

WAC 296-155-53900 Tower cranes—General. (1) This section contains supplemental requirements for tower cranes; all sections of this part apply to tower cranes unless specified otherwise. In addition, the requirements in WAC 296-155-53402 apply unless otherwise specified, except that the term "assembly/disassembly" is replaced by "erecting, climbing and dismantling," and the term "disassembly" is replaced by "dismantling."

(2) All tower cranes in use must meet the applicable requirements for design, construction, installation, testing, maintenance, inspection, and operation as prescribed by the manufacturer. If the manufacturer's recommendations are not available, follow the requirements in ASME B30.3-2009. It is not the intent of this rule to require retrofitting of existing cranes. However, when an item is being modified, its performance needs to be reviewed by a qualified person and compared to the applicable sections of this rule. For modification requirements see WAC 296-155-53400 (58) and (59). For cranes manufactured prior to the effective date of this rule the design and construction criteria must meet at a minimum, ASME B30.3-1990.

(3) You must follow the manufacturer's recommendations when installing, erecting, and dismantling tower cranes. If the manufacturer's recommendations are not available, follow the requirements in ASME B30.3-2009.

(4) When cranes are erected/dismantled, written instructions by the manufacturer or qualified person and a list of the weights of each subassembly to be erected/dismantled must be at the site.

(5) A qualified person must supervise the erection, jumping and dismantling of the crane.

(6) You must establish procedures before beginning crane erection/dismantling work to implement the instructions and adapt them to the particular needs of the site.

(7) Tower cranes and tower crane assembly parts/components must be inspected by an accredited certifier, prior to assembly, following erection of the tower crane, after each climbing operation, or reconfiguring the boom, jib, or counterjib, before placing the crane in service. (See WAC 296-155-53206.) You must only use inspected and pre-approved components in the assembly of a tower crane.

(8) You must erect tower masts plumb to a tolerance of 1:500 (approximately one inch in 40 feet) unless the manufacturer specifies otherwise and verified by a qualified person.

(9) You must install cranes that are required to weathervane when out-of-service with clearance for the boom (jib) and the superstructure to swing through a full 360 degree arc. You must maintain clearances recommended by the crane manufacturer between other weathervaning cranes and fixed objects.

(10) When the crane is out of operation, the jib or boom must be pointed downwind and the slewing brake must be released so as to permit the jib or boom to weathervane, provided the jib or boom has a clear 360 degree rotation.

(11) When the crane is out of operation and a 360 degree rotation is not feasible, you must follow the manufacturer's or RPE's written procedures for restraining the jib or boom from rotation.

(12) 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.

(13) Prior to erecting a tower crane on a nonstandard tower crane base/structural support, you must ensure that the engineering configuration of this base/structural support has been reviewed and acknowledged as acceptable by an independent registered professional structural engineer (RPSE), licensed under chapter 18.43 RCW.

(14) An RPSE must certify that the crane foundation, structural supports and underlying soil provide adequate support for the tower crane with its applied torsional and overturning moments and the horizontal and vertical forces.

(15) The controlling entity that installed the tower crane foundations and structural supports must provide a written statement/documentation to the A/D director stating that they were installed in accordance with their design and requirements the RPE, and the engineer of record if applicable.

(16) You must consult the engineer of record to verify that the host structure is capable of safely resisting the applied crane forces, if this engineer is not available an RSPE must perform this verification. When inside climbing cranes are used, the integrity of the host structure must be reviewed and approved by an RPSE, for the effects of the crane, load, and wind forces at each level of the structure.

(17) Prior to installing a tower crane that will be attached to an existing building, new construction, or structure, an RPSE must certify that the structural attachment to the building is designed to withstand the torsional and overturning moments and the horizontal and vertical forces created by the crane to be installed.

(18) The assembly/disassembly director must address backward stability before slewing, traveling or freestanding tower cranes on ballasted bases.

(19) The top of the support/foundation must be accessible and free of debris, materials and standing water. No materials can be stored on the support unless approved by a qualified person. Tower crane's foundation and fasteners must remain accessible and visible for inspection at all times.

(20) You must not climb tower cranes in concrete structures until the concrete at the levels at which horizontal and vertical supports are to be placed has reached sufficient strength to resist the crane reactions. It may be necessary to test concrete cylinders or cores or to use on-site testing techniques for this purpose.

(21) Climbing jack systems used for raising a tower crane must be equipped with over-pressure relief valves, direct-reading pressure gauges, and pilot-operated hydraulic check valves installed in a manner which will prevent the jack from retracting should a hydraulic line or fitting rupture or fail.

(22) Before climbing or erecting/dismantling, you must balance cranes in accordance with the manufacturer's or a qualified person's instructions. If no such limit has been set, wind velocity must not exceed the limit set by the manufacturer, or 20 miles per hour as indicated by a wind velocity device mounted near the top of the crane. The crane operator must be present during climbing or erecting/dismantling operations.

(23) You must not commence climbing operations until all crane support provisions at the new support level are in place as per the manufacturer's recommendations or as specified by an RPSE.

(24) Crane superstructures and counterjibs (counterweight jib) must be arranged to receive counterweights, made in accordance with the manufacturer's specifications for the specified jib or boom

length, and to hold them in position. You must provide means to guard against shifting or dislodgement during crane operation. Manufacturer's specified counterweight weights are not to be exceeded.

(25) Moveable counterweights, if provided, must either move automatically or must be equipped with a position indicator with read out at the operator's station(s).

(26) When counterweight position is controlled by wire ropes, you must provide means to prevent uncontrolled movement in the event of wire rope or wire rope termination failure.

(27) When counterweight position is controlled by wire ropes and/or linkages between the counterweight and the boom, you must make provisions to avert structural damage if the boom is moved beyond its normal limits.

(28) For cranes utilizing ballast, bases must include provisions to support and position the ballast. You must provide means to guard against shifting or dislodgement of ballast during crane operation.

(29) All electrical equipment must be properly grounded and protection must be provided against lightning per the manufacturer's recommendation or if not available, a registered professional electrical engineer.

(30) Each electrically powered crane must have a main disconnect switch at or near the initial base of the crane. This switch must have provisions for locking in the "off" position.

(31) You must guard or locate equipment so that live parts are not exposed to inadvertent contact by personnel and equipment under normal operating conditions.

(32) You must protect electrical equipment from dirt, grease, oil, and moisture. Fixtures, wiring, and connections exposed to the weather must be of weather resistant type.

(33) Wiring must conform to the provisions of ANSI/NFPA 70 for temporary wiring. Motors, controls, switches, and other electrical equipment must meet the applicable requirements of ANSI/NFPA 70. Hoists, slewing, trolley, and travel controllers must conform to ISO 7752-1, 2010.

(34) You must make provisions to guard against reversing of each motor due to reversed phase connections.

(35) Electrical circuits between the fixed and rotating portions of the crane must pass through a slip ring assembly that will permit continuous rotation of the upper crane structure in either direction, unless other means are provided to prevent damage to the electrical conductors.

(36) Individual overload protection must be provided for each motor.

(37) Crane trucks must be fitted with sweeps extending below the top of the rail, unless the construction of the rail foundation prohibits such extension, and placed in front of the leading wheels in either direction. Truck wheels/bogies must be guarded.

(38) You must provide a means to limit the drop of truck frames in case of wheel or axle breakage to a distance that will not cause a crane to overturn.

(39) Multiple tower crane job sites. On job sites where more than one tower crane is installed, you must locate the cranes such that no crane may come in contact with the structure of another crane. Crane's jibs or booms are permitted to pass over one another.

(40) You must position tower cranes, in service, whereby they can slew 360 degrees without either the counterjib or jib/boom striking any building, structure, or other object, unless:

- (a) Suitable anticollision devices are installed which will prohibit contact with such objects or;
- (b) Direct voice communications are established between any operator of the tower crane(s) involved and a signal person so stationed where the boom and/or counterweight movement, and the object with which it may contact can be observed so that the operator(s) can be warned of imminent danger.
 - (i) You must establish a secondary means of positive communications as a back-up for possible direct voice communication failure.
 - (ii) Radio communication systems without tone coded squelch are prohibited. You must not use citizens band radios as a means of communications for tower cranes.
- (41) Limit switches must be installed and you must keep them properly adjusted. You must protect or isolate them in a manner which will prevent unauthorized tampering. Limit switches must provide the following functions:
 - (a) Limit the travel of the trolley to prevent it from hitting the outer end of the jib.
 - (b) Limit the upward travel of the load block to prevent two-blocking.
 - (c) Lower over travel limiting devices must be provided for all load hoists where the hook area is not visible to the operator.
 - (d) In the absence of the crane manufacturer's specifications, limit the load being lifted in a manner whereby no more than 110% of the maximum rated load can be lifted or moved.
 - (e) Cranes mounted on rail tracks must be equipped with limit switches limiting the travel of the crane on the track and stops or buffers at each end of the tracks.
- (42) All tower cranes manufactured after July 27, 2010, must be equipped with a safety device (also referred to as a limit device) that provides deceleration before the top position of the crane hook is reached.
- (43) The load must be free when lifted; it must not be caught on nor attached to other objects. You must limit side loading of jibs to freely suspended loads. You must not use cranes for dragging loads.
- (44) When the operator may be exposed to the hazard of falling objects, the tower crane cab and/or remote control station must have adequate overhead protection.
- (45) You must provide a safe means for access to the tower, operator's cab and machinery platform.
- (46) When necessary for inspection or maintenance purposes, you must provide ladders, walkways with railing or other devices.
- (47) All crane brakes must automatically set in event of power failure. Slewing brakes must also function in this manner or be capable of being set manually.
- (48) Each tower crane must be provided with a slewing brake capable of holding in both directions preventing the superstructure from rotating during operation and must be capable of being set in the holding position and remaining so without further action on the part of the operator.
- (49) The trolley must be provided with an operating brake capable of stopping the trolley in either direction. The system must include a means for holding the trolley without further action on the part of the operator, and must engage automatically if power or pressure to the brake is lost.
- (50) In addition to the operating brake, the trolley must be equipped with an automatic braking device capable of stopping trolley

in either direction in the event of trolley drive rope breakage, if such ropes are used.

(51) The body or frame of the trolley must be fitted with a means to restrain the trolley from becoming detached from its guide rail(s) in the event of trolley wheel or axle breakage or side loading.

(52) The jib point sheave, if provided, must have at least one broad stripe of bright, contrasting color painted on each side so it can be determined whether or not the sheave is turning.

(53) You must protect employees required to perform duties on the boom/jib of tower cranes against falling in accordance with Part C-1 of this chapter.

(54) An audible signal must automatically sound whenever the crane travels in order to warn persons in the vicinity.

(55) You must mount a wind velocity indicating device at or near the top of the crane. You must provide a velocity readout at the operator's station in the cab, and a visible or audible alarm must be triggered in the cab and at remote control stations when a preset wind velocity has been exceeded.

(56) When the wind velocity indicating device is not functioning, crane operations may continue if another crane on the site is equipped with a functioning wind velocity indicator or if a qualified person determines that ambient wind velocity is within permitted limits.

(57) You must provide indicating devices to:

(a) Display the magnitude of the load on the hook;

(b) Display the boom angle or operating radius, as appropriate. On hammerhead booms (jibs), radius indication may be by means of flags or markers along the length of the boom (jib) so as to be visible to the operator;

(c) Display ambient wind velocity.

(58) You must provide a limiting device to:

(a) Decelerate the trolley travel at both ends of the jib prior to the final limit activation;

(b) Decelerate the luffing boom travel at upper and lower ends prior to final limit activation;

(c) Limit trolley travel at both ends of the jib;

(d) Stop boom luffing at lower and upper limits of boom movement;

(e) Decelerate the hoist up hook travel prior to final limit activation;

(f) Stop load block upper motion before two-blocking occurs;

(g) Stop load block downward motion to prevent the last two wraps of wire rope from spooling off the hoist drum;

(h) Limit crane travel at both ends of the runway tracks;

(i) Limit lifted load;

(j) Limit operating radius in accordance with lifted load, i.e., limit movement; and

(k) Limit pressures in hydraulic or pneumatic circuits.

(59) You must lock or seal load limiting devices and acceleration/deceleration limiters when provided with a method to inhibit tampering and unauthorized adjustment.

(60) **Safety devices.**

(a) 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) Slewing 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.

(b) Proper operation required. You must not begin operations unless the devices listed in this subsection are in proper working order. If a device stops working properly during operations, the operator must safely stop operations. You must take the crane out of service, and you must not resume operations until the device is again working properly. You must not use alternative measures.

(61) **Operational aids.**

(a) The devices listed in this subsection (operational aids) are required on all tower cranes covered by this part, unless otherwise specified.

(b) You must not begin crane operations unless the operational aids are in proper working order, except where you meet the specified temporary alternative measures. You must follow more protective alternative measures, if any are specified by the tower crane manufacturer.

(c) When operational aids are inoperative or malfunctioning, you must follow the crane and/or device manufacturer's recommendations for operation or shutdown of the crane until the problems are corrected. Without such recommendations and any prohibitions from the manufacturer against further operation, the following requirements apply:

Note: 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 WAC 296-155-53400 (58) and (59).

(i) You must accomplish recalibration or repair of the operational aid as soon as is reasonably possible, as determined by a qualified person.

(ii) **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.** You must mark the trolley rope (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.** You must use a spotter who is in direct communication with the operator when operations are conducted within 10 feet of the outer or inner trolley end stops.

(iii) **Boom hoist limiting device.** You must limit the range of the boom at the minimum and maximum radius. Temporary alternative measures: Clearly mark the hoist rope (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.

(iv) **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 hoist rope (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.

Note: This temporary alternative measure cannot be used if lifting personnel in a suspended platform.

(v) **Hoist drum lower limiting device.** Tower cranes manufactured after the effective date of this section must be equipped with a device that prevents the last two wraps of hoist cable from being spooled off the drum. Temporary alternative measures: Mark the hoist rope (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 two 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.

(vi) **Load moment limiting device.** The tower crane must have a device that prevents moment overloading. Temporary alternative measures: You must use a radius indicating device (if the tower crane is not equipped with a radius indicating device, you must measure the radius to ensure the load is within the rated capacity of the crane). In addition, the weight of the load must 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. You must provide this information to the operator prior to the lift.

(vii) **Hoist line pull limiting device.** You must limit the capacity of the hoist 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).

(viii) **Rail travel limiting device.** You must limit the travel distance in each direction to prevent the travel bogies from running into the end stops or buffers. Temporary alternative measures: You must use a spotter who is in direct communication with the operator 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.

(ix) **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: You must manually set the device when required if an electric, hydraulic or automatic type is not functioning.

(x) **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 the effective date of this section must have a hook radius indicator readable from the operator's station. Temporary alternative measures: You must determine hook radii or boom angle by measuring the hook radii or boom angle with a measuring device.

(xi) **Trolley travel deceleration device.** You must automatically reduce the trolley speed prior to the trolley reaching the end limit in both directions. Temporary alternative measures: You 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.

(xii) **Boom hoist deceleration device.** You must automatically reduce the boom speed prior to the boom reaching the minimum or maximum radius limit. Temporary alternative measures: You 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 boom maximum or minimum end limits.

(xiii) **Load hoist deceleration device.** You must automatically reduce the load speed prior to the hoist reaching the upper limit. Temporary alternative measures: You 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 hoist speed when approaching the upper limit.

(xiv) **Wind speed indicator.** You must provide a device to display the wind speed and it must be mounted at or near the top of the crane structure. 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.

(xv) **Load indicating device.** Cranes manufactured after the effective date of this section, 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 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. You must provide this information to the operator prior to the lift.

(62) You must not install advertising signs or similar panels on the crane or tower unless size, design, and positioning satisfy the manufacturer's recommendations, in the absence of the manufacturer's recommendations, you must obtain an RPE's written approval.

(63) For night operations, lighting must be adequate to illuminate the working areas while not interfering with the operator's vision.

(64) All welding procedures and welding operator qualifications for use in repair or alteration of load sustaining members must be in accordance with ANSI/AWS D14.3 or ANSI/AWS D1.1. Where special steels or other materials are used, the manufacturer or a qualified person must provide welding procedure instructions. The type of metal used for load sustaining members must be identified by the manufacturer. In the absence of the manufacturer you must use an RPSE.

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 16-09-085, § 296-155-53900, filed 4/19/16, effective 5/20/16. Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.440, 49.17.060, and 29 C.F.R. 1926, Subpart CC. WSR 12-01-086, § 296-155-53900, filed 12/20/11, effective 2/1/12.]