Editorial Notes:

1. At 44 FR 8577, Feb. 9, 1979, and corrected at 44 FR 20940, Apr. 6, 1979, OSHA reprinted without change the entire text of 29 CFR part 1926 together with certain General Industry Occupational Safety and Health Standards contained in 29 CFR part 1910, which have been identified as also applicable to construction work. This republication developed a single set of OSHA regulations for both labor and management forces within the construction industry.

2. Nomenclature changes to part 1926 appear at 84 FR 21597, May 14, 2019.

§ 1926.1433 Design, construction and testing.

The following requirements apply to equipment that has a manufacturer-rated hoisting/lifting capacity of more than 2,000 pounds.

(a) Crawler, truck and locomotive cranes manufactured prior to November 8, 2010 must meet the applicable requirements for design, construction, and testing as prescribed in ANSI B30.5-1968 (incorporated by reference, *see* § 1926.6), PCSA Std. No. 2 (1968) (incorporated by reference, *see* § 1926.6), the requirements in paragraph (b) of this section, 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 November 8, 2010 must meet the following portions of ASME B30.5-2004 (incorporated by reference, *see* § 1926.6) 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, § 1926.1414(c)(4)(ii)(A) applies.

(5) In section 5-1.3.2 (“Load Hoist Mechanism”), paragraphs (a)(2) through (a)(4) (including subparagraphs), (b) (including subparagraphs), (c) (first sentence only) and (d).

(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 5-1.9.11 (“Miscellaneous equipment”), paragraphs (a), (c), (e), and (f).

(c) Prototype testing: mobile (including crawler and truck) and locomotive cranes manufactured on or after November 8, 2010 must meet the prototype testing requirements in Test Option A or Test Option B of this section. Tower cranes manufactured on or after November 8, 2010 must meet the prototype testing requirements in BS EN 14439:2006 (incorporated by reference, *see* § 1926.6).

Note:

Prototype testing of crawler, locomotive and truck cranes manufactured prior to November 8, 2010 must conform to paragraph (a) of this section.

(1) *Test Option A.*

(i) The following applies to equipment with cantilevered booms (such as hydraulic boom cranes): All the tests listed in SAE J1063 (Nov. 1993) Table 1 (incorporated by reference, *see* § 1926.6) must be performed to load all critical structural elements to their respective limits. All the strength margins listed in SAE J1063 (Nov. 1993) Table 2 (incorporated by reference, *see* § 1926.6) must be met.

(ii) The following applies to equipment with pendant supported lattice booms: All the tests listed in SAE J987 (Jun. 2003) Table 1 (incorporated by reference, *see* § 1926.6) must be performed to load all critical structural elements to their respective limits. All the strength margins listed in SAE J987 (Jun. 2003) Table 2 (incorporated by reference, *see* § 1926.6) must be met.

(2) *Test Option B.* The testing and verification requirements of BS EN 13000:2004 (incorporated by reference, *see* § 1926.6) must be met. In applying BS EN 13000:2004, the following additional requirements must 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 (Nov. 1993) (incorporated by reference, *see* § 1926.6) meet the strength margins listed in SAE J1063 (Nov. 1993) 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 (Jun. 2003) (incorporated by reference, *see* § 1926.6) meet the strength margins listed in SAE J987 (Jun. 2003) Table 2.

(iii) *Analysis verification.* The physical testing requirements under SAE J1063 (Nov. 1993) (incorporated by reference, *see* § 1926.6) and SAE J987 (Jun. 2003) (incorporated by reference, *see* § 1926.6) 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.

(d) All equipment covered by this subpart must meet the following requirements:

(1) *Rated capacity and related information.* The information available in the cab (*see* § 1926.1417(c)) regarding “rated capacity” and related information must include, at a minimum, the following information:

(i) A complete range of the manufacturer's equipment rated capacities, 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 rated capacities, such as outriggers, stabilizers, and extra counterweights.

(ii) A work area chart for which capacities are listed in the load chart. (NOTE: An example of this type of chart is in ASME B30.5-2004, section 5-1.1.3, Figure 11).

(iii) The work area figure and load chart must clearly indicate the areas where no load is to be handled.

(iv) Recommended reeving for the hoist lines must 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.

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

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

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

(2) Load hooks (including latched and unlatched types), ball assemblies and load blocks must 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 must be marked with their rated capacity and weight.

(4) *Latching hooks.*

(i) Hooks must be equipped with latches, except where the requirements of paragraph (d)(4)(ii) of this section are met.

(ii) Hooks without latches, or with latches removed or disabled, must 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 must 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 must be maintained in legible condition.

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

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

(i) Cabs must 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) must be designed to prevent inadvertent opening or closing while traveling or operating the machine. Swinging doors adjacent to the operator must open outward. Sliding operator doors must open rearward.

(iii) *Windows.*

(A) The cab must have windows in front and on both sides of the operator. Forward vertical visibility must 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 must be designed so that they can be secured to prevent inadvertent closure.

(C) Windows must 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 must 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 must 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 must be guarded where contact by employees (except for maintenance and repair employees) is possible in the performance of normal duties.

(9) All exhaust pipes, turbochargers, and charge air coolers must be insulated or guarded where contact by employees (except for maintenance and repair employees) is possible in the performance of normal duties.

(10) Hydraulic and pneumatic lines must be protected from damage to the extent feasible.

(11) The equipment must 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 must 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 must have an integrally mounted holding device or internal static brake to prevent load hoist movement in the event of hydraulic failure.

(e) The employer's obligations under paragraphs (a) through (c) and (d)(7) through (13) of this section are met where the equipment has not changed (except in accordance with § 1926.1434 (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.

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Editorial Notes:

1. At 44 FR 8577, Feb. 9, 1979, and corrected at 44 FR 20940, Apr. 6, 1979, OSHA reprinted without change the entire text of 29 CFR part 1926 together with certain General Industry Occupational Safety and Health Standards contained in 29 CFR part 1910, which have been identified as also applicable to construction work. This republication developed a single set of OSHA regulations for both labor and management forces within the construction industry.

2. Nomenclature changes to part 1926 appear at 84 FR 21597, May 14, 2019.

§ 1926.1434 Equipment modifications.

(a) Modifications or additions which affect the capacity or safe operation of the equipment are prohibited except where the requirements of paragraphs (a)(1), (a)(2), (a)(3), (a)(4), or (a)(5) of this section are met.

(1) *Manufacturer review and approval.*

(i) The manufacturer approves the modifications/additions in writing.

(ii) The load charts, procedures, instruction manuals and instruction plates/tags/decals are modified as necessary to accord with the modification/addition.

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

(2) *Manufacturer refusal to review request.* The manufacturer is provided a detailed description of the proposed modification/addition, 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 paragraphs (a)(2)(i) and (ii) of this section are met.

(4) *Manufacturer does not complete the review within 120 days of the request.* The manufacturer is provided a detailed description of the proposed modification/addition, is asked to approve the modification/addition, agrees to review the technical merits of the proposal, but fails to complete the review of the proposal within 120 days of the date it was provided the detailed description of the proposed modification/addition, and the requirements of paragraphs (a)(2)(i) and (ii) of this section are met.

(5) *Multiple manufacturers of equipment designed for use on marine work sites.* The equipment is designed for marine work sites, contains major structural components from more than one manufacturer, and the requirements of paragraphs (a)(2)(i) and (ii) of this section 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. If the manufacturer rejects the proposal but does not explain the reasons for the rejection in writing, the employer may treat this as a manufacturer refusal to review the request under paragraph (a)(2) of this section.

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

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Editorial Notes:

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2. Nomenclature changes to part 1926 appear at 84 FR 21597, May 14, 2019.

§ 1926.1435 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) Section 1926.1403 (Assembly/Disassembly—selection of manufacturer or employer procedures), § 1926.1404 (Assembly/Disassembly—general requirements (applies to all assembly and disassembly operations)), § 1926.1405 (Disassembly—additional requirements for dismantling of booms and jibs (applies to both the use of manufacturer procedures and employer procedures)), and § 1926.1406 (Assembly/Disassembly—employer procedures—general requirements), 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 § 1926.1404(e), for self-erecting tower cranes, the following applies: Employees must not be in or under the tower, jib, or rotating portion of the crane during erecting, climbing and dismantling operations until the crane is secured in a locked position and the competent person in charge indicates it

is safe to enter this area, unless the manufacturer's instructions direct otherwise and only the necessary personnel are permitted in this area.

(3) *Foundations and structural supports.* Tower crane foundations and structural supports (including both the portions of the structure used for support and the means of attachment) must be designed by the manufacturer or a registered professional engineer.

(4) *Addressing specific hazards.* The requirements in § 1926.1404(h)(1) through (9) apply. In addition, the A/D director must address the following:

(i) *Foundations and structural supports.* The A/D director must determine that tower crane foundations and structural supports are installed in accordance with their design.

(ii) *Loss of backward stability.* Backward stability 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.

(5) *Plumb tolerance.* Towers must 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 must 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 must be located such that no crane can 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 must:

(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.

(8) *Counterweight/ballast.*

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

(ii) The maximum counterweight and/or ballast specified by the manufacturer or registered professional engineer familiar with the equipment must not be exceeded.

(c) *Signs.* The size and location of signs installed on tower cranes must be in accordance with manufacturer specifications. Where these are unavailable, a registered professional engineer familiar with the type of equipment involved must approve in writing the size and location of any signs.

(d) *Safety devices.*

(1) Section 1926.1415 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 must 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.

(x) Trolley end stops must be provided at both ends of travel of the trolley.

(3) *Proper operation required.* Operations must not begin unless the devices listed in this section are in proper working order. If a device stops working properly during operations, the operator must safely stop operations. The equipment must be taken out of service, and operations must not resume until the device is again working properly. *See* § 1926.1417(f). Alternative measures are not permitted to be used.

(e) *Operational aids.*

(1) Section 1926.1416 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 must 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, must be followed. *See* § 1926.1417(j) for additional requirements.

(4) If an operational aid stops working properly during operations, the operator must safely stop operations until the temporary alternative measures are implemented or the device is again working properly. If a replacement part is no longer available, the use of a substitute device that performs the same type of function is permitted and is not considered a modification under § 1926.1434.

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

(i) *Trolley travel limiting device.* The travel of the trolley must 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 must 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 who is in direct communication with the operator must 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 must 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 who is in direct communication with the operator to inform the operator when this point is reached.

(iii) *Anti two-blocking device.* The tower crane must 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 who is in direct communication with the operator to inform the operator when this point is reached.

(iv) *Hoist drum lower limiting device.* Tower cranes manufactured after November 8, 2011 must 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 who is in direct communication with the operator to inform the operator when this point is reached

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

(vi) *Hoist line pull limiting device.* The capacity of the hoist must be limited to prevent overloading, including each individual gear ratio if equipped with a multiple speed hoist transmission. *Temporary alternative measures:* The operator must 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 must be limited to prevent the travel bogies from running into the end stops or buffers. *Temporary alternative measures:* A spotter who is in direct communication with the operator must be used when operations are conducted within 10 feet of either end of the travel rail end stops; the spotter must inform the operator of the distance of the travel bogies from the end stops or buffers.

(viii) *Boom hoist drum positive locking device and control.* The boom hoist drum must be equipped with a control that will enable the operator to positively lock the boom hoist drum from the cab. *Temporary alternative measures:* The device must be manually set when required if an electric, hydraulic or automatic control is not functioning.

(6) *Category II operational aids and alternative measures.* Operational aids listed in this paragraph that are not working properly must be repaired no later

than 30 calendar days after the deficiency occurs. *Exception:* If the employer documents that it has ordered the necessary parts within 7 calendar days of the occurrence of the deficiency, and the part is not received in time to complete the repair in 30 calendar days, the repair must be completed within 7 calendar days of receipt of the parts.

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

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

(B) Hammerhead tower cranes manufactured after November 8, 2011 must have a hook radius indicator readable from the operator's station.

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

(ii) *Trolley travel deceleration device.* The trolley speed must be automatically reduced prior to the trolley reaching the end limit in both directions. *Temporary alternative measure:* The employer must post a notice in the cab of the crane notifying the operator that the trolley travel deceleration device is malfunctioning and instructing the operator to take special care to reduce the trolley speed when approaching the trolley end limits.

(iii) *Boom hoist deceleration device.* The boom speed must be automatically reduced prior to the boom reaching the minimum or maximum radius limit. *Temporary alternative measure:* The employer must post a notice in the cab of the crane notifying the operator that the boom hoist deceleration device is malfunctioning and instructing the operator to take special care to reduce the boom speed when approaching the minimum or maximum radius limits.

(iv) *Load hoist deceleration device.* The load speed must be automatically reduced prior to the hoist reaching the upper limit. *Temporary alternative measure:* The employer must post a notice in the cab of the crane notifying the operator that the load hoist deceleration device is malfunctioning and instructing the operator to take special care to reduce the load speed when approaching the upper limits.

(v) *Wind speed indicator.* A device must be provided to display the wind speed and must be mounted above the upper rotating structure on tower cranes. On self erecting cranes, it must 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 November 8, 2011 must 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 must be determined from a source recognized by the industry (such as the load's manufacturer), or by a calculation method recognized by the industry (such as calculating a steel beam from measured dimensions and a known per foot weight), or by other equally reliable means. This information must be provided to the operator prior to the lift.

(f) *Inspections.*

(1) Section 1926.1412 (Inspections) applies to tower cranes, except that the term "assembly" is replaced by "erection." Section 1926.1413 (Wire rope—inspection) applies to tower cranes.

(2) *Pre-erection inspection.* Before each crane component is erected, it must be inspected by a qualified person for damage or excessive wear.

(i) The qualified person must pay particular attention to components that will be difficult to inspect thoroughly during shift inspections.

(ii) If the qualified person determines that a component is damaged or worn to the extent that it would create a safety hazard if used on the crane, that component must not be erected on the crane unless it is repaired and, upon reinspection by the qualified person, found to no longer create a safety hazard.

(iii) If the qualified person determines that, though not presently a safety hazard, the component needs to be monitored, the employer must ensure that the component is checked in the monthly inspections. Any such determination must be documented, and the documentation must be available to any individual who conducts a monthly inspection.

(3) *Post-erection inspection.* In addition to the requirements in § 1926.1412(c), the following requirements must be met:

(i) A load test using certified weights, or scaled weights using a certified scale with a current certificate of calibration, must be conducted after each erection.

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

(4) *Monthly.* The following additional items must 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.

(5) *Annual.* In addition to the items that must be inspected under § 1926.1412(f), all turntable and tower bolts must be inspected for proper condition and torque.

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Editorial Notes:

1. At 44 FR 8577, Feb. 9, 1979, and corrected at 44 FR 20940, Apr. 6, 1979, OSHA reprinted without change the entire text of 29 CFR part 1926 together with certain General Industry Occupational Safety and Health Standards contained in 29 CFR part 1910, which have been identified as also applicable to construction work. This republication developed a single set of OSHA regulations for both labor and management forces within the construction industry.

2. Nomenclature changes to part 1926 appear at 84 FR 21597, May 14, 2019.

§ 1926.1436 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 1926.1417 (Operation) applies except for § 1926.1417(c) (Accessibility of procedures).

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

(i) Rated capacity at corresponding ranges of boom angle or operating radii.

(ii) Specific lengths of components to which the rated capacities apply.

(iii) Required parts for hoist reeving.

(iv) Size and construction of rope must 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 must 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 must be readily available at the job site to personnel responsible for the operation of the equipment.

(c) *Construction —*

(1) *General requirements.*

(i) Derricks must 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 must conform to recommended practices in ANSI/AWS D14.3-94 (incorporated by reference, *see* § 1926.6) or AWS D1.1/D1.1M:2002 (incorporated by reference, *see* § 1926.6).

(2) *Guy derricks.*

(i) The minimum number of guys must 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 must not be used unless the employer has the following guy information from the manufacturer or a qualified person, when not available from the manufacturer:

(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 (c)(2)(ii) of this section, the employer must have the following guy information from the manufacturer or a qualified person, when not available from the manufacturer:

(A) The amount of initial sag or tension.

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

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

(v) The mast cap must:

(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 must be supported in the vertical position by at least two stifflegs; one end of each must be connected to the top of the mast and the other end securely anchored.

(ii) The stifflegs must be capable of withstanding the loads imposed at any point of operation within the load chart range.

(iii) The mast base must:

(A) Permit the mast to rotate freely (when necessary).

(B) Permit deflection of the mast without binding.

(iv) The mast must 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 must:

(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 must 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 must ensure that the derrick is not used in an unstable position.

(ii) The base of the gin pole must permit movement of the pole (when necessary).

(iii) The gin pole must 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 must 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.*

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

(2) *Guy derricks.*

(i) The mast base must be anchored.

(ii) The guys must be secured to the ground or other firm anchorage.

(iii) The anchorage and guying must 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.

(3) *Stiffleg derricks.*

(i) The mast base and stifflegs must be anchored.

(ii) The mast base and stifflegs must 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 must be suitable for the derrick work intended and must be anchored to prevent displacement from the imposed loads.

(2) *Hoists.*

(i) Base mounted drum hoists must meet the requirements in the following sections of ASME B30.7-2001 (incorporated by reference, *see* § 1926.6):

(A) Sections 7-1.1 (“Load ratings and markings”).

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

(C) Section 7-1.3 (“Installation”).

(D) Applicable terms in section 7-0.2 (“Definitions”).

(ii) *Load tests for new hoists.* The employer must 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 their capacity or safe operation must be evaluated by a qualified person to determine if a load test is necessary. If it is, load testing must be conducted in accordance with paragraphs (e)(2)(ii) and (iv) of this section.

(iv) *Load test procedure.* Load tests required by paragraphs (e)(2)(ii) or (e)(2)(iii) of this section must be conducted as follows:

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

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

(f) *Operational aids.*

(1) Section 1926.1416 (Operational aids) applies, except for § 1926.1416(d)(1) (Boom hoist limiting device), § 1926.1416(e)(1) (Boom angle or radius indicator), and § 1926.1416(e)(4) (Load weighing and similar devices).

(2) *Boom angle aid.* A boom angle indicator is not required but if the derrick is not equipped with a functioning one, the employer must ensure that either:

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

(i) Derricks manufactured more than one year after November 8, 2010 with a maximum rated capacity over 6,000 pounds must 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 must be determined from a source recognized by the industry (such as the load's manufacturer), or by a calculation method recognized by the industry (such as calculating a steel beam from measured dimensions and a known per foot weight), or by other equally reliable means. This information must be provided to the operator prior to the lift. *See* § 1926.1417(j) for additional requirements.

(ii) A load weight/capacity device that is not working properly must 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 must be completed within 7 days of receipt of the parts.

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

(1) *Anchorages.*

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

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

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

(i) Lifting and lowering 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 must be load tested by a competent person. The test load must meet the following requirements:

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

(ii) The test must 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 must not be used unless the competent person determines that the test has been passed.

(4) *Documentation.* Tests conducted under this paragraph must be documented. The document must contain the date, test results and the name of the tester. The document must be retained until the derrick is re-tested or dismantled, whichever occurs first. All such documents must be available, during the applicable document retention period, to all persons who conduct inspections in accordance with § 1926.1412.

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

(i) [Reserved]

(j) *Power failure procedures.* If power fails during operations, the derrick operator must safely stop operations. This must 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 must not be handled on a winch head without the knowledge of the operator.

(2) While a winch head is being used, the operator must 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 must be engaged.

(2) When taken out of service for 30 days or more, the boom must 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 must be supervised by the A/D director.

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

(p) *Inspections.* In addition to the requirements in § 1926.1412, the following additional items must 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) *Qualification and training.* The employer must train each operator of a derrick on the safe operation of equipment the individual will operate. Section 1926.1427 of this subpart (Operator qualification and certification) does not apply.

ECFR CONTENT

Editorial Notes:

1. At 44 FR 8577, Feb. 9, 1979, and corrected at 44 FR 20940, Apr. 6, 1979, OSHA reprinted without change the entire text of 29 CFR part 1926 together with certain General Industry Occupational Safety and Health Standards contained in 29 CFR part 1910, which have been identified as also applicable to construction work. This republication developed a single set of OSHA regulations for both labor and management forces within the construction industry.

2. Nomenclature changes to part 1926 appear at 84 FR 21597, May 14, 2019.

§ 1926.1437 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 (*i.e.,* vessel/flotation device). The 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 when using jacked barges when the jacks are deployed to the river, lake, or sea bed and the barge is fully supported by the jacks.

(b) *General requirements.* The requirements in paragraphs (c) through (k) of this section 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 § 1926.1424 (Work area control) apply, except for § 1926.1424(a)(2)(ii).

(2) The employer must either:

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

(ii) Clearly mark the hazard areas by a combination of warning signs (such as, “Danger—Swing/Crush Zone”) and high visibility markings on the equipment that identify the hazard areas. In addition, the employer must train each employee to understand what these markings signify.

(d) *Keeping clear of the load.* Section 1926.1425 does not apply.

(e) *Additional safety devices.* In addition to the safety devices listed in § 1926.1415, the following safety devices are required:

(1) Barge, pontoon, vessel or other means of flotation list and trim device. The safety device must be located in the cab or, when there is no cab, at the operator's station.

(2) Positive equipment house lock.

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

(f) *Operational aids.*

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

(2) Section 1926.1416(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 performed under this section.

(g) *Accessibility of procedures applicable to equipment operation.* If the crane/derrick has a cab, the requirements of § 1926.1417(c) apply. If the crane/derrick does not have a cab, the employer must ensure that:

(1) Rated capacities (load charts) are posted at the operator's station. If the operator's station is moveable (such as with pendant-controlled equipment), the load charts are 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, must be readily available on board the vessel/flotation device.

(h) *Inspections.* In addition to meeting the requirements of § 1926.1412 for inspecting the crane/derrick, the employer must inspect the barge, pontoons, vessel or other means of flotation used to support a floating crane/derrick or land crane/derrick, and ensure that:

(1) *Shift.* For each shift inspection, the means used to secure/attach the equipment to the vessel/flotation device is in proper condition, including wear, corrosion, loose or missing fasteners, defective welds, and (when applicable) insufficient tension.

(2) *Monthly.* For each monthly inspection:

(i) The means used to secure/attach the equipment to the vessel/flotation device is in proper condition, including inspection for wear, corrosion, and, when applicable, insufficient tension.

(ii) The vessel/flotation device is not taking on water.

(iii) The deckload is properly secured.

(iv) The vessel/flotation device is watertight based on the condition of the chain lockers, storage, fuel compartments, and hatches.

(v) The firefighting and lifesaving equipment is in place and functional.

(3) The shift and monthly inspections are conducted by a competent person, and:

(i) If any deficiency is identified, an immediate determination is made by a qualified person whether the deficiency constitutes a hazard.

(ii) If the deficiency is determined to constitute a hazard, the vessel/flotation device is removed from service until the deficiency has been corrected.

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

(i) The external portion of the barge, pontoons, vessel or other means of flotation used is inspected annually by a qualified person who has expertise with

respect to vessels/flotation devices and that the inspection includes the following items:

(A) The items identified in paragraphs (h)(1) (*Shift*) and (h)(2) (*Monthly*) of this section.

(B) Cleats, bitts, chocks, fenders, capstans, ladders, and stanchions, for significant corrosion, wear, deterioration, or deformation that could impair the function of these items.

(C) External evidence of leaks and structural damage; evidence of leaks and damage below the waterline may be determined through internal inspection of the vessel/flotation device.

(D) Four-corner draft readings.

(E) Firefighting equipment for serviceability.

(ii) Rescue skiffs, lifelines, work vests, life preservers and ring buoys are inspected for proper condition.

(iii) If any deficiency is identified, an immediate determination is made by the qualified person whether the deficiency constitutes a hazard or, though not yet a hazard, needs to be monitored in the monthly inspections.

(A) If the qualified person determines that the deficiency constitutes a hazard, the vessel/flotation device is removed from service until it has been corrected. *See* requirements in § 1926.1417(f).

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

(5) *Four-year: internal vessel/flotation device inspection.* For each four-year inspection:

(i) A marine engineer, marine architect, licensed surveyor, or other qualified person who has expertise with respect to vessels/flotation devices surveys the internal portion of the barge, pontoons, vessel, or other means of flotation.

(ii) If the surveyor identifies a deficiency, an immediate determination is 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.

(A) If the surveyor determines that the deficiency constitutes a hazard, the vessel/flotation device is removed from service until it has been corrected.

(B) If the surveyor determines that, though not presently a hazard, the deficiency needs to be monitored, 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) of this section are documented in accordance with §§ 1926.1412 (e)(3) and 1926.1412(f)(7), respectively, and that the four-year inspection required in paragraph (h)(5) of this section is documented in accordance with § 1926.1412(f)(7), except that the documentation for that inspection must be retained for a minimum of 4 years. All such documents must be made available, during the applicable document retention period, to all persons who conduct inspections in accordance with § 1926.1412.

(i) [Reserved]

(j) *Working with a diver.* The employer must meet the following additional requirements 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 must not be used for any other purpose until the diver is back on board. When used for more than one diver, it must not be used for any other purpose until all divers are back on board.

(2) The operator must remain at the controls of the crane/derrick at all times.

(3) In addition to the requirements in §§ 1926.1419 through 1926.1422 (Signals), either:

(i) A clear line of sight must be maintained between the operator and tender; or

(ii) The signals between the operator and tender must be transmitted electronically.

(4) The means used to secure the crane/derrick to the vessel/flotation device (*see* paragraph (n)(5) of this section) must not allow any amount of shifting in any direction.

(k) *Manufacturer's specifications and limitations.*

(1) The employer must ensure that the barge, pontoons, vessel, or other means of flotation must be capable of withstanding imposed environmental, operational and in-transit loads when used in accordance with the manufacturer's specifications and limitations.

(2) The employer must ensure that the manufacturer's specifications and limitations with respect to environmental, operational, and in-transit loads for a barge, pontoon, vessel, or other means of flotation are not exceeded or violated.

(3) When the manufacturer's specifications and limitations are unavailable, the employer must ensure that the specifications and limitations established by a qualified person with respect to environmental, operational and in-transit loads for the barge, pontoons, vessel, or other means of flotation are not exceeded or violated.

(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 employer must not exceed the manufacturer load charts applicable to operations on water. When using these charts, the employer must comply with all parameters and limitations (such as dynamic and environmental parameters) applicable to the use of the charts.

(ii) The employer must ensure that load charts take into consideration a minimum wind speed of 40 miles per hour.

(2) The employer must ensure that the requirements for maximum allowable list and maximum allowable trim as specified in Table M1 of this section are met.

Expand Table

Table M1

Rated capacity	Maximum allowable list (degrees)	Maximum allowab trim (degrees)
Equipment designed for marine use by permanent attachment (other than derricks):		
25 tons or less	5	
Over 25 tons	7	
Derricks designed for marine use by permanent attachment:		
Any rated capacity	10	

(3) The employer must ensure that the equipment is stable under the conditions specified in Tables M2 and M3 of this section. (NOTE: Freeboard is the vertical distance between the water line and the main deck of the vessel.)

Expand Table

Table M2

Operated at	Wind speed (mph)	Minimum freeboard (ft)
Rated capacity	60	
Rated capacity plus 25%	60	
High boom, no load	60	

Expand Table

Table M3

Operated at	Wind speed
For backward stability of the boom:	
High boom, no load, full back list (least stable condition)	90 mph.

(4) If the equipment is employer-made, it must 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) through (3) of this section. Such documents must 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 employer must ensure that the barge, pontoons, vessel or other means of flotation used:

(i) Are 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 planned and actual 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, the employer must ensure that:

(1) The rated capacity of the equipment (including but not limited to modification of load charts) applicable for use on land is 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 environmental conditions expected and encountered.

(iii) The conditions required in paragraphs (n)(3) and (n)(4) of this section are met.

(2) The rated capacity modification required in paragraph (n)(1) of this section is performed 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) For list and trim.

(i) The maximum allowable list and the maximum allowable trim for the barge, pontoon, vessel or other means of flotation must not exceed the amount necessary to ensure that the conditions in paragraph (n)(4) of this section are met. In addition, the maximum allowable list and the maximum allowable trim does not exceed the least of the following: 5 degrees, the amount specified by the crane/derrick manufacturer, or, when, 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 does not exceed the amount specified by the crane/derrick manufacturer, or, when, an amount is not so specified, the amount specified by the qualified person.

(4) For the following conditions:

(i) All deck surfaces of the barge, pontoons, vessel or other means of flotation used are above water.

(ii) The entire bottom area of the barge, pontoons, vessel or other means of flotation used is submerged.

(5) Physical attachment, corralling, rails system and centerline cable system meet the requirements in Option (1), Option (2), Option (3), or Option (4) of this section, and that whichever option is used also meets the requirements of paragraph (n)(5)(v) of this section.

(i) *Option (1)—Physical attachment.* The crane/derrick is 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/flotation device, bolting or welding the crane/derrick to the vessel/flotation device, strapping the crane/derrick to the vessel/flotation device with chains, or other methods of physical attachment.

(ii) *Option (2)—Corralling.* The crane/derrick is prevented from shifting by installing barricade restraints (*i.e.,* a corralling system). Employers must ensure that corralling systems do not allow the equipment to shift by any amount of shifting in any direction.

(iii) *Option (3)—Rails.* The crane/derrick must be prevented from shifting by being mounted on a rail system. Employers must ensure that rail clamps and rail stops are used unless the system is designed to prevent movement during operation by other means.

(iv) *Option (4)—Centerline cable system.* The crane/derrick is prevented from shifting by being mounted to a wire rope system. The employer must ensure that the wire rope system meets the following requirements:

(A) The wire rope and attachments are of sufficient size and strength to support the side load of crane/derrick.

(B) The wire rope is attached physically to the vessel/flotation device.

(C) The wire rope is attached to the crane/derrick by appropriate attachment methods (such as shackles or sheaves) on the undercarriage, and that the method used will allow the crew to secure the crane/derrick from movement during operation and to move the crane/derrick longitudinally along the vessel/flotation device for repositioning.

(D) Means are installed to prevent the crane/derrick from passing the forward or aft end of the wire rope attachments.

(E) The crane/derrick is secured from movement during operation.

(v) The systems/means used to comply with Option (1), Option (2), Option (3), or Option (4) of this section are designed by a marine engineer, registered professional engineer familiar with floating crane/derrick design, or qualified person familiar with floating crane/derrick design.

(6) *Exception.* For mobile auxiliary cranes used on the deck of a floating crane/derrick, the requirement specified by paragraph (n)(5) of this section to use Option (1), Option (2), Option (3), or Option (4) does not apply when the employer demonstrates implementation of a plan and procedures that meet the following requirements:

(i) 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.

(ii) The plan is designed so that the applicable requirements of this section are met despite the position, travel, operation, and lack of physical attachment (or corralling, use of rails or cable system) of the mobile auxiliary crane.

(iii) The plan specifies the areas of the deck where the mobile auxiliary crane is permitted to be positioned, travel, and operate, and the parameters and limitations of such movements and operation.

(iv) The deck is marked to identify the permitted areas for positioning, travel, and operation.

(v) The plan specifies the dynamic and environmental conditions that must be present for use of the plan.

(vi) If the dynamic and environmental conditions in paragraph (n)(6)(v) of this section are exceeded, the mobile auxiliary crane is attached physically or corralled in accordance with Option (1), Option (2) or Option (4) of paragraph (n)(5) of this section.

(7) The barge, pontoons, vessel or other means of flotation used:

(i) Are 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.