WAC 296-155-54100 Self-erecting tower cranes—General. (1) All self-erecting tower cranes in use must meet the applicable requirements for design, construction, installation, testing, maintenance, inspection, and operation as prescribed by the manufacturer. For modification requirements see WAC 296-155-53400 (58) and (59).

(2) In addition to the requirements in WAC 296-155-53402(6), 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) When cranes are erected, reconfigured, or dismantled, you must follow written instructions by the manufacturer. If circumstances do not permit the normal manufacturer's written instructions from being followed, you must follow alternative written instructions from the manufacturer or an RPE.

(4) You must perform erection, reconfiguration, and dismantling under the supervision of a qualified person.

(5) You must carefully assess the area in which a crane is to be set up to ensure that it is suitable before the crane is taken to site and put into service. The area chosen must be of a sufficient size to enable the crane to be maneuvered into position, set up, operated and dismantled, with sufficient clearances between the crane and surrounding structures, as detailed by application drawings and in the manufacturer's operation and instruction manual.

(6) When setting up a crane, you must take care to ensure that the crane will not contact or approach overhead hazards such as power lines, communications cables or overhead structures.

(7) The assembly/disassembly director must address backward stability before slewing self-erecting tower cranes.

(8) Crane supports for individual outrigger pads must be level to the manufacturer's specifications or those of a qualified person. Supports may be timbers, cribbing, or other structural members to distribute the load so as not to exceed the allowable bearing capacity of the underlying material.

(9) All load bearing foundations, supports, and rail tracks must be constructed or installed to support the crane loads and to transmit them to the soil or other support medium. In addition to supporting vertical load, foundations and supports, rail supports excepted, must be designed to provide a moment resisting overturning equal to a minimum of 150% of the maximum crane overturning moment. This requirement may be met by means of structural anchors or ballast weights.

(10) In addition to the requirements in WAC 296-155-53400 (36) and (37), a qualified person must ensure that the underlying soil is adequate support for the crane with its maximum forces recommended by the manufacturer.

(11) You must install cranes required to weathervane when out-of-service with clearance for jib and superstructure to slew a full 360 degree arc unobstructed without encroaching any power line "Danger-Swing/Crush Zone." You must maintain clearances recommended by the crane manufacturer between weathervaning cranes, fixed objects and other cranes.

(12) When the crane is out of operation and a 360 degree rotation is not provided, follow the manufacturer's or RPE's written procedures.

(13) 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.

(14) Prior to installing a self-erecting tower crane on a building or structure 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.

(15) When cranes are erected and after each reconfiguration, before placing the crane in service, all functional motions, motion limiting devices, brakes, and you must test indicating devices for operation.

(a) The order in which tests of a newly erected or reconfigured crane are to be performed is as follows:

(i) Functional motion tests without load. Each test must include:

(A) Load hoisting and lowering;

(B) Jib elevating and lowering, or traversing the trolley;

(C) Slew motion;

(D) Brakes and clutches;

(E) Operational aids and motion limiting devices;

(F) Remote control, if provided.

(ii) Functional load tests at rated load. Each test must include:

(A) Load hoisting and lowering;

(B) Jib elevating and lowering, or traversing the trolley;

(C) Slew motion;

(D) Brakes and clutches;

(E) Operational aids and load limiting devices;

(F) Remote control, if provided.

(b) During the test, you must check the crane supports. Any observed displacement is reason to suspend testing until an evaluation is made by a qualified person.

(16) Conditions that adversely affect the crane at the time of erection, reconfiguration, or dismantling must be a limiting factor that could require suspending the operation. These conditions include but are not limited to:

(a) Support conditions;

(b) Wind velocity or gusting winds;

(c) Heavy rain;

(d) Fog;

(e) Extreme cold or heat;

(f) Ice;

(g) Artificial lighting.

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

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

(19) Superstructures must be arranged to receive counterweights, made in accordance with the crane manufacturer's specifications, and to hold them in position. You must provide means to guard against shifting or dislodgement during crane operation.

(20) Counterweights must be securely fastened in place and must be at the location and within the weight tolerance as recommended by the manufacturer.

(21) Limiting devices must be provided to:

(a) Decelerate the trolley and hoist hook prior to activating the motion stop limit;

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

(c) Limit jib telescoping at inner and outer position;

(d) Stop load block upward motion before two-blocking occurs;

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

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

(g) Limit lifted load;

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

(i) Limit pressures in hydraulic or pneumatic circuits, i.e., pressure relief valves.

(22) Load limiting devices and acceleration/deceleration limiters must be locked or sealed when provided with a method to inhibit tampering and unauthorized adjustment.

(23) All crane brakes must automatically set in event of power failure. Slew brakes must also function in this manner or be capable of being set manually.

(24) Each 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.

(25) 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.

(26) In addition to the operating brake, the trolley must be equipped with an automatic braking device capable of stopping the movement of the load trolley in the event of trolley drive rope breakage, if such ropes are used.

(27) 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.

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

(29) Each electrically powered crane must have an over-current protected main disconnect switch mounted at or near the initial base of the crane. This switch must have provisions for locking in the off position.

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

(31) 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.

(32) 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.

(33) You must make provisions to guard against any crane function operating in the opposite intended direction due to reversed phase connections.

(34) 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.

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

(36) For traveling cranes, both ends of all tracks must be provided with stops or buffers adjusted for simultaneous contact with both sides of the travel base. Stops attached to rails must be mounted not less than 3 feet (1 m) inboard of the last rail support. Cranes must be equipped with means to prevent running into the buffers or stops while under power.

(37) An audible signal device must be provided with the control located within reach of the operator.

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

(39) Bogies 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. Bogie wheels must be guarded.

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

(41) 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 or in the cab. 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.

(42) **Safety devices.**

(a) The following safety devices are required on all self-erecting tower cranes unless otherwise specified:

(i) Boom stops on luffing boom type self-erecting tower cranes;

(ii) Jib stops on luffing boom type self-erecting 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 or-

der. 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. Alternative measures are not permitted to be used.

(43) **Operational aids.**

(a) The devices listed in this subsection (operational aids) are required on all self-erecting 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 the employer meets the specified temporary alternative measures. You must follow protective alternative measures specified by the self-erecting tower crane manufacturer, if any.

(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 self-erecting 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.** Self-erecting 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 self-erecting 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 self-erecting tower cranes must have a boom angle indicator readable from the operator's station.

(B) Self-erecting hammerhead 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 the 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 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: You must determine the weight of the load 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.

(44) 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, § 296-155-54100, 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, § 296-155-54100, filed 12/20/11, effective 2/1/12.]