitude of the load on the hook. Displays that are part of load moment limiting devices that display the load on the hook meet this requirement. *Temporary alternative measures:* The weight of the load shall be determined from a reliable source (such as the load's manufacturer), by a reliable calculation method (such as calculating a steel beam from measured dimensions and a known per foot weight), or by other equally reliable means. This information shall be provided to the operator prior to the lift.

(e) *Inspections.*

(1) Section 1412 (Inspections) applies to tower cranes, except that the term “assembly” is replaced by “erection.”

(2) *Post-erection inspection.* In addition to the requirements in paragraph 1412(c), the following requirements shall be met:

(i) 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.

(ii) The load test shall be conducted in accordance with the manufacturer's instructions. Where these instructions are unavailable, a registered professional engineer familiar with the type of equipment involved shall develop written load test procedures.

(3) *Monthly*. The following additional items shall be included:

(i) Tower (mast) bolts and other structural bolts (for loose or dislodged condition) from the base of the tower crane up or, if the crane is tied to or braced by the structure, those above the upper-most brace support.

(ii) The upper-most tie-in, braces, floor supports and floor wedges where the tower crane is supported by the structure, for loose or dislodged components.

1436 Derricks

(a) This Section contains supplemental requirements for derricks, whether temporarily or permanently mounted; all Sections of this Subpart apply to derricks unless specified otherwise. A derrick is powered equipment consisting of a mast or equivalent member that is held at or near the end by guys or braces, with or without a boom, and its hoisting mechanism. The mast/equivalent member and/or the load is moved by the hoisting mechanism (typically base-mounted) and operating ropes. Derricks include: A-frame, basket, breast, Chicago boom, gin pole (except gin poles used for erection of communication towers), guy, shearleg, stiffleg, and variations of such equipment.

(b) *Operation – procedures*.

(1) Section 1417 (Operation) applies except for paragraph (c) (accessibility of procedures).

(2) *Load chart contents*. Load charts shall contain at least the following information:

(i) Load ratings at corresponding ranges of boom angle or operating radii.

(ii) Specific lengths of components to which the load ratings apply.

(iii) Required parts for hoist reeving.

(iv) Size and construction of rope shall be included on the load chart or in the operating manual.

(3) *Load chart location*.

(i) *Permanent installations.* For permanently installed derricks with fixed lengths of boom, guy, and mast, a load chart shall be posted where it is visible to personnel responsible for the operation of the equipment.

(ii) *Non-permanent installations.* For derricks that are not permanently installed, the load chart shall be readily available at the job site to personnel responsible for the operation of the equipment.

(c) Construction.

(1) *General requirements.*

(i) Derricks shall be constructed to meet all stresses imposed on members and components when installed and operated in accordance with the manufacturer's/ builder's procedures and within its rated capacity.

(ii) Welding of load sustaining members shall conform to recommended practices in ANSI/AWS D14.3 or D1.1.

(2) *Guy derricks.*

(i) The minimum number of guys shall be 6, with equal spacing, except where a qualified person or derrick manufacturer approves variations from these requirements and revises the rated capacity to compensate for such variations.

(ii) Guy derricks shall not be used unless the employer has the following guy information:

(A) The number of guys.

(B) The spacing around the mast.

(C) The size, grade, and construction of rope to be used for each guy.

(iii) For guy derricks manufactured after December 18, 1970, in addition to the information required in paragraph (ii), the employer shall have the following guy information:

(A) The amount of initial sag or tension.

(B) The amount of tension in guy line rope at anchor.

(iv) The mast base shall permit the mast to rotate freely with allowance for slight tilting of the mast caused by guy slack.

- (v) The mast cap shall:
 - (A) Permit the mast to rotate freely.
 - (B) Withstand tilting and cramping caused by the guy loads.
 - (C) Be secured to the mast to prevent disengagement during erection.
 - (D) Be provided with means for attaching guy ropes.

(3) *Stiffleg derricks.*

- (i) The mast shall be supported in the vertical position by at least two stifflegs; one end of each shall be connected to the top of the mast and the other end securely anchored.
- (ii) The stifflegs shall be capable of withstanding the loads imposed at any point of operation within the rated load chart range.
- (iii) The mast base shall:
 - (A) Permit the mast to rotate freely (when necessary).
 - (B) Permit deflection of the mast without binding.
- (iv) The mast shall be prevented from lifting out of its socket when the mast is in tension.
- (v) The stiffleg connecting member at the top of the mast shall:
 - (A) Permit the mast to rotate freely (when necessary).
 - (B) Withstand the loads imposed by the action of the stifflegs.
 - (C) Be secured so as to oppose separating forces.

(4) *Gin pole derricks.*

- (i) Guy lines shall be sized and spaced so as to make the gin pole stable in both boomed and vertical positions. *Exception:* Where the size and/or spacing of guy lines do not result in the gin pole being stable in both boomed and vertical positions, the employer shall ensure that the derrick is not used in an unstable position.
- (ii) The base of the gin pole shall permit movement of the pole (when necessary).

(iii) The gin pole shall be anchored at the base against horizontal forces (when such forces are present).

(5) *Chicago boom derricks*. The fittings for stepping the boom and for attaching the topping lift shall be arranged to:

(i) Permit the derrick to swing at all permitted operating radii and mounting heights between fittings.

(ii) Accommodate attachment to the upright member of the host structure.

(iii) Withstand the forces applied when configured and operated in accordance with the manufacturer's/ builder's procedures and within its rated capacity.

(iv) Prevent the boom or topping lift from lifting out under tensile forces.

(d) *Anchoring and guying*.

(i) Load anchoring data developed by the manufacturer or a qualified person shall be used.

(ii) *Guy derricks*.

(A) The mast base shall be anchored.

(B) The guys shall be secured to the ground or other firm anchorage.

(C) The anchorage and guying shall be designed to withstand maximum horizontal and vertical forces encountered when operating within rated capacity with the particular guy slope and spacing specified for the application.

(iii) *Stiffleg derricks*.

(A) The mast base and stifflegs shall be anchored.

(B) The mast base and stifflegs shall be designed to withstand maximum horizontal and vertical forces encountered when operating within rated capacity with the particular stiffleg spacing and slope specified for the application.

(e) *Swingers and hoists*.

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

(2) Base-mounted drum hoists.

(i) Base mounted drum hoists shall meet the requirements in the following sections of ASME B30.7 (2001):

(i) Sections 7-1.1 (Load ratings and markings).

(ii) Section 7-1.2 (Construction), except: 7-1.2.13 (Operator's cab); 7-1.2.15 (Fire extinguishers).

(iii) Section 7-1.3 (Installation).

(iv) Applicable terms in Section 7-0.2 (Definitions).

(ii) *Load tests for new hoists.* The employer shall ensure that new hoists are load tested to a minimum of 110% of rated capacity, but not more than 125% of rated capacity, unless otherwise recommended by the manufacturer. This requirement is met where the manufacturer has conducted this testing.

(iii) *Repaired or modified hoists.* Hoists that have had repairs, modifications or additions affecting the its capacity or safe operation shall be evaluated by a qualified person to determine if a load test is necessary. If it is, load testing shall be conducted in accordance with paragraphs (e)(ii) and (iv).

(iv) *Load test procedure.* Load tests required by paragraphs (e)(ii) or (e)(iii) shall be conducted as follows:

(A) The test load shall be hoisted a vertical distance to assure that the load is supported by the hoist and held by the hoist brake(s).

(B) The test load shall be lowered, stopped and held with the brake(s).

(C) The hoist shall not be used unless a competent person determines that the test has been passed.

(f) *Operational aids.*

(1) Section 1416 (Operational aids) applies, except for paragraph 1416 (d)(1) (Boom hoist limiting device) and (e)(1) (Boom angle or radius indicator) and (e)(4).

(2) *Boom angle aid.* The employer shall ensure that either:

(i) The boom hoist cable shall be marked with caution and stop marks. The stop marks shall correspond to maximum and minimum allowable boom

angles. The caution and stop marks shall be in view of the operator, or a spotter who is in direct communication with the operator, or

(ii) An electronic or other device that signals the operator in time to prevent the boom from moving past its maximum and minimum angles, or automatically prevents such movement, is used.

(3) *Load weight/capacity devices.* Derricks manufactured [1 year after the effective date of this Subpart] with a maximum rated capacity over 6000 pounds shall have at least one of the following: load weighing device, load moment indicator, rated capacity indicator, or rated capacity limiter. *Temporary alternative measures:* The weight of the load shall be determined from a reliable source (such as the load's manufacturer), by a reliable calculation method (such as calculating a steel beam from measured dimensions and a known per foot weight), or by other equally reliable means. This information shall be provided to the operator prior to the lift.

(g) *Post-assembly approval and testing – new or reinstalled derricks.*

(1) *Anchorage.*

(i) Anchorages, including the structure to which the derrick is attached (if applicable), shall be approved by a qualified person.

(ii) If using a rock or hairpin anchorage, the qualified person shall determine if any special testing of the anchorage is needed. If so, it shall be tested accordingly.

(2) *Functional test.* Prior to initial use, new or reinstalled derricks shall be tested by a competent person with no hook load to verify proper operation. This test shall include:

(i) Lifting and lower the hook(s) through the full range of hook travel.

(ii) Raising and lowering the boom through the full range of boom travel.

(iii) Swinging in each direction through the full range of swing.

(iv) Actuating the anti two-block and boom hoist limit devices (if provided).

(v) Actuating locking, limiting and indicating devices (if provided).

(3) *Load test.* Prior to initial use, new or reinstalled derricks shall be load tested by a competent person. The test load shall meet the following requirements:

(i) Test loads shall be at least 100% and no more than 110% of the rated load, unless otherwise recommended by the manufacturer or qualified person, but in no event shall the test load be less than the maximum anticipated load.

(ii) The test shall consist of:

(A) Hoisting the test load a few inches and holding to verify that the load is supported by the derrick and held by the hoist brake(s).

(B) Swinging the derrick, if applicable, the full range of its swing, at the maximum allowable working radius for the test load.

(C) Booming the derrick up and down within the allowable working radius for the test load.

(D) Lowering, stopping and holding the load with the brake(s).

(iii) The derrick shall not be used unless the competent person determines that the test has been passed.

(4) *Documentation.* Tests conducted under this paragraph shall be documented. The document shall contain the date, test results and the name of the tester. The document shall be retained until the derrick is re-tested or dismantled, whichever occurs first.

(h) *Load testing repaired or modified derricks.* Derricks that have had repairs, modifications or additions affecting the derrick's capacity or safe operation shall be evaluated by a qualified person to determine if a load test is necessary. If it is, load testing shall be conducted and documented in accordance with paragraph (g).

(i) [Reserved]

(j) *Power failure procedures.* If power fails during operations, the derrick operator shall safely stop operations. This shall include:

(1) Setting all brakes or locking devices.

(2) Moving all clutch and other power controls to the off position.

(k) *Use of winch heads.*

(1) Ropes shall not be handled on a winch head without the knowledge of the operator.

(2) While a winch head is being used, the operator shall be within reach of the power unit control lever.

(l) [Reserved]

(m) *Securing the boom.*

(1) When the boom is being held in a fixed position, dogs, pawls, or other positive holding mechanisms on the boom hoist shall be engaged.

(2) When taken out of service for 30 days or more, the boom shall be secured by one of the following methods:

(i) Laid down.

(ii) Secured to a stationary member, as nearly under the head as possible, by attachment of a sling to the load block.

(iii) For guy derricks, lifted to a vertical position and secured to the mast.

(iv) For stiffleg derricks, secured against the stiffleg.

(n) The process of jumping the derrick shall be supervised by the A/D supervisor.

(o) Derrick operations shall be supervised by a competent person.

(p) *Inspections.* In addition to the requirements in Section 1412, the following additional items shall be included in the inspections:

(1) *Daily:* Guys for proper tension.

(2) *Annual.*

(i) Gudgeon pin for cracks, wear, and distortion.

(ii) Foundation supports for continued ability to sustain the imposed loads.

(q) Section 1427 (Operator qualification and certification) does not apply.

1437 Floating cranes/derricks and land cranes/derricks on barges

(a) This section contains supplemental requirements for floating cranes/derricks and land cranes/derricks on barges, pontoons, vessels or other means of flotation; all Sections of this Subpart apply to floating cranes/derricks and land cranes/derricks on barges, pontoons, vessels or other means of flotation, unless specified otherwise. The requirements of this Section do not apply to jacked barges when the jacks are deployed to the river/lake/sea bed and the barge is fully supported by the jacks.

(b) *General requirements.* The requirements in paragraphs (d) – (j) apply to both floating cranes/derricks and land cranes/derricks on barges, pontoons, vessels or other means of flotation.

(c) *Work area control.*

(1) The requirements of Section 1424 (Work area control) applies, except for paragraph 1424(a)(2)(ii).

(2) The employer shall either:

(i) Erect and maintain control lines, warning lines, railings or similar barriers to mark the boundaries of the hazard areas, or

(ii) The hazard areas shall be clearly marked by a combination of warning signs (such as “Danger – Swing/Crush Zone” or “Danger – This Thing’s Gonna Swing and Crunch You – Zone”) and high visibility markings on the equipment that identify the hazard areas. In addition, the employer shall train the employees to understand what these markings signify.

(d) *Keeping clear of the load.* Section 1425 does not apply.

(e) *Additional Safety devices.* In addition to the safety devices listed in Section 1415, the following safety devices are required:

(1) Pontoon or barge/vessel list and trim device. This shall be located in the cab or, where there is no cab, at the operator’s station.

(2) Horn.

(3) Positive crane house lock.

(4) *Wind speed and direction indicator.* A competent person shall determine if wind is a factor that needs to be considered; if it needs to be considered, a wind speed and direction indicator shall be used.

(f) *Operational aids.*

(1) An anti two-block device is required only when hoisting personnel or hoisting over an occupied coffer dam or shaft.

(2) Paragraph 1416 (e)(4) (load weighing and similar devices) does not apply to dragline, clamshell (grapple), magnet, drop ball, container handling, concrete bucket, and pile driving work.

(g) *Accessibility of procedures applicable to equipment operation.* If the crane/derrick has a cab, the requirements of paragraph 1417 (c) apply. If the crane/derrick does not have a cab:

(1) Rated capacities (load charts) shall be posted at the operator's station. If the operator's station is moveable (such as with pendant-controlled equipment), the load charts shall be posted on the equipment.

(2) Procedures applicable to the operation of the equipment (other than load charts), recommended operating speeds, special hazard warnings, instructions and operators manual, shall be readily available on board.

(h) *Inspections.* In addition to meeting the requirements of Section 1412 for inspecting the crane/derrick, the employer shall ensure that the barge, pontoons, vessel or other means of flotation used to support a land crane/derrick is inspected as follows:

(1) *Shift.* The means used to secure/attach the equipment to the vessel/flotation device shall be inspected for proper condition, including wear, corrosion, loose or missing fasteners, defective welds, and (where applicable) insufficient tension.

(2) *Monthly.* The vessel/means of flotation used shall be inspected for the following:

(i) The means used to secure/attach the equipment to the vessel/flotation device shall be inspected for proper condition, including wear, corrosion and (where applicable) insufficient tension.

(ii) **Taking on water.**

(iii) Deckload for proper securing.

(iv) Chain lockers, storage, fuel compartments and battening of hatches for serviceability as a water-tight appliance.

(v) Firefighting and lifesaving equipment in place and functional.

(3) The daily and monthly inspections shall be conducted by a competent person. If any deficiency is identified, an immediate determination shall be made by a qualified person as to whether the deficiency constitutes a hazard. If the deficiency is determined to constitute a hazard, the vessel/flotation device shall be removed from service until it has been corrected.

(4) *Annual: external vessel/flotation device inspection.*

(i) The external portion of the barge, pontoons, vessel or other means of flotation used shall be inspected annually by a qualified person who has expertise with respect to vessels/flotation devices. The inspection shall include the following items:

- (A) The items identified in paragraphs (h)(1)(*Shift*) and (h)(2)(*Monthly*).
 - (B) Cleats, bitts, chocks, fenders, capstans, ladders, and stanchions, for significant: corrosion, wear, deterioration, and deformation.
 - (C) External evidence of leaks and structural damage.
 - (D) Four-corner draft readings.
 - (E) Firefighting equipment for serviceability.
- (ii) Rescue skiffs, lifelines, work vests, life preservers and ring buoys shall be inspected for proper condition.
- (iii) If any deficiency is identified, an immediate determination shall be made by the qualified person as to whether the deficiency constitutes a hazard or, though not yet a hazard, needs to be monitored in the monthly inspections. If the deficiency is determined to constitute a hazard, the vessel/flotation device shall be removed from service until it has been corrected.
- (iv) If the qualified person determines that, though not presently a hazard, the deficiency needs to be monitored, the employer shall ensure that the deficiency is checked in the monthly inspections.

(5) *Quadrennial: internal vessel/flotation device inspection.*

- (i) The internal portion of the barge, pontoons, vessel or other means of flotation used shall be surveyed once every 4 years by a **marine engineer, marine architect, licensed surveyor, or other qualified person who has expertise with respect to vessels/flotation devices.**
- (ii) If any deficiency is identified, an immediate determination shall be made by the surveyor as to whether the deficiency constitutes a hazard or, though not yet a hazard, needs to be monitored in the monthly or annual inspections, as appropriate.
- (iii) If the deficiency is determined to constitute a hazard, the vessel/flotation device shall be removed from service until it has been corrected.
- (iv) If the surveyor determines that, though not presently a hazard, the deficiency needs to be monitored, the employer shall ensure that the deficiency is checked in the monthly or annual inspections, as appropriate.

(6) *Documentation.* The monthly and annual inspections required in paragraphs (h)(2) and (h)(4) shall be documented in accordance with paragraph 1412 (e)(3) and (f)(7), respectively. The quadrennial inspection required in paragraph (h)(5) shall be documented in accordance with paragraph 1412(f)(7), except that the documentation for that inspection shall be retained for a minimum of 4 years.

(i) [Reserved]

(j) *Working with a diver.* The following additional requirements apply when working with a diver in the water:

(1) If a crane/derrick is used to get a diver into and out of the water, it shall not be used for any other purpose until the diver is back on board. When used for more than one diver, it shall not be used for any other purpose until all divers are back on board.

(2) The operator shall remain at the controls of the crane/derrick at all times.

(3) In addition to the requirements in Sections 1419-1422 (Signals), either:

(i) A clear line of sight shall be maintained between the operator and tender, or

(ii) The signals between the operator and tender shall be transmitted electronically.

(4) The means used to secure the crane/derrick to the barge/pontoons/vessel (see paragraph (n)(5)) shall not allow any amount of shifting in any direction.

(k) The barge, pontoons, vessel or other means of flotation shall be capable of withstanding imposed environmental, operational and in-transit loads under conditions specified by its manufacturer.

(l) [Reserved].

(m) *Floating cranes/derricks.* For equipment designed by the manufacturer (or employer) for marine use by permanent attachment to barges, pontoons, vessels or other means of flotation:

(1) *Load charts.*

(i) The manufacturer load charts applicable to operations on water shall not be exceeded. When using these charts, the employer shall comply with all parameters and limitations (such as dynamic/environmental parameters) applicable to the use of the charts.

(ii) The load charts shall take into consideration a minimum wind speed of 40 miles per hour.

(2) The requirements for maximum allowable list and maximum allowable trim as specified in Table M1 shall be met.

TABLE M1		
<i>Equipment designed for marine use by permanent attachment (other than derricks):</i>		
Rated Capacity	Maximum Allowable List	Maximum Allowable Trim
25 tons or less	5 degrees	5 degrees
Over 25 tons	7 degrees	7 degrees
<i>Derricks designed for marine use by permanent attachment:</i>		
Any rated capacity	10 degrees	10 degrees

(3) The equipment shall be stable under the conditions specified in Tables M2 and M3.

TABLE M2		
Operated at	Wind speed	Minimum freeboard
Rated capacity	60 mph	2 ft
Rated capacity plus 25%	60 mph	1 ft
High boom, no load	60 mph	2 ft

TABLE M3	
<i>For backward stability of the boom:</i>	
Operated at	Wind speed
High boom, no load, full back list (least stable condition)	90 mph

(4) If the equipment is employer-made, it shall not be used unless the employer has documents demonstrating that the load charts and applicable parameters for use meet the requirements of paragraphs (m)(1), (2) and (3). Such documents shall be signed by a registered professional engineer who is a qualified person with respect to the design of this type of equipment (including the means of flotation).

(5) The barge, pontoons, vessel or other means of flotation used shall:

(i) Be structurally sufficient to withstand the static and dynamic loads of the crane/derrick when operating at the crane/derrick's maximum rated capacity with all anticipated deck loads and ballasted compartments.

(ii) Have a subdivided hull with one or more longitudinal watertight bulkheads for reducing the free surface effect.

(iii) Have access to void compartments to allow for inspection and pumping.

(n) *Land cranes/derricks.* For land cranes/derricks used on barges, pontoons, vessels or other means of flotation:

(1) The rated capacity of the equipment (load charts) applicable for use on land shall be reduced to:

(i) Account for increased loading from list, trim, wave action, and wind.

(ii) Be applicable to a specified location(s) on the specific barge, pontoons, vessel or other means of flotation that will be used, under the expected environmental conditions.

(iii) Ensure that the conditions required in paragraphs (n)(3) and (n)(4) are met.

(2) The rated capacity modification required in paragraph (n)(1)(i) shall be done by the equipment manufacturer, or a qualified person who has expertise with respect to both land crane/derrick capacity and the stability of vessels/flotation devices.

(3) *List and trim.*

(i) The maximum allowable list and the maximum allowable trim for the barge/pontoons/vessel/other means of flotation shall not exceed the amount necessary to ensure that the conditions in paragraph (n)(4) are met. In addition, the maximum allowable list and the maximum allowable trim shall not exceed the least of the following: 5 degrees, the amount specified by the crane/derrick manufacturer, or where an amount is not so specified, the amount specified by the qualified person.

(ii) The maximum allowable list and the maximum allowable trim for the land crane/derrick shall not exceed the amount specified by the crane/derrick manufacturer, or where an amount is not so specified, the amount specified by the qualified person.

(4) The following conditions shall be met:

- (i) All deck surfaces of the barge, pontoons, vessel or other means of flotation used shall be above water.
- (ii) The entire bottom area of the barge, pontoons, vessel or other means of flotation used shall be submerged.

(5) *Physical attachment, corralling, rails system and centerline cable system.* The employer shall meet the requirements in Option (1), Option (2), Option (3), or Option (4). Whichever option is used, the requirements of paragraph (v) must also be met.

(i) *Option (1) – Physical attachment.* The crane/derrick shall be physically attached to the barge, pontoons, vessel or other means of flotation. Methods of physical attachment include crossed-cable systems attached to the crane/derrick and vessel/means of flotation (this type of system allows the crane/derrick to lift up slightly from the surface of the vessel/means of flotation), bolting or welding the crane/derrick to the vessel/means of flotation, strapping the crane/derrick to the vessel/means of flotation with chains, or other methods of physical attachment.

(ii) *Option (2) – Corralling.* The crane/derrick shall be prevented from shifting by installing barricade restraints (a corralling system). Corralling systems shall not allow any amount of shifting in any direction by the crane.

(iii) *Option (3) – Rails.* The crane/derrick shall be prevented from shifting by being mounted on a rail system. Rail clamps and rail stops are required unless the system is designed to prevent movement during operation by other means.

(iv) *Option (4) – Centerline cable system.* The crane/derrick shall be prevented from shifting by being mounted to a wire rope system. The wire rope system shall meet the following requirements:

(A) The wire rope and attachments shall be of sufficient size/strength to support the side load of crane/derrick.

(B) The wire rope shall be physically attached to the barge/pontoons/vessel.

(C) The wire rope shall be attached to the crane/derrick by appropriate attachment methods (such as shackles or sheaves) on the undercarriage which will allow the crew to secure the crane/derrick from movement during operation and to move the crane/derrick longitudinally along the vessel for repositioning.

(D) Means shall be installed to prevent the crane/derrick from passing the forward or aft end of the wire rope attachments.

(E) The crane/derrick shall be secured from movement during operation.

(v) The systems/means used to comply with Option (1), Option (2), Option (3), or Option (4) shall be designed by a marine engineer, registered professional engineer familiar with floating crane/derrick design, or qualified person familiar with floating crane/derrick design.

(vi) *Exception.* For mobile auxiliary cranes used on the deck of a floating crane/derrick, the requirement to use Option (1), Option (2), Option (3), or Option (4) does not apply where the employer demonstrates that the following requirements have been met:

(A) A marine engineer or registered professional engineer familiar with floating crane/derrick design develops and signs a written plan for the use of the mobile auxiliary crane.

(B) The plan shall be designed so that the applicable requirements of this Section will be met despite the position, travel, operation, and lack of physical attachment (or corraling, use of rails or cable system) of the mobile auxiliary crane.

(C) The plan shall specify the areas of the deck where the mobile auxiliary crane is permitted to be positioned, travel, and operate and the parameters/ limitations of such movements and operation.

(D) The deck shall be marked to identify the permitted areas for positioning, travel, and operation.

(E) The plan shall specify the dynamic/environmental conditions that must be present for use of the plan.

(F) If the dynamic/environmental conditions in paragraph (E) are exceeded, the mobile auxiliary crane shall be physically attached or corralled in accordance with Option (1), Option (2) or Option (4).

(6) The barge, pontoons, vessel or other means of flotation used shall:

(i) Be structurally sufficient to withstand the static and dynamic loads of the crane/derrick when operating at the crane/derrick's maximum rated capacity with all anticipated deck loads and ballasted compartments.

(ii) Have a subdivided hull with one or more longitudinal watertight bulkheads for reducing the free surface effect.

(iii) Have access to void compartments to allow for inspection and pumping.

1438 Overhead & Gantry Cranes

(a) *Permanently installed overhead and gantry cranes.*

(1) This paragraph applies to the following equipment when used in construction and permanently installed in a facility: overhead and gantry cranes, including semigantry, cantilever gantry, wall cranes, storage bridge cranes, and others having the same fundamental characteristics.

(2) The requirements of 29 CFR 1910.179, except for 1910.179 (b)(1), apply to the equipment identified in paragraph (a)(1).

(b) *Overhead and gantry cranes that are not permanently installed in a facility.*

(1) This paragraph applies to the following equipment when used in construction and not permanently installed in a facility: overhead and gantry cranes, overhead/bridge cranes, semigantry, cantilever gantry, wall cranes, storage bridge cranes, launching gantry cranes, and similar equipment, irrespective of whether it travels on tracks, wheels, or other means.

(2) The following requirements apply to equipment identified in paragraph (b)(1):

(i) Sections 1400-1414; 1417-1425; 1426(d), 1427-1434; 1437,1439, 1441 of this standard.

(ii) The following portions of 29 CFR 1910.179:

(A) Paragraphs (b)(5),(6),(7); (e)(1),(3),(5),(6); (f)(1),(4); (g); (h)(1),(3); (k); and (n).

(B) Definitions in 1910.179(a) that do not differ from those in Section 1401 of this Subpart.

(C) 1910.179 (b)(2) applies only to equipment identified in paragraph (1) manufactured before September 19, 2001.

(iii) For equipment manufactured on or after September 19, 2001, the following sections of ASME B.30.2 (2001) apply: 2-1.3.1; 2-1.3.2; 2-1.4.1; 2-1.6; 2-1.7.2; 2-1.8.2; 2-1.9.1; 2-1.9.2; 2-1.11; 2-1.12.2; 2-1.13.7; 2-1.14.2; 2-1.14.3; 2-1.14.5; 2-1.15.; 2-2.2.2; 2-3.2.1.1. In addition, 2-3.5 applies, except in 2-3.5.1(b), “29 CFR 1910.147” is substituted for “ANSI Z244.1”.

1439 Dedicated pile drivers.

- (a) The provisions of this standard apply to dedicated pile drivers, except as specified in this Section.
- (b) Paragraph 1416 (d)(3) (anti two-block device) does not apply. (NOTE: under paragraph 1431(d)(4)(iv), an anti two-block device is required when hoisting personnel).
- (c) Paragraph 1416 (e)(4) (Load weight/capacity devices) applies only to dedicated pile drivers manufactured after January 1, 2008.
- (d) In Section 1433, only paragraphs (e) and (f) apply to dedicated pile drivers.
- (e) Section 1427 (Operator qualification and certification) applies, except that the qualification or certification shall be for operation of either dedicated pile drivers or equipment that is the most similar to dedicated pile drivers.

1440 Sideboom Cranes

- (a) The provisions of this standard apply, except Sections 1402 (Ground Conditions), 1415 (Safety Devices), 1416 (Operational Aids), and 1427 (Operator Qualification and Certification).
- (b) Section 1426 (Free Fall and Controlled Load Lowering) applies, except paragraph 1426(a)(2)(i). Sideboom cranes in which the boom is designed to free fall (live boom) are permitted only if manufactured prior to [effective date of this standard].
- (c) Sideboom cranes mounted on wheel or crawler tractors shall meet the following requirements of ASME B30.14-1996 with addenda ASME B30.14a-1997, 14b-1999, and 14c-2001 (Side Boom Tractors):
 - (i) Section 14-1.1 (“Load Ratings”).
 - (ii) Section 14-1.3 (“Side Boom Tractor Travel”).
 - (iii) Section 14-1.5 (“Ropes and Reeving Accessories”).
 - (iv) Section 14-1.7.1 (“Booms”).
 - (v) Section 14-1.7.2 (“General Requirements – Exhaust Gases”).
 - (vi) Section 14-1.7.3 (“General Requirements – Stabilizers (Wheel-Type Side Boom Tractors”).

- (vii) Section 14-1.7.4 (“General Requirements – Welded Construction”).
- (viii) Section 14-1.7.6 (“General Requirements – Clutch and Brake Protection”).
- (ix) Section 14-2.2.2 (“Testing – Rated Load Test”), except that it applies only to equipment that has been modified or repaired.
- (x) In section 14-3.1.2 (“Operator Qualifications”), paragraph (a), except the phrase “When required by law.”
- (xi) In section 14-3.1.3 (“Operating Practices”), paragraphs (e), (f)(1) – (4), (6), (7); (h), and (i).
- (xii) In section 14-3.2.3 (“Moving the Load”), paragraphs (j), (l), and (m).

1441 Requirements for equipment with a manufacturer-rated hoisting/lifting capacity of 2000 pounds or less.

For equipment with a maximum manufacturer-rated hoisting/lifting capacity of 2000 pounds or less:

(a) The following sections of this Subpart apply: 1400 (Scope); 1401 (Definitions); 1402 (Ground conditions); 1407 – 1411 (Power line safety); 1413 – 1414 (Wire Rope); 1418 (Authority to Stop Operation); 1419 – 1422 (Signals); 1423 (Fall Protection); 1426 (Free Fall/Controlled Load Lowering); 1432 (Multiple Crane Lifts); 1434 (Equipment Modifications); 1435 (Tower Cranes); 1436 (Derricks); 1437 (Floating Cranes & Land Cranes on Barges); 1438 (Overhead & Gantry Cranes).

(b) *Assembly/disassembly.*

(1) Sections 1403 (Assembly/ Disassembly – Selection of Manufacturer or Employer Procedures) and 1406 (Assembly/ Disassembly – Employer Procedures) apply.

(2) *Components and Configuration.*

(i) The selection of components and configuration of the equipment that affect the capacity or safe operation of the equipment must be in accordance with:

(A) 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

(B) Approved modifications that meet the requirements of section 1434 (Equipment Modifications).

(ii) *Post-assembly inspection.* Upon completion of assembly, the equipment must be inspected to ensure compliance with paragraph (b)(2)(i) (see paragraph 1412(c) for post-assembly inspection requirements).

(3) *Manufacturer prohibitions.* The employer must comply with applicable manufacturer prohibitions.

(c) *Operation – Procedures*

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

(2) *Unavailable operation procedures.*

(i) 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.

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

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

(3) *Accessibility.*

(i) The load capacity chart shall be available to the operator at the control station.

(ii) Procedures applicable to the operation of the equipment, recommended operating speeds, special hazard warnings, instructions and operators manual, shall be readily available for use by the operator.

(iii) Where load capacities are available at the control station 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.

(d) *Safety devices and operational aids.*

(1) Originally-equipped safety devices and operational aids shall be maintained in accordance with manufacturer procedures.

- (2) *Anti-two blocking.* Equipment covered by this Section **manufactured after January 1, 2008**, shall have either an anti-two block device that meets the requirements of paragraph 1416 (d)(3), or shall be designed so that, in the event of a two-block situation, no damage will occur and there will be no load failure (such as where the power unit will stall in the event of a two-block).
- (e) *Operator qualifications.* The employer shall ensure that, prior to operating the equipment, the operator is trained on the safe operation of the type of equipment the operator will be using.
- (f) *Signal person qualifications.* The employer shall ensure that signal persons are trained in the proper use of signals applicable to the use of the equipment.
- (g) *Keeping clear of the load.* Section 1425 applies, except for paragraph 1425(c)(3) [qualified rigger].
- (h) *Inspections.* The equipment shall be inspected in accordance with manufacturer procedures.
- (i) [Reserved]
- (j) *Hoisting personnel.* Hoisting personnel using equipment covered by this section is prohibited.
- (k) *Design.* The equipment shall be designed by a qualified engineer.

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.

APPENDIX B – CHECKLIST FOR DETERMINING IF HOISTING PERSONNEL IS PERMISSIBLE

APPENDIX C – ASSEMBLY/DISASSEMBLY – SAMPLE PROCEDURES FOR MINIMIZING THE RISK OF UNINTENDED DANGEROUS BOOM MOVEMENT.

APPENDIX Q – OPERATOR CERTIFICATION – WRITTEN EXAMINATION – TECHNICAL KNOWLEDGE CRITERIA

This appendix contains information for employers, accredited testing organizations, auditors and government entities developing criteria for a written examination to test an individual's technical knowledge relating to the operation of cranes.

(a) General technical information.

(1) The functions and limitations of the crane and attachments.

(2) Wire rope:

- (i) Background information necessary to understand the inspection and removal from service criteria in Sections 1413 and 1414.
- (ii) Capacity and when multi-part rope is needed.
- (iii) Relationship between line pull and safe working load.
- (iv) How to determine the manufacturer's recommended rope for the crane.

(3) Rigging devices and their use, such as:

- (i) Slings.
- (ii) Spreaders.
- (iii) Lifting beams.
- (iv) Wire rope fittings, such as clips, shackles and wedge sockets.
- (v) Saddles (softeners).
- (vi) Clamps (beams).

- (4) The technical limitations of protective measures against electrical hazards:
 - (i) Grounding.
 - (ii) Proximity warning devices.
 - (iii) Insulated links.
 - (iv) Boom cages.
 - (v) Proximity to electric power lines, radii, and microwave structures.
- (5) The effects of load share and load transfer in multi-crane lifts.
- (6) Basic crane terms.
- (7) The basics of machine power flow systems.
 - (i) Mechanical.
 - (ii) Electrical.
 - (iii) Pneumatic.
 - (iv) Hydraulic.
 - (v) Combination.
- (8) The significance of the instruments and gauge readings.
- (9) The effects of thermal expansion and contraction in hydraulic cylinders.
- (10) Background information necessary to understand the requirements of pre-operation and inspection.
- (11) How to use the safety devices and operational aids required under Sections 1415 and 1416.
- (12) The difference between duty-cycle and lifting operations.
- (13) How to calculate net capacity for every possible configuration of the equipment using the manufacturer's load chart.
- (14) How to use manufacturer-approved attachments and their effect on the equipment.
- (15) How to obtain dimensions, weight, and center of gravity of the load.
- (16) The effects of dynamic loading from:
 - (i) Wind.
 - (ii) Stopping and starting.
 - (iii) Impact loading.

(iv) Moving with the load.

(17) The effect of side loading.

(18) The principles of backward stability.

(b) Site information.

(1) How to identify the suitability of the supporting ground/surface to support the expected loads of the operation. Elements include:

(i) Weaknesses below the surface (such as voids, tanks, loose fill).

(ii) Weaknesses on the surface (such as retaining walls, slopes, excavations, depressions).

(2) Proper use of mats, blocking/cribbing and outriggers or crawlers.

(3) Identification of site hazards such as power lines, piping, and traffic.

(4) How to review operation plans with supervisors and other workers (such as the signal person), including how to determine working height, boom length, load radius, and travel clearance.

(5) How to determine if there is adequate room for extension of crawlers or outriggers/stabilizers and counterweights.

(c) Operations.

(1) How to pick, carry, swing and place the load smoothly and safely on rubber tires and on outriggers/stabilizers or crawlers (where applicable).

(2) How to communicate at the site with supervisors, the crew and the signal person.

(3) Proper procedures and methods of reeving wire ropes and methods of reeving multiple-part lines and selecting the proper load block and/or ball.

(4) How to react to changes in conditions that affect the safe operation of the equipment.

(5) How to shut down and secure the equipment properly when leaving it unattended.

(6) Know how to apply the manufacturer's specifications for operating in various weather conditions, and understand how environmental conditions affect the safe operation of the equipment.

- (7) How to properly level the equipment.
- (8) How to verify the weight of the load and rigging prior to initiating the lift.
- (9) How to determine where the load is to be picked up and placed and how to verify the radii.
- (10) Know basic rigging procedures.
- (11) How to carry out the shift inspection required in this Subpart.
- (12) Know that the following operations require specific procedures and skill levels:
 - (i) Multi-crane lifts.
 - (ii) Hoisting personnel.
 - (iii) Clamshell/dragline operations.
 - (iv) Pile driving and extracting.
 - (v) Concrete operations, including poured-in-place and tilt-up.
 - (vi) Demolition operations.
 - (vii) Operations on water.
 - (viii) Magnet operations.
 - (ix) Multi-drum operations.
- (13) Know the proper procedures for operating safely under the following conditions:
 - (i) Traveling with suspended loads.
 - (ii) Approaching a two-block condition.
 - (iii) Operating near power lines.
 - (iv) Hoisting personnel.
 - (v) Using other than full outrigger/crawler extensions.
 - (vi) Lifting loads from beneath the surface of the water.
 - (vii) Using various approved counterweight configurations.

- (viii) Handling loads out of the operator's vision ("operating in the blind").
- (ix) Using electronic communication systems for signal communication.
- (14) Know the proper procedures for load control and the use of hand-held tag lines.
- (15) Know the emergency response procedure for:
 - (i) Fires.
 - (ii) Power line contact.
 - (iii) Loss of stability.
 - (iv) Control malfunction.
 - (v) Two-blocking.
 - (vi) Overload.
 - (vii) Carrier or travel malfunction.
- (16) Know how to properly use outriggers in accordance with manufacturer specifications.
- (d) Use of load charts.
 - (1) Know the terminology necessary to use load charts.
 - (2) Know how to ensure that the load chart is the appropriate chart for the equipment in its particular configuration and application.
 - (3) Know how to use load charts. This includes knowing:
 - (i) The operational limitations of load charts and footnotes.
 - (ii) How to relate the chart to the configuration of the crane, crawlers, or outriggers extended or retracted, jib erected or offset, and various counterweight configurations.
 - (iii) The difference between structural capacity and capacity limited by stability.
 - (iv) What is included in load chart capacity.
 - (v) The range diagram and its relationship to the load chart.

- (vi) The work area chart and its relationship to the load chart.
 - (vii) Where to find and how to use the “parts-of-line” information.
- (4) Know how to use the load chart together with the load indicators and/or load moment devices.

C-DAC Consensus