

PART L CRANES, DERRICKS, HOISTS, ELEVATORS, AND CONVEYORS

WAC 296-155-525 Cranes and derricks.

(1) Definitions applicable to this part:

Accessory - a secondary part or assembly of parts which contributes to the overall function and usefulness of a machine.

Administrative or regulatory authority - a governmental agency, or the employer in the absence of governmental jurisdiction.

Angle indicator (boom) - an accessory which measures the angle of the boom to the horizontal.

Appointed - assigned specific responsibilities by the employer or the employer's representative.

Authorized person - means a person approved or assigned by the employer to perform a specific type of duty or duties or be at a specific location or locations at the workplace.

Auxiliary hoist - a secondary hoist rope system used either in conjunction with, or independently of, the main hoist system.

Axis of rotation - the vertical axis around which the crane superstructure rotates.

Axle - the shaft or spindle with which or about which a wheel rotates. On wheel-mounted cranes it refers to a type of axle assembly including housings, gearing, differential, bearings, and mounting appurtenances.

Axle (bogie) - two or more axles mounted in tandem in a frame so as to divide the load between the axles and permit vertical oscillation of the wheels.

Ballast - weight used to supplement the weight of the machine in providing stability for lifting working loads (the term ballast is normally associated with locomotive cranes).

Base, anchor bolt - a crane base that is bolted to a footing.

Base, expendable - for static-mounting cranes, a style of bottom mast section or member that is cast into a concrete footing block; all or part of this component is lost to future installations.

Base, fixed - a crane base that does not travel. It may be expendable, knee braced, or anchor bolted.

Base (mounting) - the traveling base on which the rotating superstructure of a locomotive or crawler crane is mounted.

Base, tower crane - the lowermost supporting component of the crane.

Base, travel - a crane base that is a ballasted platform mounted on trucks that ride along rails.

Boom (crane) - a member hinged at the rotating superstructure and used for supporting the existing tackle.

Boom angle - the angle above or below horizontal of the longitudinal axis of the base boom section.

Boom hoist mechanism - means for supporting the boom and controlling the boom angle.

Boom point - the outer extremity of the crane boom, containing the hoist sheave assembly.

Boom point sheave assembly - an assembly of sheaves and pin built as an integral part of the boom point.

Boom stop - a device used to limit the angle of the boom at the highest recommended position.

Brake - a device used for retarding or stopping motion.

Brace, tower - a structural attachment placed between a crane tower and an adjacent structure to pass loads to the adjacent structure and permit the crane to be erected to greater than free standing height.

Buffer - an energy absorbing device for reducing impact when a moving crane or trolley reaches the end of its permitted travel.

Cab - a housing which covers the rotating superstructure machinery, or the operator's or driver's station.

Climbing frame - a frame used with climbing cranes to transmit operational and climbing reactions to the host building frame.

Climbing ladder - a steel member with crossbars (used in parts) suspended from a climbing frame and used as jacking support points when some cranes climb.

Clutch - a means for engagement or disengagement of power.

Commercial truck vehicle - a commercial motor vehicle designed primarily for the transportation of property in connection with business and industry.

Counterweight - weight used to supplement the weight of the machine in providing stability for lifting working loads.

Counterweight jib - a horizontal member of a crane on which the counterweights and usually the hoisting machinery are mounted.

Crane carrier - the undercarriage of a wheel-mounted crane specifically designed for transporting the rotating crane superstructure. It may or may not provide its own travel mechanism. It is distinguished from a commercial truck vehicle in that it is not designed to transport personnel, materials, or equipment other than the crane-rotating superstructure.

Cross-over points - in multiple layer spooling of rope on a drum, those points of rope contact where the rope crosses the preceding rope layer.

Designated - selected or assigned by the employer or the employer's representative as being competent to perform specific duties.

Drum - the cylindrical member around which a rope is wound for lifting and lowering the load or boom.

Dynamic (loading) - loads introduced into the machine or its components due to accelerating or decelerating forces.

Flange point - a point of contact between rope and drum flange where the rope changes layers.

Free standing height - that height of a crane which is supported by the tower (mast) alone without assistance from braces, guys, or other means.

Gage, track - the horizontal distance between two rails measured perpendicular to the direction of travel.

Gantry (A-frame) - a structural frame, extending above the superstructure, to which the boom support ropes are reeved.

High strength (traction) bolts - high strength tensile bolts used in the assembly of crane sections. The bolts are installed in tension by torquing or other means at a level greater than that produced by in-or out-of-service loads for the purpose of reducing the likelihood of bolt fatigue failure.

Hoist mechanism - a hoist drum and rope reeving system used for lifting and lowering loads.

Jib - an extension attached to the boom point to provide added boom length for lifting specified loads. The jib may be in line with the boom or offset to various angles in the vertical plane of the boom.

Jib backstop - a device which will restrain the jib from turning over backward.

Job site - work area defined by the construction contract.

Limiting device - a mechanical device which is operated by some part of a power driven machine or equipment to control loads or motions of the machine or equipment.

Load (working) - the external load in pounds (kilograms) applied to the crane, including the weight of load-attaching equipment such as lower load block, shackles, and slings.

Load block, lower - the assembly of hook or shackle, swivel, sheaves, pins, and frame suspended by the hoisting ropes.

Load block, upper - the assembly of shackle, swivel, sheaves, pins, and frame suspended from the boom point.

Load ratings - crane ratings in pounds (kilograms) established by the manufacturer.

Mast (boom) - a frame hinged at or near the boom hinge for use in connection with supporting a boom. The head of the mast is usually supported and raised or lowered by the boom hoist ropes.

Mast (jib) - a frame hinged at or near the boom point for use in connection with supporting a jib.

Normal operating conditions.

Cab- or station-operated cranes - conditions during which a crane is performing functions within the manufacturer's operating recommendations. Under these conditions, the operator is at the operating control devices on the crane, and no other persons except those appointed are to be on the crane.

Ground- or floor-operated cranes - conditions during which a crane is performing functions within the manufacturer's operating recommendations. Under these conditions, the operator is at the operating control devices that are mounted to the crane but operated with the operator off the crane, and no other persons except those appointed are to be on the crane.

Remote-operated cranes - conditions during which a crane is performing functions within the manufacturer's operating recommendations. Under these conditions, the operator is at the operating control devices that are mounted to any part of the crane, and no other persons except those appointed are to be on the crane.

Out-of-service - the condition of a crane when unloaded, without power and with the controls unattended and prepared to endure winds above the in-service level.

Outriggers - extendable or fixed members attached to the mounting base, which rest on supports at the outer ends used to support the crane.

Pawl (dog) - a device for positively holding a member against motion in one or more directions.

Payload - that load or loads being transported by the commercial truck chassis from place to place.

Pendant - a rope or strand of specified length with fixed end connections.

Pitch diameter - the diameter of a sheave or rope drum measured at the center line of the rope.

Power-controlled lowering - a system or device in the power train, other than the load hoist brake, which can control the lowering rate of speed of the load hoist mechanism.

Qualified person - a person who, by possession of a recognized degree or certificate of professional standing, or who, by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work.

Radius (load) - the horizontal distance from a projection of the axis of rotation to the base of the crane, before loading, to the center of the vertical hoist line or tackle with load applied.

Rail clamp - a tong-like metal device mounted on a locomotive crane car, which can be connected to the track.

Reeving - a rope system in which the rope travels around drums and sheaves.

Remote control station - a location, not on the crane, from which the operator can control all the crane movements.

Repetitive pickup point - when operating on a short cycle operation, the rope being used on a single layer and being spooled repetitively over a short portion of the drum.

Rope - refers to wire rope unless otherwise specified.

Rotation resistant rope - a wire rope consisting of an inner layer of strand laid in one direction covered by a layer of strand laid in the opposite direction. This has the effect of counteracting torque by reducing the tendency of the finished rope to rotate.

Running rope - a rope which travels around sheaves or drums.

Shall - this word indicates that the rule is mandatory and must be followed.

Service, light - service that involves irregular operation with loads generally about one-half or less of the rated load; a service crane at a storage yard or building site would be an example.

Service, normal - service that involves operating occasionally at rated load but normally at less than eighty-five percent of the rated load and not more than ten lift cycles per hour except for isolated instances; a crane used for concrete placement at a building site would be an example.

Service, heavy - service that involves operating at eighty-five percent to one hundred percent of the rated load or in excess of ten lift cycles per hour as a regular specified procedure; some cranes operating at material yards or in industrial applications may fall into this category.

Sheave - a grooved wheel or pulley used with a rope to change the direction and point of application of a pulling force.

Should - this word indicates that the rule is a recommendation, the advisability of which depends on the facts in each situation.

Side loading - a load applied to an angle to the vertical plane of the boom.

Stabilizer - stabilizers are extendable or fixed members attached to the mounting base to increase the stability of the crane, but which may not have the capability of relieving all of the weight from wheels or tracks.

Standby crane - a crane which is not in regular service but which is used occasionally or intermittently as required.

Standing (guy) rope - a supporting rope which maintains a constant distance between the points of attachment to the two components connected by the rope.

Structural competence - the ability of the machine and its components to withstand the stresses imposed by applied loads.

Superstructure - the rotating upper frame structure of the machine and the operating machinery mounted thereon.

Swing - rotation of the superstructure for movement of loads in a horizontal direction about the axis of rotation.

Swing mechanism - the machinery involved in providing rotation of the superstructure.

Swivel - a load carrying member with thrust bearings to permit rotation under load in a plane perpendicular to the direction of the load.

Swiveling - the rotation of the load attachment portion (hook or shackle) of a load block (lower) or hook assembly about its axis of suspension in relation to the load line(s).

Tackle - an assembly of ropes and sheaves arranged for lifting, lowering, or pulling.

Telescoping boom - consists of a base boom from which one or more boom sections are telescoped for additional length.

Telescoping (tower crane) - a process whereby the height of a traveling or fixed base crane is increased typically by raising the inner tower and then adding sections at the top of the outer tower; there are also cranes that are telescoped by adding to the inner tower from below.

Tower (mast) - a vertical structural frame consisting of columns and bracing capable of supporting an upperstructure with its working and dynamic loads and transmitting them to the supporting surface or structure.

Traction (high strength) bolts - see high strength bolts.

Transit - the moving or transporting of a crane from one job site to another.

Travel - the function of the machine moving under its own power from one location to another on a job site.

Trolley - the device that travels along the load jib and contains the upper load block.

Two-blocking - the condition in which the lower load block or hook assembly comes in contact with the upper load block or boom point sheave assembly.

Weathervaning - wind induced rotation of a crane upperstructure, when out-of-service, to expose minimal surface area to the wind.

Wedge - a tapered wood or steel device used to provide stability to cranes during use as a climber. When the wedges are tightened against the four main legs of the tower, they convert overturning moments into horizontal forces to be resisted by the floor framing or slab.

Wheel base - the distance between centers of front and rear axles. For a multiple axle assembly the axle center for wheel base measurement is taken as the midpoint of the assembly.

Whipline (runner or auxiliary) - a secondary rope system usually of lighter load capacity than that provided by the main rope system.

Winch head - a power driven spool for handling of loads by means of friction between fiber or wire rope and the spool.

(2) General requirements.

- (a) The employer shall comply with the manufacturer's specifications and limitations applicable to the operation of any and all cranes and derricks. Where manufacturer's specifications are not available the limitations assigned to the equipment shall be based on the determinations of a qualified engineer, competent in this field and such determinations will be appropriately documented and recorded. Attachments used with cranes shall not exceed the capacity, rating, or scope recommended by the manufacturer.
- (b) Rated load capacities, and recommended operating speeds, and special hazard warnings, or instruction, shall be conspicuously posted on all equipment. Instructions or warnings shall be visible to the operator while at the control station.
- (c) Hand signals to crane and derrick operators shall be those prescribed by the applicable ANSI standard for the type of crane in use. An illustration of the signals shall be posted at the job site.
- (d) The employer shall designate a competent person who shall inspect all machinery and equipment prior to each use, and periodically during use to make sure it is in safe operating condition. Any deficiencies shall be repaired, or defective parts replaced, before continued use.
- (e) A thorough, annual inspection of the hoisting machinery shall be made by a competent person, or by a government or private agency recognized by the department. The employer shall maintain a permanent record of the dates and results of all inspections for each hoisting machine and piece of equipment.

- (f) A tag line or guide rope shall be used on all loads that swing freely. Guide ropes or tag lines shall be held by experienced persons.
 - (g) Care shall be taken to guard against injury to workers, or damage to scaffolds or buildings, from swinging loads.
 - (h) The operator shall avoid carrying loads over people.
 - (i) When work is stopped or when the derrick is not in operation, the boom shall be lowered to a horizontal position or tied in place to prevent it whipping with the wind or other external force.
 - (j) Only authorized personnel shall make sling hitches on loads.
 - (k) Workers shall not be allowed to ride on loads handled by derricks.
 - (l) Operators shall observe signals only from duly authorized persons. Under no circumstances shall a load be moved until the signal is received from authorized personnel.
 - (m) Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or other moving parts or equipment shall be guarded if such parts are exposed to contact by employees, or otherwise create a hazard. Guarding shall meet the requirements of chapter 296-806 WAC, Machine safety.
 - (n) A minimum distance of thirty inches clearance shall be maintained between the swing radius of the greatest extension of the crane superstructure or counterweights and a stationary object, including the crane itself, while the crane is in operation. When this clearance cannot be maintained, suitable barricades or safeguards shall be used to isolate the pinch point hazard area.
 - (o) All exhaust pipes shall be guarded or insulated where contact by employees, in the performance of normal duties, is possible.
- (3) Additional requirements.
- (a) Whenever internal combustion engine powered equipment exhausts in enclosed spaces, tests shall be made and recorded to see that employees are not exposed to unsafe concentrations of toxic gases or oxygen deficient atmospheres. (See chapter 296-62 WAC, the general occupational health standards and chapter 296-841 WAC, Identifying and controlling respiratory hazards.)

- (b) All cab glazing shall be safety glazing material. Windows shall be provided in the front and on both sides of the cab or operator's compartment with visibility forward and to either side. Visibility forward shall include a vertical range adequate to cover the boom point at all times. The front window may have a section which can be readily removed or held open, if desired. If the section is of the type held in the open position, it shall be secured to prevent inadvertent closure. A windshield wiper should be provided on the front window.
- (c)
 - (i) Where necessary for rigging or service requirements, a ladder or steps shall be provided to give access to a cab roof.
 - (ii) On cranes, guardrails, handholds and steps shall be provided for easy access to the car and cab in accordance with chapter 296-155 WAC, Part C-1 and Part J.
 - (iii) Platforms and walkways shall have anti-skid surfaces.
- (d) Fuel tank filler pipe shall be located in such a position, or protected in such manner, as to not allow spill or overflow to run onto the engine, exhaust, or electrical equipment of any machine being fueled.
 - (i) An accessible fire extinguisher of 5BC rating, or higher, shall be available at all operator stations or cabs of equipment.

Note: For additional requirements relating to portable fire extinguishers see WAC 296-800-300.

- (ii) All fuels shall be transported, stored, and handled to meet the rules of Part D of this chapter. When fuel is transported by vehicles on public highways, department of transportation rules concerning such vehicular transportation are considered applicable.
- (e) Except where electrical distribution and transmission lines have been deenergized and visibly grounded at point of work or where insulating barriers, not a part of or an attachment to the equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the following:
 - (i) For lines rated 50 kV. or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet;
 - (ii) For lines rated over 50 kV., minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV. over 50 kV., or twice the length of the line insulator, but never less than 10 feet;
 - (iii) In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltages less than 50 kV., and 10 feet for voltages over 50 kV. up to and including 345 kV., and 16 feet for voltages up to and including 750 kV;

- (iv) A person shall be designated to observe clearance of the equipment and give timely warning to insure that the required separation is maintained for all operations where it is difficult for the operator to maintain the desired clearance by visual means;
 - (v) Cage-type boom guards, insulating links, or proximity warning devices may be used on cranes, but the use of such devices shall not alter the requirements of any other regulation of this part even if such device is required by law or regulation;
 - (vi) Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded;
 - (vii) Prior to work near transmitter tower where an electrical charge can be induced in the equipment or materials being handled, the transmitter shall be deenergized or tests shall be made to determine if electrical charge is induced on the crane.
- (f) The following precautions shall be taken when necessary to dissipate induced voltage:
- (i) The equipment shall be provided with an electrical ground directly to the upper rotating structure supporting the boom; and
 - (ii) Ground jumper cables shall be attached to materials being handled by boom equipment when electrical charge is induced while working near energized transmitters. Crews shall be provided with nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load.
 - (iii) Combustible and flammable materials shall be removed from the immediate area prior to operations.
- (g) No modifications or additions which affect the capacity or safe operation of the equipment shall be made by the employer without the manufacturer's or a qualified engineer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals, shall be changed accordingly. In no case shall the original safety factor of the equipment be reduced.
- (h) The employer shall comply with Power Crane and Shovel Association, Mobile Hydraulic Crane Standard No. 2.
- (i) Sideboom cranes mounted on wheel or crawler tractors shall meet the requirements of SAE J743a-1964.

- (4) Crawler, locomotive, and truck cranes.
- (a) All jibs shall have positive stops to prevent their movement of more than 5° above the straight line of the jib and boom on conventional type crane booms. The use of cable type belly slings does not constitute compliance with this standard.
 - (b) All crawler, truck or locomotive cranes in use shall meet the applicable requirements for design, inspection, construction, testing, maintenance and operation as prescribed in the ANSI B30.5-1989, Safety Code for Crawler, Locomotive and Truck Cranes.
- (5) Tower cranes.
- (a) Tower cranes shall be erected, jumped and dismantled under the immediate supervision of a competent person, designated by the employer.
 - (b) Tower cranes shall be erected, maintained and used in accordance with the manufacturer's specifications, recommendations and procedures. All modifications shall be approved by the manufacturer and engineered by a professional engineer. The safety factors shall not be reduced by any modifications. The crane plates and charts shall be changed to reflect any modifications made.
 - (c) A professional engineer shall certify that the crane foundations and underlying soil are adequate support for the tower crane with its maximum overturning movement.
 - (d) Tower cranes shall be positioned whereby they can swing 360° without either the counterweight or jib striking any building, structure or other object, except:
 - (i) If the crane can strike an object or another crane, suitable limit switches shall be installed which will prohibit contact with such objects, or;
 - (ii) Direct voice communications shall be established between any operator of the tower crane(s) involved and a signaller 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.
 - (iii) A secondary means of positive communications shall be established as a back-up for possible direct voice communication failure.
 - (iv) Radio communication systems without tone coded squelch are prohibited. Citizens band radios shall not be used as a means of communications for tower cranes.

- (e) Prior to installing a climbing tower crane within an existing building or new construction, a structural engineer shall certify that the building is designed to withstand the torque and floor loading created by the crane to be installed.
- (f) Tower cranes erected on a new foundation shall be tested in accordance with ANSI B30.3-1990 Chapter 3-1.
 - (i) The test shall consist of suspending a load of not less than 110% of the rated capacity for 15 minutes. The load shall be suspended from the furthest point of the length of boom (jib) to be used. The results of this test shall be within the manufacturer's recommendations and/or specifications.
 - (ii) A record of each test shall be made and signed by the person responsible for conducting the test. Such records shall be maintained on the construction site for the duration of the construction work for which it was erected and subsequently made a part of the firm's permanent equipment records. Records shall be made available to authorized representatives of the department, upon request.
- (g) A capacity chart shall be furnished by each crane manufacturer which shall include a full and complete range of crane load ratings at all stated operating radii for each allowable speed and each recommended counterweight load.
 - (i) Such chart shall be posted in the operator's cab or at the remote control stand in use. In lieu of the chart at the remote control stand, a minimum of two weight capacity signs shall be affixed to the jib or boom.
 - (ii) The chart shall be visible and readable to the operator while at the normal operating position.
- (h) Operating controls shall be properly marked to indicate the function of the controls in each position.
- (i) An operating and maintenance manual written in the English language shall be provided with each tower crane.
- (j) Limit switches shall be installed and shall be kept properly adjusted. They shall be protected or isolated in a manner which will prevent unauthorized tampering. Limit switches shall provide the following functions:
 - (i) Safely limit the travel of the trolley to prevent it from hitting the outer end of the jib.
 - (ii) Limit the upward travel of the load block to prevent two-blocking.
 - (iii) Lower over travel limiting devices shall be provided for all load hoists where the hook area is not visible to the operator.

- (iv) Limit the load being lifted in a manner whereby no more than 110% of the maximum rated load can be lifted or moved.
- (k) The crane shall not be used to pull vehicles of any type, remove piling, loosen form work, pull away loads which are attached to the ground or walls, or for any operation other than the proper handling of freely suspended loads.
- (l) When the operator may be exposed to the hazard of falling objects, the tower crane cab and/or remote control station shall have adequate overhead protection.
- (m) The operator shall be protected from the weather. If enclosed cabs are provided they shall provide clear visibility in all directions and glass shall be approved safety glass or the equivalent.
- (n) An approved and safe means shall be provided for access to operator's cab and machinery platform.
- (o) When necessary for inspection or maintenance purposes, ladders, walkways with railing or other devices shall be provided.
- (p) Each tower crane shall be provided with a slewing brake capable of preventing the jib or boom from rotating in either direction and stopping the rotation of the jib or boom while loaded, when desired. Such brake shall have a holding device which, when set, will hold the jib or boom in a fixed location without additional attention of the operator. When the crane is out of operation, the jib or boom shall be pointed downwind and the slewing brake shall be released so as to permit the jib or boom to weathervane, providing the jib or boom has a clear 360 degree rotation. Where a 360 degree rotation is not provided, the jib or boom shall be pointed downwind from the prevailing wind and the slewing brake set.
- (q) Each tower crane shall be provided with a braking system on the trolley capable of stopping and holding the trolley in any desired position while carrying a maximum load. This brake shall be capable of being locked in a fixed location without additional attention of the operator. An automatic brake or device shall be installed which will immediately stop and lock the trolley in position in the event of a breakage of the trolley rope.
- (r) All electrical equipment shall be properly grounded and protection shall be provided against lightning.
- (s) When the operator is actually operating the crane, the operator shall remain in a stationary position.
- (t) All crane brakes shall automatically set in event of power failure. Swing brakes shall also function in this manner or be capable of being set manually.

- (u) Climbing jack systems used for raising a tower crane shall be equipped with over-pressure relief valves, direct-reading pressure gauges, and pilot-operated hydraulic check valves installed in a manner which will prevent jack from retracting should a hydraulic line or fitting rupture or fail.
 - (v) During periods of high winds or weather affecting visibility, i.e., fog, etc., only loads shall be handled that are consistent with good safety practices. Good safety practices shall be mutually agreed upon by the operator and the person in charge of the construction job, with due consideration given to manufacturer's specifications and recommendations.
 - (w) Counterweights shall be securely fastened in place and shall not exceed the weight as recommended by the manufacturer for the length of jib being used. However, an amount of counterweight as recommended by the manufacturer shall be used.
 - (x) Tower cranes shall be inspected and maintained in accordance with the manufacturer's recommendations or more frequently if there is reason to suspect a possible defect or weakening of any portion of the structure or equipment.
 - (y) Guy wires, wedges, braces or other supports shall be inspected at the beginning and at midpoint of each working shift to ascertain that they are functioning as intended.
- (6) Additional tower crane requirements.
- (a) An approved method must be instituted for transmitting signals to the operator. Standard hand signals for crane operations must be used, whenever possible; however, if conditions are such that hand signals are ineffective, radio-controlled or electric-whistle signal or two-way voice communication must be used. (See WAC 296-155-525(5)(d).)
 - (b) Tower cranes shall not be erected or raised when the wind velocity at the worksite exceeds 20 m.p.h. or that specified by the manufacturer.
 - (c) Tower crane operators shall be trained and experienced in tower crane operations; however, for gaining experience, persons may operate the tower crane if under the immediate supervision of an experienced operator.
 - (d) Adequate clearance shall be maintained between moving and rotating structures of the crane and fixed objects to allow the passage of employees without harm.
 - (e) Employees required to perform duties on the horizontal boom of hammerhead tower cranes shall be protected against falling by guardrails or by a full body harness and lanyards attached to crane or to lifelines in conformance with Part C-1 of this chapter.

- (f) Buffers shall be provided at both ends of travel of the trolley.
 - (g) Cranes mounted on rail tracks shall be equipped with limit switches limiting the travel of the crane on the track and stops or buffers at each end of the tracks.
 - (h) All hammerhead tower cranes in use shall meet the applicable requirements for design, construction, installation, testing, maintenance, inspection, and operation as prescribed by the manufacturer.
 - (i) Access ladders inside the telescoping sections of tower cranes are exempt from those sections of the safety standards pertaining to cleat length and cleat spacing, but shall conform to manufacturer's recommendations and specifications.
- (7) Overhead and gantry cranes.
- (a) The rated load of the crane shall be plainly marked on each side of the crane, and if the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its load block, and this marking shall be clearly legible from the ground or floor.
 - (b) Bridge trucks shall be equipped with sweeps which extend below the top of the rail and project in front of the truck wheels.
 - (c) Except for floor-operated cranes, a gong or other effective audible warning signal shall be provided for each crane equipped with a power traveling mechanism.
 - (d) All overhead and gantry cranes in use shall meet the applicable requirements for design, construction, installation, testing, maintenance, inspection, and operation as prescribed in ANSI B30.2.0-1990, Safety Code for Overhead and Gantry Cranes.
- (8) Derricks. All derricks in use shall meet the applicable requirements for design, construction, installation, inspection, testing, maintenance, and operation as prescribed in American National Standard Institute B30.6-1990, Safety Code for Derricks.
- (9) Floating cranes and derricks.
- (a) Mobile cranes mounted on barges.
 - (i) When a mobile crane is mounted on a barge, the rated load of the crane shall not exceed the original capacity specified by the manufacturer.
 - (ii) A load rating chart, with clearly legible letters and figures, shall be provided with each crane, and securely fixed at a location easily visible to the operator.
 - (iii) When load ratings are reduced to stay within the limits for list of the barge with a crane mounted on it, a new load rating chart shall be provided.

- (iv) Mobile cranes on barges shall be positively secured.
 - (b) Permanently mounted floating cranes and derricks.
 - (i) When cranes and derricks are permanently installed on a barge, the capacity and limitations of use shall be based on competent design criteria.
 - (ii) A load rating chart with clearly legible letters and figures shall be provided and securely fixed at a location easily visible to the operator.
 - (iii) Floating cranes and floating derricks in use shall meet the applicable requirements for design, construction, installation, testing, maintenance, and operation as prescribed by the manufacturer.
 - (c) Protection of employees working on barges. The employer shall comply with the applicable requirements for protection of employees as specified in WAC 296-155-630.
- (10) Mobile cranes and excavation machines.
- (a) In all power driven shovel operations the person in charge shall issue instructions necessary to prevent accidents, to detect and correct unsafe acts and dangerous conditions, and to enforce all safety rules and regulations.

The person in charge shall also issue instructions on the proper method of using tools and handling material.
 - (b) Where the ground is soft or uneven, timbering and planking shall be used to provide firm foundation and distribute the load.
 - (c) In case of a breakdown, the shovel shall be moved away from the foot of the slope before repairs are made.
 - (d) All persons shall keep away from the range of the shovel's swing and shall not be permitted to stand back of the shovel or in line with the swing of the dipper during operation or moving of shovel.
 - (e) Unauthorized persons shall not be allowed on the shovel during operations, and the operator shall not converse with other persons while operating machine.
 - (f) The shovel dipper shall rest on the ground or on blocking during shut down periods.
 - (g) Shovels shall be inspected daily and all defects promptly repaired.
 - (h) All rubber tired mobile cranes shall be equipped with outriggers and sufficient blocking to properly stabilize crane while operating.

- (i) Rubber tired mobile cranes shall be equipped with rear view mirrors.
- (j) Positive boom stops shall be provided on all mobile cranes of the wheel and crawler type.
- (k) Length of a crane boom and amount of counterweight shall not exceed manufacturer's rated capacity for equipment involved; except on isolated cases where permission is granted by the department.
- (l) On all cranes where wedge brackets are used as terminal connections, the proper size wedge shall be used.
- (m) On all mobile cranes, the hoist and boom drums shall be provided with a positive operated pawl or dog which shall be used in addition to the brake to hold the load and boom when they are suspended. Counterweight operated dogs are prohibited.
- (n) Oiling and greasing shall be done under safe conditions with machine at rest, except when motion of machine is necessary.
- (o) All steps, running boards, and boom ladder shall be of substantial construction and in good repair at all times.
- (p) Operators shall not leave the cab while master clutch is engaged.
- (q) Fire extinguishers shall be readily accessible and within reach of operator at all times.
- (r) All shovel and crane cabs shall be kept clean and free of excess oil and grease on floor and machinery. Oily and greasy rags shall be disposed of immediately after use and not allowed to accumulate.
- (s) Tools shall not be left on the cab floor. Spare cans of oil or fuel, and spare parts, shall not be stored in cabs, except in approved racks provided for that purpose.
- (t) Mats or planking shall be used in moving shovels or cranes over soft or uneven ground.
- (u) Cranes or shovels setting on steep grades shall be securely blocked or secured with a tail hold.
- (v) Smoking shall be prohibited while fueling or oiling machines.
- (w) Gasoline powered motors shall be stopped during refueling.
- (x) Handling of movable feed line (bologna) shall be accomplished with insulated hooks and lineman's rubber gloves.
- (y) Where cables cross roads they shall be elevated or placed in a trench.

- (z) On all power shovels, including back-hoe types, of one-half cubic yard capacity or over, and on all dragline cranes or all-purpose cranes of the crawler or wheel type, two persons shall constitute the minimum working crew. It is mandatory that one be a qualified operator of the equipment in use. The job title of the other crew member may be oiler, rigger, signal person, or a laborer. The primary purpose of the second crew member is to signal the operator when the operator's vision is impaired or obscured and to be on-hand in case of emergency.
 - (i) Second-crew persons shall be properly trained in their second-person required skills.
 - (ii) The second crew member shall be close enough to the machine in operation to be aware of any emergency, if one arises, and to assure the machine is operated with necessary and appropriate signals to the operator.

WAC 296-155-526 Crane attached personnel platforms.

- (1) Scope, application, and definitions.
 - (a) Scope and application. This standard applies to the design, construction, testing, use and maintenance of personnel platforms, and the hoisting of personnel platforms attached to the boom of cranes. Crane attached personnel platforms must meet the applicable requirements for design, inspection, construction, testing, maintenance, and operation as prescribed in the ASME B30.23-1998 safety code for Personnel Lifting Systems.
 - (b) Definitions. For the purposes of this section, the following definitions apply:
 - “**Failure**” means load refusal, breakage, or separation of components.
 - “**Lift**” (or lifting) refers to all crane functions such as hoisting, lowering, swinging, booming in and out or up and down, or moving an attached personnel platform.
 - “**Load refusal**” means the point where the ultimate strength is exceeded.
 - “**Runway**” means a firm, level surface, designed, prepared, and designated as a path of travel for the weight and configuration of the crane being used to lift and travel with the attached crane platform. An existing surface may be used as long as it meets these criteria.
- (2) General requirements. The use of a crane to hoist employees on a personnel platform is prohibited, except when the erection, use, and dismantling of conventional means of reaching the worksite, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform or scaffold, would be more hazardous, or is not possible because of structural design or worksite conditions.

- (3) Cranes requirements.
- (a) All lifting operations must be performed in accordance with the manufacturer's requirements.
 - (b) Hoist lines must be removed and stowed or an anti two-block device installed.
 - (c) Lifting of the personnel platform must be performed in a slow, controlled manner with no sudden movements of the crane or the platform.
 - (d) Load and boom hoist drum brakes, swing brakes, and locking devices, such as pawls or dogs, must be engaged when the personnel platform is occupied in a stationary working position.
 - (e) The crane must be uniformly level within one percent of level grade and located on firm footing. Cranes equipped with outriggers must follow manufacturer's requirements for use.
 - (f) The total weight of the loaded personnel platform must not exceed fifty percent of the rated capacity for the radius and configuration of the crane as required by load chart specifications.
 - (g) The use of machines having live booms (booms in which lowering is controlled by a brake without aid from other devices which slow the lowering speeds) is prohibited.
- (4) Instruments and components.
- (a) Cranes with variable angle booms must be equipped with a boom angle indicator, readily visible to the operator.
 - (b) Cranes with telescoping booms must be equipped with a device that at all times clearly indicates the boom's extended length to the operator. An accurate determination of the load radius, to be used during the lift, must be made before hoisting personnel.
- (5) Personnel platforms - design criteria.
- (a) A qualified engineer must design the personnel platform and attachment system.
 - (b) The attachment system must be designed to minimize tipping of the platform to no more than ten degrees from horizontal.
 - (c) The platform design must incorporate a motion control device that stabilizes the platform while being held in a working position.

- (d) The personnel platform, excluding the guardrail system and body harness anchorages, must be capable of supporting, without failure, its own weight and at least five times the maximum intended load-based on a minimum allowance of five hundred pounds for the first person with light tools, and an additional two hundred fifty pounds for each additional person.
 - (e) Criteria for guardrail systems contained in chapter 296-155 WAC, Part K and body harness anchorages are contained in chapter 296-155 WAC, Part C will be followed.
 - (f) A plate or other permanent marking which indicates the weight of the platform and its rated load capacity or maximum intended load, must be conspicuously posted on the personnel platform.
- (6) Platform specifications.
- (a) Each personnel platform must be equipped with a guardrail system which meets the requirements of chapter 296-155 WAC, Part K. The personnel platform must also be enclosed at least from the toeboard to mid-rail with either solid construction or expanded metal having openings no greater than one-half inch (1.27 cm).
 - (b) A grab rail must be installed inside the entire perimeter of the personnel platform.
 - (c) Access gates, if installed, must not swing outward during hoisting.
 - (d) Access gates, including sliding or folding gates, must be equipped with a restraining device to prevent accidental opening.
 - (e) Employees must have sufficient headroom to stand upright on the platform.
 - (f) All rough edges exposed to contact by employees must be surfaced or smoothed in order to prevent injury to employees from punctures or lacerations.
 - (g) A qualified welder familiar with the weld grades and types must perform all welding of the personnel platform and its components, with material specified in the platform design.
- (7) Personnel platform loading.
- (a) The personnel platform must not be loaded in excess of its rated load capacity.
 - (b) The number of employees on the personnel platform must not exceed the number required for the work to be performed.

- (c) Personnel platforms must be used only for employees, tools, and materials necessary to do the work. Personnel platforms will not be used to hoist materials or tools without an employee on the platform (except to perform a trial lift or proof test as described in subsection (8) of this section).
 - (d) Materials and tools must be secured to prevent displacement.
 - (e) Materials and tools must be evenly distributed, within the confines of the platform, while work is being performed.
 - (f) Employees must keep their feet in contact with the floor of the platform at all times.
- (8) Prelift meeting.
- (a) A meeting attended by the crane operator, signal person(s) (if necessary for the lift), employee(s) to be lifted, and the person responsible for the task to be performed must be held to review the appropriate requirements of this section and the procedures to be followed.
 - (b) This meeting must be held before the trial lift at each new work location, and must be repeated for any employees newly assigned to the operation.
- (9) Trial lift, inspection, and proof testing.
- (a) A trial lift with an unoccupied personnel platform loaded at least to the anticipated lift weight must be made from ground level, or any other location where employees will enter the platform, to each location at which the personnel platform is to be hoisted and positioned. This trial lift must be performed immediately prior to allowing employees on the platform. The operator must determine that:
 - All systems, controls, and safety devices are activated and functioning properly;
 - No interferences exist; and
 - All configurations necessary to reach work locations will allow the operator to remain under the fifty percent limit of the crane's rated capacity.
 - Materials and tools to be used during the actual lift must be loaded in the platform, as provided in subsection (7) of this section, for the trial lift.

Note: A single trial lift may be performed for all locations that are to be reached from a single set-up position.

- (b) The trial lift must be repeated:
 - Prior to hoisting employees whenever the crane is moved and set up in a new location, or returned to a previously used location.

- A meeting attended by the crane operator, signal person(s) (if necessary for the lift), employee(s) to be lifted, and the person responsible for the task to be performed must be held to review the appropriate requirements of this section and the procedures to be followed.
- (c) After the trial lift:
- But prior to hoisting personnel, the platform must be hoisted a few inches and inspected to ensure that it is secure and properly balanced.
 - A visual inspection of the crane, personnel platform, and the crane base support or ground must be conducted by a competent person to determine whether the testing has exposed any defect or produced any adverse effect upon any component or structure.
- (d) Deficiencies found during inspection, or operation, which create a safety hazard, must be corrected before hoisting personnel.
- (e) The platform must be proof tested:
- At each job site;
 - Prior to hoisting employees on the personnel platform; and
 - After any repair or modification.
- (i) For the proof test, one hundred twenty-five percent of the platform's rated capacity will be hoisted and held in a suspended position for five minutes. The proof test load must be evenly distributed on the platform.
- (ii) After each proof test a competent person must inspect the platform and rigging.
- (iii) Deficiencies found during proof testing must be corrected, and another proof test conducted. Employees must not be hoisted until a deficiency free proof test has been achieved.

Note: Proof testing may be done concurrently with the required trial lift.

- (10) Work practices.
- (a) Employees must keep all parts of the body inside the platform during raising, lowering, and positioning, except when performing the duties of a signal person.
 - (b) Before entering or exiting a personnel platform that is not landed, the platform must be secured to the structure where the work is to be performed, unless securing to the structure creates an unsafe situation.
 - (c) The crane operator must remain at the controls at all times when the platform is occupied.

- (d) Employee lifting must be promptly discontinued upon indication of any dangerous weather conditions.
- (e) Employees being lifted must remain in continuous sight of and in direct communication with the operator or signal person. Any disruption in communications will cause operations to be immediately discontinued. Signals to the operator will be in accordance with section 5-3.3, ASME B30.5 1994 and this section.
- (f) In situations where direct visual contact with the operator is not possible, or the use of a signal person may be hazardous for that person, direct communication alone, such as by radio, may be used. If a secure radio frequency is not available, hard-wired voice communication will be used. When using voice commands, there will be a continuous pause between commands of one-second duration per ten feet to the desired lift height or any contact point.
- (g) The following voice commands are recommended for use:
 - Boom up.
 - Boom down.
 - Swing left.
 - Swing Right.
 - Extend out.
 - Retract in.
 - Stop.

Note: If special voice commands are required to perform the lift safely, they must be mutually agreed upon between the designated signal person and the crane operator before the lift procedure starts.

- (h) Employees on a personnel platform must use a full body harness system with lanyard appropriately attached to a structural member within the personnel platform capable of supporting a fall impact for employees using the anchorage as specified in chapter 296-155 WAC, Part C.
 - (i) Lifts must not be made on the crane's load lines while personnel are working from an attached platform.
- (11) Traveling.
- (a) Lifting of employees while the crane is traveling is prohibited, except for portal, tower and locomotive cranes, or where the employer demonstrates that there is no less hazardous way to perform the work.
 - (b) Under any circumstances where a crane would travel while lifting personnel, the employer must implement the following procedures to safeguard employees:
 - (i) Crane travel must be restricted to a fixed track or runway;

- (ii) Travel must be limited to the load radius of the boom used during the lift; and
- (iii) The boom must be parallel to the direction of travel.
- (c) A complete trial run must be performed before employees are allowed to occupy the platform.

Note: This trial run can be performed concurrent with the trial lift required by subsection (8) of this section.

- (d) If travel is done with a rubber tired-carrier, the condition and air pressure of the tires must be checked. The chart capacity for lifts on rubber must be used for application of the fifty percent reduction of rated capacity. Notwithstanding the requirements of subsection (3) of this section, outriggers may be partially retracted as necessary for travel.
- (12) Communication. When using verbal signals, clarity and precision are essential for safe operation. Operators must be able to communicate with others at the worksite sufficiently to understand the signs, notices, operation instructions, and the signal code to be used.

WAC 296-155-527 Appendix A to WAC 296-155-525.

Due to crane design configuration to maintain mobility, sheave diameters and rope, design factors are limited. Because of these limited design parameters, inspection to detect deterioration in accordance with subsections below and timely replacement are essential.

- (1) Frequent inspection.
 - (a) All running ropes in service should be visually inspected once each working day. A visual inspection shall consist of observation of all rope which can reasonably be expected to be in use during the day's operations. These visual observations should be concerned with discovering gross damage, such as listed below, which may be an immediate hazard:
 - (i) Distortion of the rope such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion. Loss of rope diameter in a short rope length or unevenness of outer strands should provide evidence that the rope or ropes must be replaced.
 - (ii) General corrosion.
 - (iii) Broken or cut strands.
 - (iv) Number, distribution and type of visible broken wires. (See subsection below for further guidance.)

- (v) Core failure in rotation resistant ropes. When such damage is discovered the rope shall be either removed from service or given an inspection as detailed in periodic inspection.
 - (b) Care shall be taken when inspecting sections of rapid deterioration such as flange points, crossover points and repetitive pickup points on drums.
 - (c) Care shall be taken when inspecting certain ropes such as the following:
 - (i) Rotation resistant ropes, because of their higher susceptibility to damage and increased deterioration when working on equipment with limited design parameters. The internal deterioration of rotation resistant ropes may not be readily observable.
 - (ii) Boom hoist ropes, because of the difficulties of inspection and the important nature of these ropes.
- (2) Periodic inspection.
- (a) The inspection frequency shall be determined by a qualified person and shall be based on such factors as expected rope life as determined by experience on the particular installation or similar installations, severity of environment, percentage of capacity lifts, frequency rates of operation, and exposure to shock loads. Inspections need not be at equal calendar intervals and should be more frequent as the rope approaches the end of its useful life. This inspection shall be performed at least annually.
 - (b) Periodic inspections shall be performed by a qualified person. This inspection shall cover the entire length of rope. Only the surface wires of the rope need be inspected. No attempt should be made to open the rope. Any deterioration resulting in an appreciable loss of original strength, such as described below, shall be noted and determination made as to whether further use of the rope would constitute a hazard:
 - (i) Points listed in subsection (1) of this section (Frequent inspection).
 - (ii) Reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires.
 - (iii) Severely corroded or broken wires at end connections.
 - (c) Care shall be taken when inspecting sections of rapid deterioration, such as the following:
 - (i) Sections in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited;

- (ii) Sections of the rope at or near terminal ends where corroded or broken wires may protrude.
- (3) Rope replacement.
- (a) No precise rules can be given for determination of the exact time for replacement of rope, since many variable factors are involved. Continued use in this respect depends largely upon good judgment by an appointed or authorized person in evaluating remaining strength in a used rope after allowance for deterioration disclosed by inspection. Continued rope operations depends upon this remaining strength.
 - (b) Conditions such as the following shall be sufficient reason for questioning continued use of the rope or increasing the frequency of inspection:
 - (i) In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay (for special conditions relating to rotation resistant rope refer to paragraph 5-3.2.1.1(d)(1)(b) ANSI\ASME B30.5 1989).
 - (ii) One outer wire broken at the point of contact with the core of the rope which has worked its way out of the rope structure and protrudes or loops out from the rope structure. Additional inspection of this section is required.
 - (iii) Wear of one-third the original diameter of outside individual wires.
 - (iv) Kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure.
 - (v) Evidence of any heat damage from any cause.
 - (vi) Reductions from nominal diameter of more than:
 - (A) 1/64 in. (0.4 mm) for diameters up to and including 5/16 in. (8.0 mm);
 - (B) 1/32 in. (0.8 mm) for diameters 3/8 in. (9.5 mm) to and including 1/2 in. (13.0 mm);
 - (C) 3/64 in. (1.2 mm) for diameters 9/16 in. (14.5 mm) to and including 3/4 in. (19.0 mm);
 - (D) 1/16 in. (1.6mm) for diameters 7/8 in. (22.0 mm) to and including 1 1/8 in. (29.0 mm);

- (E) 3/32 in. (2.4 mm) for diameters 1 1/4 in. (32.0 mm) to and including 1 1/2 in. (38.0 mm).
 - (vii) In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.
 - (c) Replacement rope shall have a strength rating at least as great as the original rope furnished or recommended by the crane manufacturer. Any deviation from the original size, grade, or construction shall be specified by a rope manufacturer, the crane manufacturer or a qualified person.
 - (d) Rope not in regular use. All rope which has been idle for a period of a month or more due to shutdown or storage of a crane on which it is installed shall be given an inspection before it is placed in service. This inspection shall be for all types of deterioration and shall be performed by an appointed or authorized person.
 - (e) Inspection records:
 - (i) Frequent inspection; no records required.
 - (ii) Periodic inspection: In order to establish data as a basis for judging the proper time for replacement, a dated report of rope condition at each periodic inspection shall be kept on file. This report shall cover points of deterioration. If the rope is replaced only that part need be recorded.
 - (f) A long-range inspection program should be established and should include records on the examination of ropes removed from service so that a relationship can be established between visual observation and actual condition of the internal structure.
- (4) Rope maintenance.
- (a) Rope should be stored to prevent damage or deterioration.
 - (b) Unreeling or uncoiling of rope shall be done as recommended by the rope manufacturer and with care to avoid kinking or inducing a twist.
 - (c) Before cutting a rope, seizings shall be placed on each side of the place where the rope is to be cut to prevent unlaying of the strands. On preformed rope, one seizing on each side of the cut is required. On nonpreformed ropes of 7/8 in. (22 mm) diameter or smaller, two seizings on each side of the cut are required, and for nonpreformed rope of 1 in. (26 mm) diameter or larger, three seizings on each side of the cut are required.
 - (d) During installation, care should be exercised to avoid dragging of the rope in dirt or around objects which will scrape, nick, crush, or induce sharp bends in it.

- (e) Rope should be maintained in a well lubricated condition. It is important that lubricant applied as part of a maintenance program shall be compatible with the original lubricant, and to this end, the rope manufacturer should be consulted; lubricant applied shall be of the type which does not hinder visual inspection. Those sections of rope which are located over sheaves or otherwise hidden during inspection and maintenance procedures require special attention when lubricating rope. The object of rope lubrication is to reduce internal friction and to prevent corrosion.
 - (f) When an operating rope shows greater wear at well-defined localized areas than on the remainder of the rope, rope life can be extended (in cases where a reduced rope length is adequate) by cutting off a section at the worn end, and thus shifting the wear to different areas of the rope.
- (5) Operating near electric power lines:
- (a) Cranes shall be operated so that no part of the crane or load enters into the danger zone.

Exceptions: The danger zone may be entered if the electrical distribution and transmission lines have been de-energized and visibly grounded at the point of work; or the danger zone may be entered if insulating barriers (not a part of nor an attachment to the crane) have been erected to prevent physical contact with the lines.

- (i) For lines rated 50 kV. or below, minimum clearance between the lines and any part of the crane or load (including handling appendages) shall be 10 feet (3 m).
- (ii) Caution shall be exercised when working near overhead lines because they can move horizontally or vertically due to wind, moving the danger zone to new positions.
- (iii) While in transit with no load and boom lowered, the clearance shall be as specified in WAC 296-155-525 (3)(e).
- (iv) A qualified signal person shall be assigned to observe the clearance when the crane moves to within a boom's length of the limits specified in WAC 296-155-525 (3)(e). The operator is not in the best position to judge distance between the power line and the crane or its protuberances.

- (b) If cage-type boom guards, insulating links, or proximity warning devices are used on cranes, such devices shall not be a substitute for the requirements of WAC 296-155-525 (3)(e), even if such devices are required by law or regulation. In view of the complex, invisible, and lethal nature of the electrical hazard involved, and to lessen the potential of false security, limitations of such devices, if used, shall be understood by operating personnel and tested in the manner and intervals prescribed by the manufacturer of the device. Compliance with WAC 296-155-525 (3)(e) is the recommended practice of this regulation in determining permissible proximity of the crane and its protuberances, including load, to electrical power lines.
 - (c) Before the commencement of operations near electrical lines, the person responsible for the job shall notify the owners of the lines or their authorized representatives, provide them with all pertinent information, and request their cooperation.
 - (d) Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities verify that it is not an energized line.
 - (e) Exceptions to this procedure, if approved by the owner of the electrical lines, may be granted by the administrative or regulatory authority if the alternate procedure provides protection and is set forth in writing.
 - (f) Durable signs shall be installed at the operator's station and on the outside of the crane warning that electrocution or serious bodily injury may occur unless a minimum clearance of 10 feet (3 m) is maintained between the crane or the load being handled and energized power lines. Greater clearances are required because of higher voltage as stated in WAC 296-155-525 (3)(e). These signs shall be revised when local jurisdiction requires greater clearances.
- (6) Site preparation and erection.
- (a) All load bearing foundations, supports, and rail tracks shall 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, should be designed to provide a moment resisting overturning equal to a minimum of 150% of the maximum crane overturning moment.
 - (b) Rails should be level and straight, unless specifically designed for curves or grades, and properly spaced for the crane trucks in accordance with the manufacturer's specifications. The track and support system should have sufficient rigidity to limit dynamic oscillations and deviations from plumb.

- (c) Rails shall be securely attached to the supporting surface in a manner capable of resisting the horizontal and vertical loads specified by the manufacturer. When applicable, provisions should be made for thermal expansion and contraction.
 - (d) Splices in rail tracks (bolted or welded) shall have smooth joints.
 - (e) When required, a designated portion of the track should be arranged and constructed as an out-of-service parking area complete with means needed for supporting the crane against storm wind effects and anchoring it against unwanted movement along the track; the parking track should be in place before erection commences.
 - (f) Rails shall be electrically grounded when they carry cranes electrically powered from an outside source.
 - (g) Both ends of all tracks shall be provided with stops or buffers adjusted for simultaneous contact with both sides of the travel base.
 - (h) When more than one crane will be operating on a run of track, particular consideration should be given to the number and disposition of parking areas.
 - (i) The hazard of earthquake effects appropriated to the site or zone should be considered.
 - (j) The crane manufacturer shall provide maximum resulting loads at the base of the crane, or wheel loads, for use in design of the supports.
- (7) General erection requirements.
- (a) When cranes are erected, the manufacturer's or a qualified person's written erection instructions and a list of the weights of each component to be erected shall be at the site.
 - (b) Cranes shall be erected in accordance with the crane manufacturer's or a qualified person's recommendations. Erection shall be performed under the supervision of a qualified person.
 - (c) Procedures shall be established before erection work commences to implement the erection instructions and to adapt them to the particular needs of the site. The need for temporary guying and bracing during erection shall be established.
 - (d) Before crane components are erected, they shall be visually inspected for damage. Damaged members shall not be erected until repaired in accordance with the manufacturer's or qualified person's instructions, or replaced.
 - (e) Slings and lifting accessories shall be selected and arranged to avoid damaging or marring crane members during erection.

- (f) Wind velocity at the site at the time of erection should be considered as a limiting factor that could require suspending the erection operation.
- (g) Crane towers shall be erected plumb to a tolerance that is specified by the manufacturer.
- (h) Cranes required to weathervane when out-of-service shall be installed with clearance for the boom and superstructure to swing a full 360o arc without striking a fixed object or other crane.

WAC 296-155-528 Crane or derrick suspended personnel platforms.

- (1) Scope, application, and definitions.
 - (a) Scope and application. This standard applies to the design, construction, testing, use and maintenance of personnel platforms, and the hoisting of personnel platforms on the load lines of cranes or derricks.
 - (b) Definitions. For the purposes of this section, the following definitions apply:
 - (i) “Failure” means load refusal, breakage, or separation of components.
 - (ii) “Hoist” (or hoisting) means all crane or derrick functions such as lowering, lifting, swinging, booming in and out or up and down, or suspending a personnel platform.
 - (iii) “Load refusal” means the point where the ultimate strength is exceeded.
 - (iv) “Maximum intended load” means the total load of all employees, tools, materials, and other loads reasonably anticipated to be applied to a personnel platform or personnel platform component at any one time.
 - (v) “Runway” means a firm, level surface designed, prepared, and designated as a path of travel for the weight and configuration of the crane being used to lift and travel with the crane suspended platform. An existing surface may be used as long as it meets these criteria.
- (2) General requirements. The use of a crane or derrick to hoist employees on a personnel platform is prohibited, except when the erection, use, and dismantling of conventional means of reaching the worksite, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform or scaffold, would be more hazardous, or is not possible because of structural design or worksite conditions.
- (3) Cranes and derricks.
 - (a) Operational criteria.

- (b) Hoisting of the personnel platform shall be performed in a slow, controlled, cautious manner with no sudden movements of the crane or derrick, or the platform.
 - (c) Load lines shall be capable of supporting, without failure, at least seven times the maximum intended load, except that where rotation resistant rope is used, the lines shall be capable of supporting without failure, at least ten times the maximum intended load. The required design factor is achieved by taking the current safety factor of 3.5 (required under WAC 296-155-525 (4)(b)) and applying the fifty percent derating of the crane capacity which is required by (f) of this subsection.
 - (d) Load and boom hoist drum brakes, swing brakes, and locking devices such as pawls or dogs shall be engaged when the occupied personnel platform is in a stationary working position.
 - (e) The crane shall be uniformly level within one percent of level grade and located on firm footing. Cranes equipped with outriggers shall have them all fully deployed following manufacturer's specifications, insofar as applicable, when hoisting employees.
 - (f) The total weight of the loaded personnel platform and related rigging shall not exceed fifty percent of the rated capacity for the radius and configuration of the crane or derrick.
 - (g) The use of machines having live booms (booms in which lowering is controlled by a brake without aid from other devices which slow the lowering speeds) is prohibited.
 - (h) Multiple-part line block: When a multiple-part line block is in use, a substantial strap shall be used between the crane hook and common ring, shackle, or other equivalent device, to eliminate employee exposure to the lines running through the block, and to the block itself.
- (4) Instruments and components.
- (a) Cranes and derricks with variable angle booms shall be equipped with a boom angle indicator, readily visible to the operator.
 - (b) Cranes with telescoping booms shall be equipped with a device to indicate clearly to the operator, at all times, the boom's extended length, or an accurate determination of the load radius to be used during the lift shall be made prior to hoisting personnel.

- (c) A positive acting device shall be used which prevents contact between the load block or overhaul ball and the boom tip (anti-two-blocking device), or a system shall be used which deactivates the hoisting action before damage occurs in the event of a two- blocking situation (two block damage prevention feature).
 - (d) The load line hoist drum shall have a system or device on the power train, other than the load hoist brake, which regulates the lowering rate of speed of the hoist mechanism (controlled load lowering). Free fall is prohibited.
- (5) Rigging.
- (a) Lifting bridles on box-type platforms shall consist of four legs of equal length, with one end securely shackled to each corner of the platform and the other end securely attached to a common ring, shackle, or other equivalent device to accommodate the crane hook, or a strap to the crane hook.
 - (b) Shackle bolts used for rigging of personnel platforms shall be secured against displacement.
 - (c) A substantial safety line shall pass through the eye of each leg of the bridle adjacent to the common ring, shackle, or equivalent device.
 - (d) Securely fastened with a minimum amount of slack to the lift line above the headache ball or to the crane hook itself.
 - (e) All eyes in wire rope slings shall be fabricated with thimbles.
 - (f) Wire rope, shackles, rings, master links, and other rigging hardware must be capable of supporting, without failure, at least five times the maximum intended load applied or transmitted to that component. Where rotation resistant wire rope is used for slings, they shall be capable of supporting without failure at least ten times the maximum intended load.
 - (g) Hooks on headache ball assemblies, lower load blocks, or other attachment assemblies shall be of a type that can be closed and locked, eliminating the hook throat opening. Alternatively, an alloy anchor type shackle with a bolt, nut and retaining pin may be used.
 - (h) Bridles and associated rigging for attaching the personnel platform to the hoist line shall be used only for the platform and the necessary employees, their tools and the materials necessary to do their work, and shall not be used for any other purpose when not hoisting personnel.
- (6) Personnel platforms - design criteria.
- (a) The personnel platform and suspension system shall be designed by a qualified engineer or a qualified person competent in structural design.

- (b) The suspension system shall be designed to minimize tipping of the platform due to movement of employees occupying the platform.
 - (c) The personnel platform itself, except the guardrail system and body harness anchorages, shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load based on a minimum allowance of five hundred pounds for the first person with light tools, and an additional two hundred fifty pounds for each additional person.
 - (d) Criteria for guardrail systems contained in chapter 296-155 WAC, Part K and body harness anchorages are contained in chapter 296-155 WAC, Part C-1.
 - (e) The personnel platform shall be conspicuously posted with a plate or other permanent marking which indicates the weight of the platform and its rated load capacity or maximum intended load.
- (7) Platform specifications.
- (a) Each personnel platform shall be equipped with a guardrail system which meets the requirements of chapter 296-155 WAC, Part K and, shall be enclosed at least from the toeboard to mid-rail with either solid construction or expanded metal having openings no greater than one-half inch (1.27 cm).
 - (b) A grab rail shall be installed inside the entire perimeter of the personnel platform.
 - (c) Access gates, if installed, shall not swing outward during hoisting.
 - (d) Access gates, including sliding or folding gates, shall be equipped with a restraining device to prevent accidental opening.
 - (e) Headroom shall be provided which allows employees to stand upright in the platform.
 - (f) In addition to the use of hard hats, employees shall be protected by overhead protection on the personnel platform when employees are exposed to falling objects.
 - (g) All rough edges exposed to contact by employees shall be surfaced or smoothed in order to prevent injury to employees from punctures or lacerations.
 - (h) All welding of the personnel platform and its components shall be performed by a qualified welder familiar with the weld grades, types, and material specified in the platform design.
 - (i) Occupants of all personnel platforms shall wear a safety belt or harness and lanyard which meets the requirements of chapter 296-155 WAC, Part C-1.

- (j) Box-type platform: The workers lanyard shall be secured to an anchorage within the platform meeting the requirements of chapter 296-155 WAC, Part C-1.
- (k) Rescue platform:
 - (i) If the platform is used as a rescue vehicle, the injured worker shall be strapped into the stretcher or basket.
 - (ii) The basket shall then be secured by lanyard to an anchorage within the platform meeting the requirements of chapter 296-155 WAC, Part C-1.
- (l) Boatswains chair: The workers lanyard shall be secured to the lift line above the headache ball or to the crane hook itself.
- (m) Barrel-type platform:
 - (i) The workers lanyard shall be secured to the lift line above the headache ball or to the crane hook itself.
 - (ii) A solid bar or rod shall be substantially attached in a rigid position to the bottom or side of the platform.
 - (iii) The bottom of the barrel-type platform shall be of a convex shape to cause the platform to lay on its side when lowered to the ground or floor.
 - (iv) The bar or rod shall extend a minimum of eight feet above the floor of the platform.
 - (v) Workers shall enter and exit from barrel-type platforms only when they are in an upright position, stable, and securely attached to the load line.
 - (vi) The employer shall use methods or devices which allow employees to safely enter or exit barrel-type platforms.
- (8) Personnel platform loading.
 - (a) The personnel platform shall not be loaded in excess of its rated load capacity.
 - (b) The number of employees occupying the personnel platform shall not exceed the number required for the work being performed.
 - (c) Personnel platforms shall be used only for employees, their tools, and the materials necessary to do their work, and shall not be used to hoist only materials or tools when not hoisting personnel.
 - (d) Materials and tools for use during a personnel lift shall be secured to prevent displacement.

- (e) Materials and tools for use during a personnel lift shall be evenly distributed within the confines of the platform while the platform is suspended.
- (9) Trial lift, inspection, and proof testing.
- (a) A trial lift with the unoccupied personnel platform loaded at least to the anticipated liftweight shall be made from ground level, or any other location where employees will enter the platform, to each location at which the personnel platform is to be hoisted and positioned. This trial lift shall be performed immediately prior to placing personnel on the platform. The operator shall determine that all systems, controls, and safety devices are activated and functioning properly; that no interferences exist; and that all configurations necessary to reach those work locations will allow the operator to remain under the fifty percent limit of the hoist's rated capacity. Materials and tools to be used during the actual lift can be loaded in the platform, as provided in subsection (8)(d) and (e) of this section for the trial lift. A single trial lift may be performed at one time for all locations that are to be reached from a single set-up position.
 - (b) The trial lift shall be repeated prior to hoisting employees whenever the crane or derrick is moved and set up in a new location or returned to a previously used location. Additionally, the trial lift shall be repeated when the lift route is changed unless the operator determines that the route change is not significant (i.e., the route change would not affect the safety of hoisted employees).
 - (c) After the trial lift, and just prior to hoisting personnel, the platform shall be hoisted a few inches and inspected to ensure that it is secure and properly balanced. Employees shall not be hoisted unless the following conditions are determined to exist:
 - (i) Hoist ropes shall be free of kinks;
 - (ii) Multiple part lines shall not be twisted around each other;
 - (iii) The primary attachment shall be centered over the platform; and
 - (iv) The hoisting system shall be inspected if the load rope is slack to ensure all ropes are properly stated on drums and in sheaves.
 - (d) A visual inspection of the crane or derrick, rigging, personnel platform, and the crane or derrick base support or ground shall be conducted by a competent person immediately after the trial lift to determine whether the testing has exposed any defect or produced any adverse effect upon any component or structure.
 - (e) Any defects found during inspections which create a safety hazard shall be corrected before hoisting personnel.

- (f) At each job site, prior to hoisting employees on the personnel platform, and after any repair or modification, the platform and rigging shall be proof tested to one hundred twenty-five percent of the platform's rated capacity by holding it in a suspended position for five minutes with the test load evenly distributed on the platform (this may be done concurrently with the trial lift). After proof testing, a competent person shall inspect the platform and rigging. Any deficiencies found shall be corrected and another proof test shall be conducted. Personnel hoisting shall not be conducted until the proof testing requirements are satisfied.
- (10) Work practices.
- (a) Employees shall keep all parts of the body inside the platform during raising, lowering, and positioning. This provision does not apply to an occupant of the platform performing the duties of a signal person.
- (b) Before employees exit or enter a hoisted personnel platform that is not landed, the platform shall be secured to the structure where the work is to be performed, unless securing to the structure creates an unsafe situation.
- (c) Tag lines shall be used unless their use creates an unsafe condition.
- (d) The crane or derrick operator shall remain at the controls at all times when the crane engine is running and the platform is occupied.
- (e) Hoisting of employees shall be promptly discontinued upon indication of any dangerous weather conditions or other impending danger.
- (f) Employees being hoisted shall remain in continuous sight of and in direct communication with the operator or signal person. In those situations where direct visual contact with the operator is not possible, and the use of a signal person would create a greater hazard for that person, direct communication alone such as by radio may be used.
- (g) Hand signals to the operator shall be in accordance with WAC 296-155-525 (2)(c).
- (h) Except over water, employees occupying the personnel platform shall use a full body harness system with lanyard appropriately attached to the lower load block or overhaul ball, or to a structural member within the personnel platform capable of supporting a fall impact for employees using the anchorage as specified in chapter 296-155 WAC, Part C-1. When working over water, the requirements of WAC 296-155-235 shall apply.

No lifts shall be made on another of the crane's or derrick's load lines while personnel are suspended on a platform.

(11) Traveling.

- (a) Hoisting of employees while the crane is traveling is prohibited, except for portal, tower and locomotive cranes, or where the employer demonstrates that there is no less hazardous way to perform the work.
- (b) Under any circumstances where a crane would travel while hoisting personnel, the employer shall implement the following procedures to safeguard employees:
 - (i) Crane travel shall be restricted to a fixed track or runway;
 - (ii) Travel shall be limited to the load radius of the boom used during the lift; and
 - (iii) The boom must be parallel to the direction of travel.
- (c) A complete trial run shall be performed to test the route of travel before employees are allowed to occupy the platform. This trial run can be performed at the same time as the trial lift required by subsection (9)(a) of this section which tests the route of the lift.
- (d) If travel is done with a rubber tired-carrier, the condition and air pressure of the tires shall be checked. The chart capacity for lifts on rubber shall be used for application of the fifty percent reduction of rated capacity. Notwithstanding subsection (3)(e) of this section, outriggers may be partially retracted as necessary for travel.

(12) Prelift meeting.

- (a) A meeting attended by the crane or derrick operator, signal person(s) (if necessary for the lift), employee(s) to be lifted, and the person responsible for the task to be performed shall be held to review the appropriate requirements of this section and the procedures to be followed.
- (b) This meeting shall be held prior to the trial lift at each new work location, and shall be repeated for any employees newly assigned to the operation.

WAC296-155-529 Crane certifier accreditation and crane certification.

WAC 296-155-52900 Scope.

- (1) Except as provided in subsection (2) of this section, this part applies to power-operated cranes and derricks used in construction that can hoist, lower and horizontally move a suspended load (with or without attachments). Such equipment includes, but is not limited to: Articulating boom cranes (such as knuckle-boom cranes); crawler cranes; floating cranes; cranes on barges; locomotive cranes; mobile cranes (such as wheel-mounted, rough-terrain, all-terrain, commercial truck-mounted, and boom truck cranes); multipurpose machines when configured to hoist and lower (by means of a winch or hook) and horizontally move a suspended load; industrial cranes (such as carry-deck cranes); dedicated pile drivers; service/mechanic trucks with a hoisting device; a crane on a monorail; tower cranes (such as fixed jib ("hammerhead boom"), luffing boom and self-erecting); pedestal cranes; portal cranes; overhead and gantry cranes; straddle cranes; side-boom tractors; derricks; and variations of such equipment.
- (2) Exemptions. WAC 296-155-529 through 296-155-53214 do not apply to the following:
 - (a) Cranes having a maximum rated capacity of one ton or less are exempt from this rule for the purposes of crane certification and operator certification.
 - (b) Equipment included in subsection (1) of this section while it has been converted or adapted for nonhoisting/lifting use. Such conversions/adaptations include, but are not limited to, power shovels, excavators and concrete pumps.
 - (c) Power shovels, excavators, wheel loaders, backhoes, loader backhoes, track loaders. This machinery is also excluded when used with chains, slings or other rigging to lift suspended loads.
 - (d) Automotive wreckers and tow trucks when used to clear wrecks and haul vehicles.
 - (e) Service trucks with mobile lifting devices designed specifically for use in the power line and electric service industries or handling associated materials.
 - (f) Equipment originally designed as vehicle-mounted aerial devices (for lifting personnel) and self-propelled elevating work platforms.
 - (g) Hydraulic jacking systems, including telescopic/hydraulic gantries.
 - (h) Stacker cranes.
 - (i) Powered industrial trucks (forklifts).
 - (j) Mechanic's truck with a hoisting device when used in activities related to equipment maintenance and repair.

- (k) Equipment that hoists by using a come-a-long or chainfall.
 - (l) Dedicated drilling rigs.
 - (m) Gin poles used for the erection of communication towers.
 - (n) Tree trimming and tree removal work.
 - (o) Anchor handling with a vessel or barge using an affixed A-frame.
 - (p) Roustabouts.
 - (q) Service cranes with booms that rotate manually.
 - (r) Machines equipped with a boom that is limited to up and down movement only and does not rotate.
 - (s) Conveyors.
 - (t) Pump hoists with booms that do not rotate.
 - (u) Cranes used on-site in manufacturing facilities or powerhouses for occasional or routine maintenance and repair work; and
 - (v) Crane operators operating cranes on-site in manufacturing facilities or powerhouses for occasional or routine maintenance and repair work.
- (3) Where provisions of this standard direct an operator, crewmember, or other employee to take certain actions, the employer must establish, effectively communicate to the relevant persons, and enforce work rules, to ensure compliance with such provisions.

WAC 296-155-52902 Definitions.

Accredited crane certifier means a crane inspector who has been accredited by the department.

Apprentice operator or trainee means a crane operator who has not met requirements established by the department under RCW 49.17.430.

Articulating boom crane means a crane whose boom consists of a series of folding, pin connected structural members, typically manipulated to extend or retract by power from hydraulic cylinders.

Audible signal means a signal made by a distinct sound or series of sounds. Examples include, **but are not limited to, sounds made by a bell, horn, or whistle.**

Bogie. See “travel bogie.”

Boom (equipment other than tower crane) means an inclined spar, strut, or other long structural member which supports the upper hoisting tackle on a crane or derrick. Typically, the length and vertical angle of the boom can be varied to achieve increased height or height and reach when lifting loads. Booms can usually be grouped into general categories of hydraulically extendible, cantilevered type, latticed section, cable supported type or articulating type.

Boom (tower cranes) on tower cranes: If the "boom" (i.e., principal horizontal structure) is fixed, it is referred to as a jib; if it is moveable up and down, it is referred to as a boom.

Boom angle indicator means a device which measures the angle of the boom relative to horizontal.

Boom hoist limiting device includes boom hoist disengaging device, boom hoist shut-off, boom hoist disconnect, boom hoist hydraulic relief, boom hoist kick-outs, automatic boom stop device, or derricking limiter. This type of device disengages boom hoist power when the boom reaches a predetermined operating angle. It also sets brakes or closes valves to prevent the boom from lowering after power is disengaged.

Boom length indicator indicates the length of the permanent part of the boom (such as ruled markings on the boom) or, as in some computerized systems, the length of the boom with extensions/attachments.

Boom stop includes boom stops (belly straps with struts/standoff), telescoping boom stops, attachment boom stops, and backstops. These devices restrict the boom from moving above a certain maximum angle and toppling over backward.

Boom suspension systems means a system of pendants, running ropes, sheaves, and other hardware which supports the boom tip and controls the boom angle.

Certified crane inspector means a crane certifier accredited by the department.

Climbing means the process in which a tower crane is raised to a new working height, either by adding additional tower sections to the top of the crane (top climbing), or by a system in which the entire crane is raised inside the structure (inside climbing).

Counterjib (counterweight jib) means a horizontal member of the tower crane on which the counterweights and usually the hoisting machinery are mounted.

Counterweight means weight used to supplement the weight of equipment in providing stability for lifting loads by counterbalancing those loads.

Crane means power-operated equipment used in construction that can hoist, lower, and horizontally move a suspended load. "Crane" includes, but is not limited to: Articulating boom cranes, such as knuckle-boom cranes; crawler cranes; floating cranes; cranes on barges; locomotive cranes; mobile cranes, such as wheel-mounted, rough-terrain, all-terrain, commercial truck mounted, and boom truck cranes; multipurpose machines when configured to hoist and lower by means of a winch or hook and horizontally move a suspended load; industrial cranes, such as carry-deck cranes; dedicated pile drivers; service/mechanic trucks with a hoisting device; a crane on a monorail; tower cranes, such as fixed jib, hammerhead boom, luffing boom, and self-erecting; pedestal cranes; portal cranes; overhead and gantry cranes; straddle cranes; side-boom tractors; derricks; and variations of such equipment.

Crane/derrick type means cranes or derricks as established by American Society of Mechanical Engineers (ASME). Crane operator means an individual engaged in the operation of a crane.

Crawler crane means equipment that has a type of base mounting which incorporates a continuous belt of sprocket driven track.

Critical lift means a lift that:

- Exceeds seventy-five percent of the crane or derrick rated load chart capacity; or
- Requires the use of more than one crane or derrick.

Crossover points means locations on a wire rope which is spooled on a drum where one layer of rope climbs up on and crosses over the previous layer. This takes place at each flange of the drum as the rope is spooled onto the drum, reaches the flange, and begins to wrap back in the opposite direction.

Dedicated drilling rig means a machine which creates bore holes and/or shafts in the ground.

Dedicated pile-driver is a machine that is designed to function exclusively as a pile-driver. These machines typically have the ability to both hoist the material that will be pile-driven and to pile-drive that material.

Derrick is an apparatus consisting of a mast or equivalent member held at the end by guys or braces, with or without a boom, for use with a hoisting mechanism and operating ropes.

Directly under the load means a part or all of an employee is directly beneath the load.

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

Drum rotation indicator is a device on a crane or hoist which indicates in which direction and at what relative speed a particular hoist drum is turning.

Electrical contact means when a person, object, or equipment makes contact or comes close in proximity with an energized conductor or equipment that allows the passage of current.

Equipment means equipment covered by this part.

Equipment criteria means instructions, recommendations, limitations and specifications.

Fall protection equipment means guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems.

Flange points means a point of contact between rope and drum flange where the rope changes layers.

Floating cranes/derricks means equipment designed by the manufacturer (or employer) for marine use by permanent attachment to a barge, pontoons, vessel or other means of flotation.

Free rated load test means testing stability and operation of crane, carrier, wheels, tires, tracks, brakes, etc., under load, when lifting without outriggers and/or traveling with the load are permitted at the activity for the type of crane being tested.

Hoist means a mechanical device for lifting and lowering loads by winding rope onto or off a drum.

Hoisting means the act of raising, lowering or otherwise moving a load in the air with equipment covered by this standard. As used in this standard, "hoisting" can be done by means other than wire rope/hoist drum equipment.

Jib means an extension attached to the boom point to provide added boom length for lifting specified loads. The jib may be in line with the boom or offset to various angles in the vertical plane of the boom. For tower cranes, see boom (tower cranes).

Land crane/derrick means equipment not originally designed by the manufacturer for marine use by permanent attachment to barges, pontoons, vessels, or other means of flotation.

Load is the weight of the object being lifted or lowered, including the weight of the load-attaching equipment such as the load block, ropes, slings, shackles, and any other auxiliary attachment.

Load moment (or rated capacity) indicator means a system which aids the equipment operator by sensing the overturning moment on the equipment, i.e., load X radius. It compares this lifting condition to the equipment's rated capacity, and indicates to the operator the percentage of capacity at which the equipment is working. Lights, bells, or buzzers may be incorporated as a warning of an approaching overload condition.

Load moment (or rated capacity) limiter means a system which aids the equipment operator by sensing the overturning moment on the equipment, i.e., load X radius. It compares this lifting condition to the equipment's rated capacity, and when the rated capacity is reached, it shuts off power to those equipment functions which can increase the severity of loading on the equipment, e.g., hoisting, telescoping out, or luffing out. Typically, those functions which decrease the severity of loading on the equipment remain operational, e.g., lowering, telescoping in, or luffing in.

Locomotive crane means a crane mounted on a base or car equipped for travel on a railroad track.

Load sustaining/bearing parts means those parts of a crane that support the crane or load and upon failure could cause dropping, uncontrolled shifting, or uncontrolled movement of the crane or load.

Luffing boom is a member hinged to the rotating superstructure and used for supporting the hoisting tackle.

Luffing jib limiting device is similar to a boom hoist limiting device, except that it limits the movement of the luffing jib.

Mobile cranes means a lifting device incorporating a cable suspended latticed boom or hydraulic telescopic boom designed to be moved between operating locations by transport over the road. These are referred to in Europe as a crane mounted on a truck carrier.

Multiple lift rigging means a rigging assembly manufactured by wire rope rigging suppliers that facilitates the attachment of up to five independent loads to the hoist rigging of a crane.

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

Nonstandard tower crane base means any deviation from the structural support or base configuration recommended by the crane manufacturer.

Occasional or routine maintenance and repair work means regular, customary and foreseeable work necessary to keep equipment in good repair and/or condition. This also includes regular, customary and foreseeable work necessary to return equipment to sound condition after damage.

Operational aid means an accessory that provides information to facilitate operation of a crane or that takes control of particular functions without action of the operator when a limiting condition is sensed. Examples of such devices include, but are not limited to, the following: Anti-two-block device, rated capacity indicator, rated capacity (load) limiter, boom angle or radius indicator, lattice boom hoist disconnect device, boom length indicator, crane level indicator, drum rotation indicator, load indicator, and wind speed indicator.

Operational controls means levers, switches, pedals and other devices for controlling equipment operation.

Operator is a person who is operating the equipment.

Overhead and gantry cranes includes overhead/bridge cranes, semigantry, cantilever gantry, wall cranes, storage bridge cranes, launching gantry cranes, and similar equipment, irrespective of whether it travels on tracks, wheels, or other means.

Pendants includes both wire and bar types. Wire type: A fixed length of wire rope with mechanical fittings at both ends for pinning segments of wire rope together. Bar type: Instead of wire rope, a bar is used. Pendants are typically used in a latticed boom crane system to easily change the length of the boom suspension system without completely changing the rope on the drum when the boom length is increased or decreased.

Powerhouse means a plant wherein electric energy is produced by conversion from some other form of energy (e.g., chemical, nuclear, solar, mechanical, or hydraulic) by means of suitable apparatus. This includes all generating station auxiliaries and other associated equipment required for the operation of the plant. Not included are stations producing power exclusively for use with communication systems.

Power lines means electrical distribution and electrical transmission lines.

Qualified crane operator means a crane operator who meets the requirements established by the department under RCW 49.17.430.

Qualified person means a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, successfully demonstrated the ability to solve/resolve problems relating to the subject matter, the work, or the project.

Rated capacity means the maximum working load permitted by the manufacturer under specified working conditions. Such working conditions typically include a specific combination of factors such as equipment configuration, radii, boom length, and other parameters of use.

Rated capacity indicator, see load moment indicator.

Rated capacity limiter, see load moment limiter.

RPE means a registered professional engineer licensed under RCW 18.43.040(1).

RPSE means a registered professional structural engineer licensed under RCW 18.43.040(1).

Running wire rope is a wire rope that moves over sheaves or drums.

Safety devices, examples of safety devices are, but are not limited to, the following: Horn, boom/jib or trolley stops, hydraulic holding device/check valve, rail clamps, rail stops, brakes, deadman control or forced neutral return control, emergency stop switch, guards, handrails, audible and visual alarms, etc.

Safety or health standard means a standard adopted under this chapter.

Taglines means a rope (usually fiber) attached to a lifted load for purposes of controlling load spinning and pendular motions or used to stabilize a bucket or magnet during material handling operations.

Tower crane means a type of lifting structure which utilizes a vertical mast or tower to support a working boom (jib) suspended from the working boom. While the working boom may be fixed horizontally or have luffing capability, it can always rotate about the tower center to swing loads. The tower base may be fixed in one location or ballasted and moveable between locations.

Travel bogie (tower cranes) means an assembly of two or more axles arranged to permit vertical wheel displacement and equalize the loading on the wheels.

Two blocking means a condition in which a component that is uppermost on the hoist line such as the load block, hook block, overhaul ball, or similar component, comes in contact with the boom tip, fixed upper block or similar component. This binds the system and continued application of power can cause failure of the hoist rope or other component.

WAC 296-155-530 Material hoists, personnel hoists, and elevators.

- (1) General requirements.
 - (a) The employer shall comply with the manufacturer's specifications and limitations applicable to the operation of all hoists and elevators. Where the manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a professional engineer competent in the field.
 - (b) The employer shall ensure that no person shall enter a hoistway, elevator shaft, or similar enclosure in which the hoisting apparatus or vehicle is installed and functioning unless the power source operating those systems is locked out in accordance with WAC 296-155-429.
 - (c) Rated load capacities, recommended operating speeds, and special hazard warning or instructions shall be posted on cars and platforms.
 - (d) Wire rope shall be removed from service when any of the following conditions exists:
 - (i) In hoisting ropes, six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay;

- (ii) Abrasion, scrubbing, flattening, or peening, causing loss of more than one-third of the original diameter of the outside wires;
 - (iii) Evidence of any heat damage resulting from a torch or any damage caused by contact with electrical wires;
 - (iv) Reduction from nominal diameter of more than three sixty-fourths inch for diameters up to and including three-fourths inch; one-sixteenth inch for diameters seven-eighths to 1 1/8 inches; and three thirty-seconds inch for diameters 1 1/4 to 1 1/2 inches.
- (e) Hoisting ropes shall be installed in accordance with the wire rope manufacturer's recommendations.
- (f) The installation of live booms on hoists is prohibited.
- (g) The use of endless belt-type man lifts on construction shall be prohibited.
- (h) Employees shall not be permitted to ride on top of material hoists, personnel hoists or permanent elevators except for purposes of inspection, maintenance, elevator installation or dismantling work.
- (2) Material hoists,
- (a) (i) Operating rules shall be established and posted at the operator's station of the hoist. Such rules shall include signal system and allowable line speed for various loads. Rules and notices shall be posted on the car frame or crosshead in a conspicuous location, including the statement "No riders allowed."
 - (ii) No person shall be allowed to ride on material hoists except for the purposes of inspection and maintenance.
- (b) All entrances of the hoistways shall be protected by substantial gates or bars which shall guard the full width of the landing entrance. All hoistway entrance bars and gates shall be painted with diagonal contrasting colors, such as black and yellow stripes.
- (i) Bars shall be not less than 2- by 4-inch wooden bars or the equivalent, located 2 feet from the hoistway line. Bars shall be located not less than 36 inches nor more than 42 inches above the floor.
 - (ii) Gates or bars protecting the entrances to hoistway shall be quipped with a latching device.

- (c) Overhead protective covering of two-inch planking, 3/4-inch plywood or other solid material of equivalent strength shall be provided on the top of every material hoist cage or platform to prevent objects falling on the workers loading or unloading the hoist.
 - (i) The protective covering on the top of the cage or platform may be made in hinged sections that may be raised when hoisting long material.
 - (ii) When using a cage or platform for long material, the several pieces of the material shall be securely fastened together and made fast to the cage or platform, so that no part of the load can fall or project beyond the sides of the cage or platform.
 - (d) The operator's station of a hoisting machine shall be provided with overhead protection equivalent to tight planking not less than 2 inches thick. The support for the overhead protection shall be of equal strength.
 - (e) Hoist towers may be used with or without an enclosure on all sides. However, whichever alternative is chosen, the following applicable conditions shall be met:
 - (i) When a hoist tower is enclosed, it shall be enclosed on all sides for its entire height with a screen enclosure of 1/2-inch mesh, No. 18 U.S. gauge wire or equivalent, except for landing access.
 - (ii) When a hoist tower is not enclosed, the hoist platform or car shall be totally enclosed (caged) on all sides for the full height between the floor and the overhead protective covering with 1/2-inch mesh of No. 14 U.S. gauge wire or equivalent. The hoist platform enclosure shall include the required gates for loading and unloading. A 6-foot high enclosure shall be provided on the unused sides of the hoist tower at ground level.
 - (f) Car arresting devices shall be installed to function in case of rope failure.
 - (g) All material hoist towers shall be designed by a licensed professional engineer.
 - (h) All material hoists shall conform to the requirements of ANSI A10.5-1969, Safety Requirements for Material Hoists.
- (3) Personnel hoists.
- (a) Personnel hoists shall be provided for access and egress on all multi story buildings where vertical travel exceeds sixty feet from a ground level access point.

- (b) Hoist towers outside the structure shall be enclosed for the full height on the side or sides used for entrance and exit to the structure. At the lowest landing, the enclosure on the sides not used for exit or entrance to the structure shall be enclosed to a height of at least 10 feet. Other sides of the tower adjacent to floors or scaffold platforms shall be enclosed to a height of 10 feet above the level of such floors or scaffolds.
- (c) Towers inside of structures shall be enclosed on all four sides throughout the full height.
- (d) Towers shall be anchored to the structure at intervals not exceeding 25 feet. In addition to tie-ins, a series of guys shall be installed. Where tie-ins are not practical the tower shall be anchored by means of guys made of wire rope at least one-half inch in diameter, securely fastened to anchorages to ensure stability.
- (e) Hoistway doors or gates shall be not less than 6 feet 6 inches high and shall be provided with mechanical locks which cannot be operated from the landing side, and shall be accessible only to persons on the car.
- (f) Cars shall be permanently enclosed on all sides and the top, except sides used for entrance and exit, which have car gates or doors.
- (g) A door or gate shall be provided at each entrance to the car which shall protect the full width and height of the car entrance opening.
- (h) Overhead protective covering of 2-inch planking, 3/4-inch plywood or other solid material of equivalent strength shall be provided on the top of every personnel hoist.
- (i) Doors or gates shall be provided with electric contacts which do not allow movement of the hoist when door or gate is open.
- (j) A signal device shall be installed in the elevator car and only operated by an attendant who shall give the signals for operation, when transporting workers.
- (k) An electrical push button signalling device or other approved signalling system shall be provided at each floor landing connected to an annunciator in the car. The signal code shall be posted adjacent to the signal device at each and every work level and at operator's work level. All wording shall be black on a white card, in large clear letters.
- (l) The elevator machine and controls shall be housed in as a protection against accidents and the weather, and the door kept locked against unauthorized entrance when operator is not in attendance.
- (m) Safeties shall be capable of stopping and holding the car and rated load when traveling at governor tripping speed.

- (n) Cars shall be provided with a capacity and data plate secured in a conspicuous place on the car or crosshead.
- (o) Internal combustion engines shall not be permitted for direct drive.
- (p) Normal and final terminal stopping devices shall be provided.
- (q) An emergency stop switch shall be provided in the car and marked “stop.”
- (r) Ropes:
 - (i) The minimum number of hoisting ropes used shall be three for traction hoists and two for drum-type hoists.
 - (ii) The minimum diameter of hoisting and counterweight wire ropes shall be 1/2-inch.
 - (iii) Safety factors:

Minimum factors of safety for suspension wire ropes	
Rope speed in feet per minute:	Minimum factor of Safety:
50	7.60
75	7.75
100	7.95
125	8.10
150	8.25
175	8.40
200	8.60
225	8.75
250	8.90
300	9.20
350	9.50
400	9.75
450	10.00
500	10.25
550	10.45
600	10.70

- (s) Following assembly and erection of hoists, and before being put in service, an inspection and test of all functions and safety devices shall be made under the supervision of a competent person. A similar inspection and test is required following major alteration of an existing installation. All hoists shall be inspected and tested at not more than 3-month intervals. Records shall be maintained and kept on file for the duration of the job.

- (t) All personnel hoists used by employees shall be constructed of materials and components which meet the specifications for materials, construction, safety devices, assembly, and structural integrity as stated in the American National Standard A10.4-1963, Safety Requirements for Workmen's Hoists. The requirements of this subdivision do not apply to cantilever type personnel hoists.
- (u) Wire rope shall be taken out of service when any of the following conditions exist:
 - (i) In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay;
 - (ii) Wear of one-third the original diameter of outside individual wires. Kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure;
 - (iii) Evidence of any heat damage from any cause;
 - (iv) Reductions from nominal diameter of more than three-sixty-fourths inch for diameters to and including three-fourths inch, one sixteenth inch for diameter seven-eighths inch to 1 1/8 inches inclusive, three-thirty-seconds inch for diameters 1 1/4 to 1 1/2 inches inclusive;
 - (v) In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.
- (v)
 - (i) Personnel hoists used in bridge tower construction shall be approved by a registered professional engineer and erected under the supervision of a qualified engineer competent in this field.
 - (ii) When a hoist tower is not enclosed, the hoist platform or car shall be totally enclosed (caged) on all sides for the full height between the floor and the overhead protective covering with 3/4-inch mesh of No. 14 U.S. gauge wire or equivalent. The hoist platform enclosure shall include the required gates for loading and unloading.
 - (iii) These hoists shall be inspected and maintained on a weekly basis. Whenever the hoisting equipment is exposed to winds exceeding 35 miles per hour it shall be inspected and put in operable condition before reuse.
- (4) All elevators, manlifts or other lifting devices must be installed and maintained in conformity with the requirements specified in the Washington state elevator laws and regulations adopted by the elevator section of the department of labor and industries.

Note: For additional information refer to chapter 296-100 WAC, safety requirements for material hoists.

WAC 296-155-531 Crane certifier accreditation process.

WAC 296-155-53100 Accreditation of crane certifiers of cranes and derricks-- Requirements.

- (1) Any person engaging in the testing, examination or inspection for the certification of a crane, used in lifting at a construction site, must apply for and obtain a certificate of accreditation from the department pursuant to this rule. For the purposes of this rule an “accredited crane certifier” refers to any individual holding a certificate of accreditation pursuant to this regulation.
- (2) Any person authorized by the department to certify maritime cranes prior to the effective date of this rule may continue to perform services under this regulation until January 1, 2012. Any accredited crane certifier desiring to continue providing services pursuant to this rule must have applied for and obtained a certificate of accreditation under these rules from the department prior to January 1, 2012. Maritime certifiers wishing to perform construction crane certifications must notify the department that they will perform construction crane certifications. In addition, the maritime certifier must specify which cranes they are qualified to inspect under their maritime certificate. The department may issue these individuals a provisional accreditation specifying the crane types they are authorized to inspect which will be valid through December 31, 2011, or upon expiration of their maritime certification, whichever is earlier. Any provisionally accredited crane certifier desiring to continue providing services pursuant to this rule must have applied for and obtained a certificate of accreditation under these rules from the department prior to January 1, 2012.
- (3) Crane certifiers accredited by any other state or governmental entity may be authorized to inspect cranes in Washington state provided the certifier submits an application and resume along with the certificate of accreditation from that state or governmental entity, and the types of cranes they are authorized to inspect. The department may issue these individuals a provisional accreditation specifying the crane types they are authorized to inspect which will be valid through December 31, 2011, or upon expiration of their out-of-state certification, whichever is earlier. Any provisionally accredited crane certifier desiring to continue providing services pursuant to this rule must have applied for and obtained a certificate of accreditation under these rules from the department prior to January 1, 2012.
- (4) No person that has modified, altered, or repaired a crane which affected a load sustaining member of the crane may conduct the certifying inspection and proof load testing of that particular crane within the same certification period.

WAC 296-155-53102 Accreditation--Application form and applicant qualifications.

- (1) An accreditation to certify cranes pursuant to this rule may be obtained by submitting a completed application to the division of occupational safety and health (DOSH) and successfully completing written examinations developed and administered by the department or its authorized representative. Application forms may be obtained by calling the:

Crane certification section of DOSH 360-902-4943 or by written request to:
P.O. Box 44650, Olympia, WA 98504-4650
- (2) An applicant seeking an accreditation must satisfy all of the following criteria:
 - (a) An application with an attached resume must be submitted to the department based on experience with the various crane types per the ASME B30 series. The application and resume must include knowledge, training and experience with verifiable references.
 - (b) All applicants must possess knowledge of chapter 296-155 WAC, Safety standards for construction work, as well as American Society of Mechanical Engineers (ASME) standards, relating to the design, testing, inspection and operation of cranes, including those specifically applicable to the types of cranes for which an accreditation will be issued.
 - (c) All applicants must demonstrate at least five years crane related experience, of which two years must be actual crane inspection activities. The other three years may include experience in duties such as a crane operator, crane mechanic, crane shop foreman, crane operations supervision, or rigging specialist. Related education may be substituted for related experience at a ratio of two years of education for one year of experience up to three years. Related education could include such courses in engineering, physics, applied mathematics, applied science courses in ondestructive testing, construction technology, technical courses in heavy equipment mechanic, welding technology, etc.
- (3) Application form. Any application for accreditation will be accepted by the department upon the filing of a completed application. All information and attachments must be given under penalty of perjury. The application must include, but not be limited to, the following:
 - (a) A statement of the crane types per the ASME B30 series the applicant desires to certify pursuant to the accreditation.
 - (b) A statement of qualifications and experience, including their capacities, satisfying at a minimum the criteria set forth in this section as well as any and all other qualifications the applicant wishes the department to consider.

- (c) Any other relevant information the applicant desires to be considered by the department.
- (4) Written examinations. Applicants to be approved for accreditation must successfully complete the written examinations administered by the department or its authorized representative.
 - (a) Once the department receives the application and resume, the department will make the determination and notify the applicant if they meet the minimum qualifications to take the written examinations.
 - (b) The first written examination will include a general knowledge of operation, testing, inspection and maintenance requirements, and the duties and recordkeeping responsibilities required by this rule.
 - (c) The other written examinations will include safe operating and engineering principles and practices with respect to specific crane types subject to the accreditation, including inspection and proof loading requirements.

WAC 296-155-53104 Issuance of accreditation.

- (1) The department may impose restrictions on the scope and use of the accreditation, such as limiting it to specific types of cranes based upon the qualifications of the applicant. The accreditation issued by the department will identify any limitations imposed by the department and the types of cranes the certifier is authorized to certify.
- (2) The department must deny issuance of an accreditation if the applicant does not satisfy the requirements of this rule.

WAC 296-155-53106 Accreditation application--Processing time.

- (1) Within forty-five calendar days of receipt of a completed application for an accreditation, the department must inform the applicant in writing that it is either complete and accepted for filing or that it is deficient and what specific information or documentation is required to complete the application and will inform the applicant if the applicant is eligible to take the written examination. An application is considered complete if it is in compliance with the requirements of this rule.
- (2) Within seventy-five calendar days from the date of completion of the written examinations, the department must inform the applicant in writing of its decision regarding the issuance of the certificate of accreditation.

WAC 296-155-53108 Duration and renewal of an accreditation.

- (1) The accreditation will be valid for three years. Crane certifiers must complete forty hours of crane related training every three years, in courses recognized by the department.

- (2) Application for renewal must be filed with the department not less than sixty days prior to expiration of the accredited crane certifier's certification. A renewal may be obtained by filing a completed application for renewal meeting the requirements of WAC 296-155-53102 hereof providing the applicant has been actively inspecting cranes during their prior accreditation period. An applicant is considered active if he/she has certified/inspected at least twenty-one cranes during their accreditation period. If the applicant certified cranes in another state, then that applicant must provide documentation showing they were active during their accreditation period. An applicant who has not certified/inspected at least twenty-one cranes during the accreditation period may take the written exam to become recertified.
- (3) At a minimum, all applicants for renewal must successfully complete the written examinations every six years.

WAC 296-155-53110 Revocation or suspension of an accreditation.

- (1) The department may suspend or revoke a certificate issued under the provisions of these rules upon the following grounds:
 - (a) Permitting the duplication or use of one's own accreditation certificate by another;
 - (b) Performing work for which accreditation has not been received;
 - (c) Any person who obtains accreditation through fraudulent representation of accreditation requirements such as education, training, professional registration, or experience;
 - (d) Any person who falsifies training documentation;
 - (e) The holder of the certificate is found to be incompetent to carry out the work for which the certificate was issued;
 - (f) Gross negligence, gross incompetence, a pattern of incompetence, or fraud in the certification of a crane;
 - (g) Willful or deliberate disregard of any occupational safety standard while certifying a crane;
 - (h) Misrepresentation of a material fact in applying for, or obtaining, a license to certify under this chapter;
 - (i) Failure by an accredited crane certifier to maintain records;
 - (j) Failure by an accredited crane certifier to report crane safety deficiencies affecting the safe operation of a crane while in the process of conducting an annual certification inspection;

- (k) Failure to meet or comply with the requirements of this rule or the limitations imposed on the accreditation; or
 - (l) Performance of work not in compliance with applicable laws and regulations.
- (2) Before any certificate may be suspended or revoked, the certificate holder must be given written notice of the department's intention, mailed by certified mail, return receipt requested to the address as shown on the application form. The notice must specify the reasons for the department action. The department must also include within the notice of revocation or suspension specific conditions which must be met before the applicant will be entitled to apply for a new certification.
 - (3) A suspension or revocation order may be appealed to the board of industrial insurance appeals within fifteen working days after the suspension or revocation order is entered. The notice of appeal may be filed with the department or the board of industrial insurance appeals. The board of industrial insurance appeals shall hold the hearing in accordance with procedures established in RCW 49.17.140. Any party aggrieved by an order of the board of industrial insurance appeals may obtain superior court review in the manner provided in RCW 49.17.150.
 - (4) The filing of an appeal must not stay the suspension or revocation, and such action must remain in effect until such time as the applicant presents proof that the specified written conditions required by the department are met or until otherwise ordered after resolution of the appeal.

WAC 296-155-53112 Monitoring of accredited crane certifiers.

The division of occupational safety and health must monitor accredited crane certifiers to ensure that these certifiers certify cranes in accordance with all applicable Washington state laws and regulations. Monitoring activities will include, but not be limited to, audits of crane certifier's activities, complaint inspections, referrals, or accident investigations.

WAC 296-155-53114 Issuance of temporary and annual certificates of operation.

- (1) Accredited crane certifiers will issue a temporary certificate of operation if upon inspection and load proof testing no deficiencies were found that would affect the safe operation of the crane.
- (2) The accredited crane certifier will submit inspection worksheets and proof of load testing to the department within ten working days from the completion of the inspection and load proof test for consideration of the department for the issuance of a permanent certificate of operation.

- (3) If the accredited crane certifier upon inspection of a crane identifies deficiencies that would affect the safe operation or load handling capabilities of the crane, the accredited crane certifier must notify the department within five working days from completion of the on-site inspection by submitting the worksheet that identifies the deficiencies. If deficiencies are found that affect the safe operation or load handling capabilities of the crane, no temporary certificate of operation will be issued until all identified deficiencies have been corrected and verified by an on-site visit by an accredited crane certifier.
- (4) After the accredited crane certifier has verified that all deficiencies have been corrected and the crane has successfully passed a load proof test, the accredited crane certifier will issue a temporary certificate of operation. The accredited crane certifier will submit inspection worksheets and proof of load testing to the owner or lessee and within ten days of completion of the inspection to the department for consideration of the department for the issuance of an annual certificate of operation.
- (5) The accredited crane certifier must attach an identification sticker if not already attached and legible to each crane and crane component (component meaning: Luffing boom, swing-away jibs, fly sections, jibs at variable offsets and boom sections). The identification sticker number must be entered on the inspection worksheet submitted to the department. Identification stickers may only be removed by a department representative or an accredited crane certifier.

Note: Certified components may be installed without voiding the annual proof load test, providing the component was proof load tested within the prior four-year period.

- (6) Certificates of operation issued by the department under the crane certification program established in this section are valid for one year from the effective date of the temporary operating certificate issued by the certified crane inspector.
- (7) The temporary or annual certificate of operation must be posted in the operator's cab or with the operator's manual.
- (8) Maintaining required records. Accredited crane certifiers are required to maintain complete and accurate records pertaining to each crane of all inspections, tests and other work performed as well as copies of all notices of crane safety deficiencies, verifications of correction of crane safety deficiencies, and crane certifications issued for the previous five years and provide these records to the department upon request. Failure by an accredited crane certifier to maintain required records may result in accreditation suspension or revocation.

WAC 296-155-532 Crane certification requirements for cranes.

WAC 296-155-53200 General inspection criteria, wire rope inspection and removal criteria, and preproof load test requirements for all cranes.

- (1) The accredited crane certifier must review the following documents as part of the crane certification process:
 - (a) Crane maintenance records of critical components to ensure maintenance of these components has been performed in accordance with the manufacturer's recommendations.
 - (b) Crane periodic and frequent inspection documentation.
- (2) Safety devices. Make sure all safety devices are installed on equipment in accordance with the requirements located in chapter 296-155 WAC, Part L.
- (3) Operational aids. Operations must not begin unless operational aids are in proper working order, except where the owner or lessee meets the specified temporary alternative measures. See chapter 296-155 WAC, Part L for the list of operational aids.

Note: All accredited crane certifiers must meet and follow the requirements relating to fall protection, located in chapter 296-155 WAC, Part C-1, Fall restraint and fall arrest.

- (4) General.
 - (a) The accredited crane certifier must determine that the configurations of the crane are in accordance with the manufacturer's equipment criteria.
 - (b) Where the manufacturer equipment criteria are unavailable, a registered professional engineer (RPE), familiar with the type of equipment involved, must ensure criteria are developed for the equipment configuration.
- (5) Wire rope.
 - (a) Wire ropes must meet the crane or wire rope manufacturer's specifications for size, type and inspection requirements. In the absence of the manufacturer's specifications, follow the requirements for removal criteria located in this section, including Table 1.

**Table 1 - Wire Rope Inspection/Removal Criteria
(See also Figure 1 - Wire Rope)**

Category of Crane Types	Running Ropes.* # of broken wires in		Rotation Resistant.* # of broken wires in		Standing Ropes.* # of broken wires	
	1 rope lay	1 strand in 1 lay	Specified diameters		In 1 lay beyond end connection	At end connection
Mobile	6	3	2 (in 6xd)	4 (in 30xd)	3	2
Articulating	6	3	Consult rope mfg.	Consult rope mfg.	3	2
Tower	12	4	2 (in 6xd)	4 (in 30xd)	3	3
Self-Erector	6	3	2 (in 6xd)	4 (in 30xd)	3	2
Overhead & Bridge	12	4	2 (in 6xd)	4 (in 30xd)	--	--
Derricks	6	3	Consult rope mfg.	Consult rope mfg.	3	2

*** Also remove if you detect 1 wire broken at the contact point with the core or adjacent strand; so called valley breaks or evidence from any heat damage from any cause.**

Note: xd means times the "diameter."

- (b) The accredited crane certifier must perform a complete and thorough inspection covering the surface of the working range plus three additional wraps on the drum of the wire ropes.
- (c) If a deficiency is identified, an immediate determination must be made by the accredited crane certifier as to whether the deficiency constitutes a safety hazard. If the deficiency is determined to constitute a safety hazard, the crane must not be certified until:
 - (i) The wire rope is replaced and verified by the accredited crane certifier; or
 - (ii) If the deficiency is localized, the problem is corrected by severing the wire rope; the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited.
- (d) Remove wire rope from service if reductions from nominal diameter are greater than those shown below in Table 2.

Table 2 - Maximum Allowable Reduction from Nominal Diameter

Rope Diameter	Maximum Allowable Reduction from Nominal Diameter
Up to 5/16 inch (8 mm)	1/64 inch (0.4 mm)
3/8 inch (9.5 mm) to 1/2 inch (13 mm)	1/32 inch (0.8 mm)
9/16 inch (14.5 mm) to 3/4 inch (19 mm)	3/64 inch (1.2 mm)
7/8 inch (22 mm) to 1 1/8 inch (29 mm)	1/16 inch (1.6 mm)
Over 1 1/8 inch (32 mm) to 1 1/2 inch (38 mm)	3/32 inch (2.4 mm)

Replacement rope must be of a compatible size and have a strength rating at least as great as the original rope furnished or recommended by the crane manufacturer.

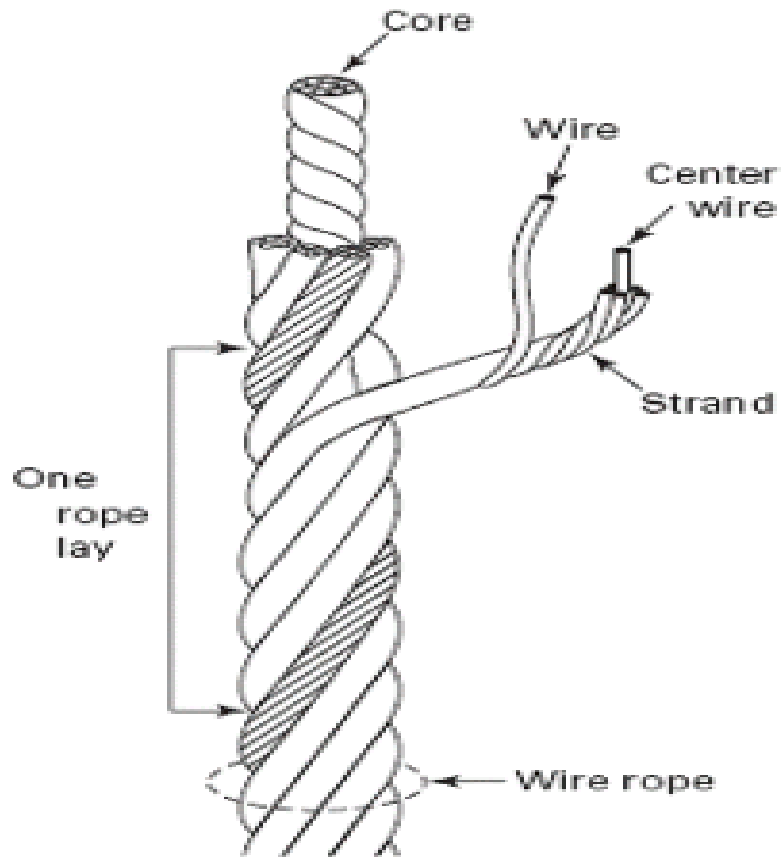


Figure 1 --Wire Rope

- (6) Sheaves.
- (a) **Sheave grooves must be free from surface defects that could damage the rope.** The cross-sectional radius at the bottom of the groove should be such as to form a close fitting saddle for the size of rope used. The sides of the groove must be tapered outward and rounded at the rim to facilitate entrance of the rope into the groove. Flange rims must run true about the axis of rotation.
 - (b) Sheave guards must be in place to:
 - (i) Guide the rope back into the sheave groove, when using ropes that can be momentarily unloaded.
 - (ii) Prevent ropes from becoming fouled when the block is lying on the ground with loose ropes.
 - (c) Sheave bearings, except for permanently lubricated ones, must have a means of lubrication.
- (7) Prior to performing a proof load test:
- (a) A safe test area must be selected and all traffic and unauthorized personnel and equipment must be cleared from test area. This test area must be roped off or otherwise secured to prevent entry of unauthorized personnel and equipment;
 - (b) Rigging gear must be inspected by a qualified person prior to using for load test of crane;
 - (c) The employer must ensure all load test personnel understand the safety procedures of the test;
 - (d) Proof load tests, with the exception of tower cranes, are overload tests and extreme caution must be observed at all times. Personnel must remain clear of suspended loads and areas where they could be struck in the event of boom failure. The test load must be raised only to a height sufficient to perform the test;
 - (e) During tests, safe operating speeds must be employed. Rated speeds in accordance with manufacturer's specifications need not be attained. Emphasis must be placed on the ability to safely control loads through all motions at normal speeds;
 - (f) Proof load tests require the use of certified weights, or scaled weights using a certified scale with a current certificate of calibration;
 - (g) Proof load tests must not exceed the manufacturer's specifications. Where these specifications are unavailable, a registered professional engineer familiar with the type of equipment involved must develop written specifications.

WAC 296-155-53202 Additional inspection criteria and proof load testing--Mobile cranes.

- (1) After it is determined that the crane configurations meet the criteria in WAC 296-155-53200, the accredited crane certifier must conduct a visual inspection of the following components, if applicable, which can be visually inspected without disassembly (not including removal of inspection covers):
 - (a) All control and drive mechanisms for adjustments interfering with proper operation and for excessive wear or contamination by lubricants or other foreign matter;
 - (b) Air, hydraulic, and other pressurized lines for deterioration or leakage, particularly those which flex in normal operation;
 - (c) Hydraulic system for proper fluid level;
 - (d) Safety latches on hooks for damage;
 - (e) Hooks for deformation, cracks, excessive wear, or damage such as from chemicals or heat;
 - (f) A legible and applicable operator's manual and load chart is in the operator's cab or station;
 - (g) A portable fire extinguisher, with a basic minimum extinguishing rating of ten BC must be installed in the cab or at the machinery housing;
 - (h) Crane cleanliness and housekeeping. Inspect for trash, oil, grease, debris or excessive dirt on crane components and catwalks, if applicable;
 - (i) Wire rope reeving for compliance with the manufacturer's specifications;
 - (j) Wire rope, in accordance with WAC 296-155-53200(5);
 - (k) Electrical apparatus for malfunctioning, signs of apparent excessive deterioration, dirt or moisture accumulation;
 - (l) Tires (when in use) for proper inflation and condition;
 - (m) Ground conditions around the equipment for proper support, including ground settling under and around outriggers and supporting foundations, ground water accumulation, or similar conditions;
 - (n) The equipment for level position;
 - (o) Operator cab windows for significant cracks, breaks, or other deficiencies that would hamper the operator's view;

- (p) Rails, rail stops, rail clamps and supporting surfaces when the equipment has rail traveling;
- (q) Equipment structure (including the boom and, if equipped, the jib):
 - (i) Structural members: Deformed, cracked, or significantly corroded.
 - (ii) Bolts, rivets and other fasteners: Loose, failed or significantly corroded.
 - (iii) Welds for cracks.
- (r) Sheaves and drums for cracks or significant wear;
- (s) Parts such as pins, bearings, shafts, gears, rollers and locking devices for distortion, cracks or significant wear;
- (t) Brake and clutch system parts, linings, pawls and ratchets for excessive wear;
- (u) Safety devices and operational aids for proper operation (including significant inaccuracies);
- (v) Gasoline, diesel, electric, or other power plants for safety-related problems (such as leaking exhaust and emergency shut-down feature), condition and operation;
- (w) Chains and chain drive sprockets for excessive wear of sprockets and excessive chain stretch;
- (x) Travel steering, brakes, and locking devices, for proper operation;
- (y) Tires for damage or excessive wear;
- (z) Hydraulic, pneumatic and other pressurized hoses, fittings and tubing, as follows:
 - (i) Flexible hose or its junction with the fittings for indications of leaks.
 - (ii) Threaded or clamped joints for leaks.
 - (iii) Outer covering of the hose for blistering, abnormal deformation or other signs of failure/impending failure.
 - (iv) Outer surface of a hose, rigid tube, or fitting for indications of excessive abrasion or scrubbing.
- (aa) Hydraulic and pneumatic pumps and motors, as follows:
 - (i) Performance indicators: Unusual noises or vibration, low operating speed.
 - (ii) Loose bolts or fasteners.

- (iii) Shaft seals and joints between pump sections for leaks.
 - (bb) Hydraulic and pneumatic cylinders, as follows:
 - (i) Drifting.
 - (ii) Rod seals and welded joints for leaks.
 - (iii) Cylinder rods for scores, nicks and dents.
 - (iv) Case (barrel) for significant dents.
 - (v) Rod eyes and connecting joints: Loose or deformed.
 - (cc) Outrigger pads/floats and slider pads for excessive wear or cracks; cribbing/dunnage for proper installation;
 - (dd) Electrical components and wiring for cracked or split insulation and loose or corroded terminations;
 - (ee) Legible warning labels and decals as required by the manufacturer;
 - (ff) Operator seat: Missing or unusable;
 - (gg) Equipped with original, or the equivalent, steps, ladders, handrails, guards;
 - (hh) Steps, ladders, handrails, and guards are in safe and usable condition;
- (2) Crane deficiencies. If the accredited crane certifier determines other findings need to be monitored, the accredited crane certifier must provide written notification to the owner or lessee.
- (3) Operational testing. An operational test must be made without a load applied to the hook of the following items if they are applicable to the crane to ensure they function correctly:
- (a) Load lifting/hoisting and lowering mechanisms;
 - (b) Boom lifting/hoisting and lowering mechanisms;
 - (c) Boom extension and retraction mechanism;
 - (d) Swing mechanism;
 - (e) Travel mechanism;
 - (f) Brakes and clutches;
 - (g) Limit, locking, and safety devices;

- (h) Suspension systems for cranes that work on rubber (tires); and
 - (i) During the operational testing, special attention must be paid to hydraulic and pneumatic valves: Spools (sticking, improper return to neutral, and leaks); leaks; valve housing cracks; relief valves.
- (4) Annual and quadrennial proof load testing.
- (a) Proof load tests must be completed on all hoist lines. The test load must be at least one hundred percent but not to exceed one hundred and ten percent of rated capacity (i.e., for the crane's configuration of reeving, boom length, etc.). The rated capacity must be the capacity shown on the posted load chart or as limited by other factors such as hook block capacity or wire rope line pull if the crane is not fully reeved. The test load includes the weight of (or deduction values for) the hook, block, slings, and auxiliary lifting devices (and for some cranes hoist wire rope not accounted for in load charts), and the combined weight deduction values must be subtracted from the nominal test load in order to determine the amount of test weights to be used. Follow original equipment manufacturer (OEM) load chart instructions for weight deduction values. Check accuracy of load indicators where installed. Test procedures for these cranes must follow OEM procedures and recommendations.
 - (b) Annual proof load testing. After the crane has passed the visual and operational tests, a proof load test must be conducted in the as-configured condition and must be performed within the structural and stability section of the manufacturer's load chart, as applicable. This test must be documented on the form or in the format approved by the department. A copy of this completed form and inspection worksheets must be sent to the department within ten working days upon completion of the examination.
 - (c) Quadrennial proof load testing. No major component (luffing boom, swing-away jibs, fly sections, jibs at variable offsets and boom sections) may be used unless it has been proof load tested within the prior four-year period. For jibs with variable offset angles, tests at the maximum offset used and maximum extension of all boom sections.
 - (i) This test must be performed in accordance with this section and documented on the form or in the format approved by the department.
 - (ii) A copy of this completed form and inspection worksheets must be sent to the department within ten working days upon completion of the inspection.
 - (d) Free rated load test ("on rubber"). Check the stability and operation of crane, carrier, wheels, tires, tracks, brakes, etc., under load by performing the following tests, when lifting without outriggers and/or traveling with the load are permitted at the activity for the type of crane being tested.

Note: Ensure all free rated load tests "on rubber" lifting requirements established by the OEM are complied with. Attach taglines to the load to control oscillation. For cranes with outriggers, extend outriggers and maintain minimal clearance (three to four inches) above ground. Test personnel must stand clear of tires during load tests. This test is only required if the owner/lessee wants an "on rubber" certification. If the crane has "on rubber" capabilities and the owner does not desire this certification, the crane certifier must document it on the certification document.

- (i) Maximum free rated load. Hoist maximum free rated test load at minimum possible radius over the rear (or over the front as required by the OEM). Slowly boom down to the maximum radius for the load. With boom and load hoist pawls (dogs) engaged where applicable, complete (d)(i)(A) and (B) of this subsection.
 - (A) Rotate through the appropriate working arc;
 - (B) Travel a minimum of fifty feet with test load over the rear (or front as required by the OEM) with the boom parallel to the longitudinal axis of the crane carrier.
- (ii) Stability test. Repeat the step in (d)(i) of this subsection with a test load corresponding to the radii determined as follows: For telescoping boom cranes, test with the boom approximately halfway between fully retracted and fully extended but do not exceed OEM's boom length limitation for lifting on rubber. If no ratings are governed by stability, no stability test is required.

Note: When lifting test loads, always lift the load well within the maximum radius and slowly boom down to a premeasured radius. Lift the test load only high enough to perform the required tests.

WAC 296-155-53204 Additional inspection criteria and proof load testing-- Articulating boom cranes.

- (1) After it is determined that the crane configurations meet the criteria in WAC 296-155-53200, the accredited crane certifier must visually inspect the following items, if applicable, on cranes for sound physical condition and that they are functional within the manufacturer's recommendations (not including removal of inspection covers):
 - (a) All control and drive mechanisms for adjustments interfering with proper operation and for excessive wear or contamination by lubricants or other foreign matter;
 - (b) Safety devices for malfunction;
 - (c) All hydraulic hoses, particularly those which flex in normal operation of crane functions;
 - (d) Hooks and latches for deformation, chemical damage, cracks, and wear;
 - (e) Rope reeving for compliance with crane manufacturer's specifications;

- (f) Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt, and moisture accumulation;
- (g) Hydraulic system for proper oil level and leaks;
- (h) Excessively worn or damaged tires. Recommended inflation pressure, cuts, and loose wheel nuts;
- (i) Connecting pins and locking device for wear and damage;
- (j) Deformed, cracked, or corroded members in the crane structure and carrier;
- (k) Loose bolts, particularly mounting bolts;
- (l) Cracked or worn sheaves and drums;
- (m) Worn, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers, and locking devices;
- (n) Excessive wear on brake and clutch system parts and lining;
- (o) Travel steering, braking, and locking devices, for malfunction;
- (p) Hydraulic, pneumatic and other pressurized hoses, fittings and tubing, as follows:
 - (i) Flexible hose or its junction with the fittings for indications of leaks.
 - (ii) Threaded or clamped joints for leaks.
 - (iii) Outer covering of the hose for blistering, abnormal deformation or other signs of failure/impending failure.
 - (iv) Outer surface of a hose, rigid tube, or fitting for indications of excessive abrasion or scrubbing;
- (q) Hydraulic and pneumatic pumps and motors, as follows:
 - (i) Performance indicators: Unusual noises or vibration, low operating speed.
 - (ii) Loose bolts or fasteners.
 - (iii) Shaft seals and joints between pump sections for leaks;

- (r) Hydraulic and pneumatic cylinders, as follows:
 - (i) Drifting.
 - (ii) Rod seals and welded joints for leaks.
 - (iii) Cylinder rods for scores, nicks and dents.
 - (iv) Case (barrel) for significant dents;
 - (s) Crane cleanliness and housekeeping. Inspect for trash, oil, grease, debris or excessive dirt on crane components and catwalks, if applicable;
 - (t) Legible warning labels and decals as required by the manufacturer;
 - (u) A portable fire extinguisher, with a basic minimum extinguishing rating of ten BC must be installed in the cab or at the machinery housing;
 - (v) A legible and applicable operator's manual and load chart is in the operator's cab or station.
- (2) Annual proof load testing of articulating boom cranes.
- (a) Annual proof load testing. After the crane has passed the visual and operational tests, the accredited crane certifier must ensure a proof load test is conducted and must be performed within the structural and stability section of the manufacturer's load chart, as applicable. This test must be documented on the form or in the format approved by the department. A copy of this completed form and inspection worksheets must be sent to the department within ten working days upon completion of the examination.
 - (b) Test loads must not be less than one hundred percent or more than one hundred and ten percent of the rated load, unless otherwise recommended by the manufacturer.
 - (c) Hoist the test load to assure that the load is supported by the crane and held by the hoist brake(s).
 - (d) Swing the crane, if applicable, the full range of its swing.
 - (e) Boom the crane up and down within allowable working radius for the test load.
 - (f) Lower the test load, stop and hold the load with the brake(s).
- (3) Quadrennial proof load testing. If the articulating boom crane has a jib or boom extension, these components may not be used unless it has been proof load tested within the prior four-year period.

WAC 296-155-53206 Additional inspection criteria and proof load testing--Tower cranes.

- (1) Tower cranes and tower crane assembly parts must be inspected by a crane certifier both 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.
- (2) The accredited crane certifier must verify a registered professional structural engineer, licensed under chapter 18.43 RCW, has certified that the crane foundations and underlying soil are adequate support for the tower crane with its maximum overturning movement.
- (3) Prior to erecting a tower crane on a nonstandard tower crane base, the accredited crane certifier must verify that the engineering configuration of this base has been reviewed and acknowledged as acceptable by an independent registered professional structural engineer, licensed under chapter 18.43 RCW.
- (4) The accredited crane certifier must review the following documents as part of the crane certification process for the current location and inspection period:
 - (a) Crane maintenance records of critical components to ensure maintenance of these components has been performed in accordance with the manufacturer's recommendations;
 - (b) Crane periodic and frequent inspection documentation.
- (5) After it is determined that the crane configurations meet the criteria in WAC 296-155-53200, the accredited crane certifier must visually inspect the following items, if applicable, on tower cranes for sound physical condition and that they are functional within the manufacturer's recommendations (not including removal of inspection covers):
 - (a) All control and drive mechanisms for interfering with proper operation and for excessive wear or contamination by lubricants or other foreign matter;
 - (b) Motion limiting devices for proper operation with the crane unloaded; each motion should be inched into its limiting device by carefully running at slow speed;
 - (c) Load limiting devices for proper operation and accuracy of settings;
 - (d) Air, hydraulic, and other pressurized lines for deterioration or leakage, particularly those which flex in normal operation;
 - (e) Hydraulic system for proper fluid level;
 - (f) Hydraulic, pneumatic and other pressurized hoses, fittings and tubing, as follows:

- (i) Flexible hose or its junction with the fittings for indications of leaks.
 - (ii) Threaded or clamped joints for leaks.
 - (iii) Outer covering of the hose for blistering, abnormal deformation or other signs of failure/impending failure.
 - (iv) Outer surface of a hose, rigid tube, or fitting for indications of excessive abrasion or scrubbing;
- (g) Hydraulic and pneumatic pumps and motors, as follows:
- (i) Performance indicators: Unusual noises or vibration, low operating speed.
 - (ii) Loose bolts or fasteners.
 - (iii) Shaft seals and joints between pump sections for leaks;
- (h) Hydraulic and pneumatic cylinders, as follows:
- (i) Drifting.
 - (ii) Rod seals and welded joints for leaks.
 - (iii) Cylinder rods for scores, nicks and dents.
 - (iv) Case (barrel) for significant dents;
- (i) Electrical components for malfunctioning, signs of apparent excessive deterioration, dirt or moisture accumulation, wiring for cracked or split insulation, and loose or corroded terminations;
- (j) Stationary cranes for manufacturer's recommended grounding of structure and power supply. Rail traveling cranes for grounding of each rail and the power supply per the manufacturer's recommendations;
- (k) Runway rail and clamps. Inspect for loose, broken or missing clamps;
- (l) Hooks and safety latches for deformation, cracks, excessive wear, or damage such as from chemicals or heat;
- (m) Wedges and supports of climbing cranes for looseness or dislocation;
- (n) Braces or guys supporting cranes' masts (towers) and anchor bolt base connections for looseness;

- (o) Crane structure (including the boom, jib and counter jib):
 - (i) Structural members: Deformed, cracked, or significantly corroded.
 - (ii) Bolts, rivets and other fasteners: Loose, failed or significantly corroded.
 - (iii) Welds for cracks.
- (p) Cracked or worn sheaves and drums;
- (q) Worn, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers, locking and clamping devices, sprockets, and drive chains or belts;
- (r) Excessive wear on brake and clutch system parts, linings, pawls, and ratchets;
- (s) Load, wind, and other indicators for inaccuracies outside the tolerances recommended by the manufacturer;
- (t) Travel mechanisms for malfunction, excessive wear or damage;
- (u) A legible and applicable operator's manual and load chart is in the operator's cab;
- (v) Crane cleanliness and housekeeping. Inspect for trash, oil, grease, debris or excessive dirt on crane components and catwalks, if applicable;
- (w) A portable fire extinguisher, with a basic minimum extinguishing rating of ten BC must be installed in the cab or at the machinery housing;
- (x) When applicable, tower tie-in collars, struts, and connections to building structure are structurally sound, free of cracks, distortion, excessive wear or corrosion. Pins and structural bolts are tight and installed per the manufacturer's specification;
- (y) Ballast blocks in place and secured per manufacturer's recommendations;
- (z) For cranes that telescope, the raising mechanism operates within the manufacturer's specifications;
- (aa) For cranes that top climb, the climbing frame operates within the manufacturer's specifications;
- (bb) A means to prevent traveling tower cranes running into stops while under power;
- (cc) A functional audible warning alarm that automatically sounds whenever the traveling tower crane travels;
- (dd) Wire rope reeving for compliance with the manufacturer's specifications;

- (ee) Wire rope, in accordance with WAC 296-155-53200(5);
 - (ff) Safety devices and operational aids for proper operation (including significant inaccuracies);
 - (gg) Legible warning labels and decals as required by the manufacturer;
 - (hh) Steps, ladders, handrails and guards are in safe and usable condition.
- (6) Additional requirements for tower cranes prior to performing a proof load test.

Note: General requirements relating to preproof load tests for all cranes are located in WAC 296-155-53200.

- (a) When tower cranes are erected, and before placing in service, all functional motions, motion limiting, load limiting devices, locking and safety devices, brakes and clutches must be tested for operation and be within the manufacturer's specification prior to placing the crane in operation.
- (b) Proof load tests require the use of certified weights, or scaled weights using a certified scale with a current certificate of calibration.
- (c) Functional motion test must be at crane manufacturer's rated load. Each test must include:
 - (i) Load hoisting and lowering;
 - (ii) Jib (boom) hoisting and lowering, or trolley travel;
 - (iii) Slewing motion;
 - (iv) Travel motion when rail mounted;
 - (v) Brakes and clutches; and
 - (vi) Limit, locking, and safety devices.

Note: Functional motion tests made after climbing or telescoping may be performed without load.

- (d) The functional motion test listed in (c) of this subsection must continue until all controls, drives, and braking systems have been engaged and have functioned per the crane manufacturer's specifications.
- (e) Order in which tests of tower cranes are to be performed is as follows:
 - (i) Functional motion test without rated load;

- (ii) Functional motion test at crane manufacturer's rated load. For other than traveling cranes, these tests may be combined with test of base structural support or foundation system given in (c) of this subsection;
 - (iii) Test of base structural support or foundation under (f) of this subsection.
 - (f) During functional motion tests, the crane's base structural support or foundation system must be visually checked by the accredited crane certifier. If any part of the crane's base structural support or foundation system shows excessive visual displacement, visual distress, or audible distress, then the lifted load must be lowered at hoist creep speed and all crane operations are to cease. An evaluation must then be made by the accredited crane certifier.
- (7) Proof load testing of tower cranes. Setting hoist load limits for tower cranes.
- (a) Annual proof load testing. After the crane has passed the visual and operational tests, the accredited crane certifier must ensure a proof load test is conducted and must be performed according to the manufacturer's recommendations. This test must be documented on the form or in the format approved by the department. A copy of this completed form and inspection worksheets must be sent to the department within ten working days upon completion of the examination.
 - (b) Tower crane hoist load limit switches must be set in accordance with the manufacturer's specifications using specified certified weights. Procedure is to be verified by the accredited crane certifier. In the absence of the manufacturer's specifications, hoist load limit switches must be verified by means of a static test using test loads of one hundred and two and one-half percent to one hundred and ten percent of the applicable ratings. Test loads are to be lifted at creep speed until just clear of the ground.
 - (c) Setting of hoist load limits must be documented on the form provided by the department. A copy of the completed form and inspection worksheets must be sent to the department within ten days upon completion of the examination.
 - (d) After erection of fixed freestanding tower cranes, the base structural support or foundation system on which the crane is supported must be tested before placing the crane in service. The test must be conducted with the crane manufacturer's rated load placed at maximum radius permitted by site conditions. When the base structural support or foundation is symmetrical, the crane's jib (boom) must be rotated through ninety degrees with ten minute stops at the starting position and at each forty-five degree position. When the support is asymmetrical, the crane's jib (boom) must be rotated through three hundred and sixty degrees with ten minute stops at the starting position and at each forty-five degree position.

- (e) After erection of rail traveling tower cranes, the base structural support or foundation system to which the rail is attached must be tested before placing the crane in service. The test must be conducted with the crane manufacturer's rated load placed at maximum radius permitted by site conditions. The jib (boom) must be located over the bogie. The crane must travel the entire length of runway, returning with the same load over the bogie on the opposite rail.

WAC 296-155-53208 Additional inspection criteria and proof load testing--Self-erecting tower cranes.

- (1) After it is determined that the crane configurations meet the criteria in WAC 296-155-53200, the accredited crane certifier must visually inspect the following items, if applicable, on cranes for sound physical condition and that they are functional within the manufacturer's recommendations (not including removal of inspection covers):
 - (a) For cranes that telescope the internal tower by a climbing frame, the climbing mechanism is structurally sound; is free of cracks, distortion, excessive wear or corrosion; operates within the manufacturer's specifications;
 - (b) Structural bolts are tightened;
 - (c) All control and drive mechanisms for interfering with proper operation and for excessive wear or contamination by lubricants or other foreign matter;
 - (d) Motion limiting devices for proper operation with the crane unloaded; each motion should be inched into its limiting device by carefully running at slow speed;
 - (e) Load limiting devices for proper operation and accuracy of settings;
 - (f) Air, hydraulic, and other pressurized lines for deterioration or leakage, particularly those which flex in normal operation;
 - (g) Hydraulic system for proper fluid level;
 - (h) Hydraulic, pneumatic and other pressurized hoses, fittings and tubing, as follows:
 - (i) Flexible hose or its junction with the fittings for indications of leaks.
 - (ii) Threaded or clamped joints for leaks.
 - (iii) Outer covering of the hose for blistering, abnormal deformation or other signs of failure/impending failure.
 - (iv) Outer surface of a hose, rigid tube, or fitting for indications of excessive abrasion or scrubbing;

- (i) Hydraulic and pneumatic pumps and motors, as follows:
 - (i) Performance indicators: Unusual noises or vibration, low operating speed.
 - (ii) Loose bolts or fasteners.
 - (iii) Shaft seals and joints between pump sections for leaks;
- (j) Hydraulic and pneumatic cylinders, as follows:
 - (i) Drifting.
 - (ii) Rod seals and welded joints for leaks.
 - (iii) Cylinder rods for scores, nicks and dents.
 - (iv) Case (barrel) for significant dents;
- (k) Electrical components for malfunctioning, signs of apparent excessive deterioration, dirt or moisture accumulation, wiring for cracked or split insulation, and loose or corroded terminations;
- (l) Ensure crane is grounded per manufacturer's specifications;
- (m) Hooks and safety latches for deformation, cracks, excessive wear, or damage such as from chemicals or heat;
- (n) Crane structure (including the boom, jib and counter jib):
 - (i) Structural members: Deformed, cracked, or significantly corroded.
 - (ii) Bolts, rivets and other fasteners: Loose, failed or significantly corroded.
 - (iii) Welds for cracks;
- (o) Cracked or worn sheaves and drums;
- (p) Worn, cracked, or distorted parts such as pins, bearings, shafts, gears, rollers, locking and clamping devices, sprockets, and drive chains or belts;
- (q) Excessive wear on brake and clutch system parts, linings, pawls, and ratchets;
- (r) Load, wind, and other indicators for inaccuracies outside the tolerances recommended by the manufacturer;
- (s) A legible and applicable operator's manual and load chart is in the operator's station;

- (t) Crane cleanliness and housekeeping. Inspect for trash, oil, grease, debris or excessive dirt on crane components and catwalks, if applicable;
 - (u) A portable fire extinguisher, with a basic minimum extinguishing rating of ten BC must be installed in the cab or at the machinery housing;
 - (v) Ballast blocks in place and secured per manufacturer's recommendations;
 - (w) Wire rope reeving for compliance with the manufacturer's specifications;
 - (x) Wire rope, in accordance with WAC 296-155-53200(5);
 - (y) Safety devices and operational aids for proper operation (including significant inaccuracies);
 - (z) Legible warning labels and decals as required by the manufacturer;
 - (aa) Steps, ladders, handrails and guards are in safe and usable condition.
- (2) Additional requirements for self-erecting tower cranes prior to performing a proof load test.

Note: General requirements relating to preproof load tests for all cranes are located in WAC 296-155-53200.

- (a) Functional motion test must be at crane manufacturer's rated load. Each test must include:
 - (i) Load hoisting and lowering;
 - (ii) Jib (boom) hoisting and lowering, or trolley travel;
 - (iii) Slewing motion;
 - (iv) Brakes and clutches;
 - (v) Limit, locking, and safety devices.
- (b) The functional motion test listed in (a) of this subsection must continue until all controls, drives, and braking systems have been engaged and have functioned per the crane manufacturer's specifications.
- (c) Order in which tests of self-erecting tower cranes are to be performed is as follows:
 - (i) Functional motion test without rated load;
 - (ii) Functional motion test at crane manufacturer's rated load. These tests may be combined with test of base structural support or foundation system given in (a) of this subsection.

- (d) During functional motion tests, the crane's base structural support or foundation system must be visually checked by the accredited crane certifier. If any part of the crane's base structural support or foundation system shows excessive visual displacement, visual distress, or audible distress, then the lifted load must be lowered at hoist creep speed and all crane operations are to cease. An evaluation must then be made by the accredited crane certifier.
- (3) Annual proof load testing of self-erecting tower cranes.
- (a) Annual proof load testing. After the crane has passed the visual and operational tests, the accredited crane certifier must ensure a proof load test is conducted and must be performed according to the manufacturer's recommendations. This test must be documented on the form or in the format approved by the department. A copy of this completed form and inspection worksheets must be sent to the department within ten working days upon completion of the examination.
 - (b) The structural support or foundation examination during proof load test:
 - (i) This test must be conducted with the rated load placed at maximum radius permitted by site conditions. The superstructure must be rotated through three hundred sixty degrees with five-minute stops at each outrigger position. If any part of the support structure becomes displaced or distressed, all crane operations must stop until an evaluation is made by a qualified person.
 - (ii) For rail-mounted cranes, a load test must be conducted with the jib in the position causing maximum loading on one wheel or bogie. The test must comprise traveling the entire length of the runway, then returning with the same load on the other rail. If a sleeper or support becomes displaced or damaged, crane operations must stop until an evaluation is made by a qualified person or until track ballast has been reset, or repairs made and a satisfactory test performed.
 - (c) Self-erecting tower crane hoist load limit switches must be set in accordance with the manufacturer's specifications using specified certified weights. Procedure is to be verified by the accredited crane certifier.
 - (d) Setting of hoist load limits must be documented on the form provided by the department. A copy of the completed form and inspection worksheets must be sent to the department within ten days upon completion of the examination.

**WAC 296-155-53210 Additional inspection criteria and proof load testing--
Overhead and bridge cranes.**

- (1) After it is determined that the crane configurations meet the criteria in WAC 296-155-53200, the accredited crane certifier must visually inspect, without disassembly, and if applicable, the following items on overhead and bridge cranes for sound physical condition and that they are functional within the manufacturer's recommendations (not including removal of inspection covers):
 - (a) Controllers. Control mechanisms for interfering with proper operation. Control and drive mechanisms for apparent excessive wear of components and contamination by lubricants, water or other foreign matter;
 - (b) Load hooks. Inspect for damage wear to hook nuts, safety latch and hook swivel. Check for deformation, cracks, excessive wear, or damage such as from chemicals or heat. Inspect blocks for wear to sheaves, check plates, and pins. Check for loose pins, bolts and guards;
 - (c) Sheaves and bearings. Check all sheaves and bearings for lubrication and excessive wear. Ensure sheaves turn freely. Check sheave pin locking device;
 - (d) Structural supports. Inspect for damage or bent girders, girder seat top plate, diaphragms and structural column connections. Check for loose bolts or rivets, and cracks;
 - (e) Bridge inspection.
 - (i) Check complete structure for broken, cracked, damaged, missing, or corroded parts and members.
 - (ii) Handrails, walkways, and ladders. Inspect for loose, missing, bent, deteriorated or misaligned members, loose bolts, rivets, broken welds and hangers;
 - (f) Brackets. Check for cracked or corroded welds, missing or loose bolts, bent or cracked brackets;
 - (g) End stops. Inspect for damaged wheels, broken welds, loose or missing bolts, damaged bumpers, missing pins or damaged plates;
 - (h) Runway rail and clamps. Inspect for loose, broken or missing clamps. Check the condition of railhead and side wear, rail splice plates and/or welds, rail gaps and associated bolts, wedges, connectors and rail switches;
 - (i) Crane alignment. Inspect for proper bridge end float while crane travels in both directions on runway. Check all corner connections for rust, shear marks, loose or missing bolts, nuts and washers. Inspect square marks and legibility of dimension;

- (j) Wheels and bearings. Inspect wheels for wear, flat spots, chips, flange wear, cracks, loose axle pins, or securing devices. Check bearing clearance, chatter, loose bearing caps and lubrication;
- (k) Trolley. Check for loose, missing, broken or bent members. Inspect for loose, faulty or missing coupling guards. Check for broken, loose or missing axle pins. Inspect for axle pins displaying excessive wear;
- (l) Trolley rail. Inspect for bent or damaged members, loose bolts, rivets, guards, trolley rail clamps, end stops and broken welds. Check condition of rail head and side wear, rail splice plates and/or welds and rail gaps;
- (m) Trolley conductors. Inspect insulators and clamps, loose connectors, bent, pitted or damaged wires or collectors;
- (n) Shafts, couplings, and bearings. Inspect shafts for vibration, cuts and nicks, loose or worn keyways and misalignment. Check coupling for wear, loose bolts or keys and misalignment. Inspect bearing for clearance, chatter, loose bearing caps and proper lubrication;
- (o) Gearing. Inspect gears for worn teeth, cracked teeth, superficial root cracks, pitting, unusual indentation or wear marks, full contact or end loading, loose set screws and keys. Check guards and covers. Inspect gear cases for excessive noise and vibration, proper lubrication and leaking;
- (p) Wire rope and drum. Inspect wire rope for damage. Check rope clip fittings and associated mounting hardware for wear and damage. Inspect drum grooves for excessive wear. Inspect drum pedestal and bearing condition. Check for cracks in drum;
- (q) Electrical items. Check all contacts for proper alignment and evidence of excess heating or unusual arcing. Inspect all coils, contact leads, shunts and wires, fuses or overload devices for loose connections and evidence of overheating. Inspect panel board and arc shields for cracks, loose bolts, dirt and moisture. Check panel marking for legibility. Inspect speed control resistors for damaged insulation, cracked or broken grids, loose connections, bolts and brackets;
- (r) Motor. Inspect for damage, bearing noise, vibration and lubrication, spark and cleanliness of commutator and brush wear, loose hold down bolts and motor brackets. Inspect commutator or slip rings for evidence of overheating and brush sparking. Inspect motor leads and insulators, damaged or deteriorated insulation and loose connections. Inspect brush holder for proper clearance to commutator or slip rings, and freedom of brushes;

- (s) Brakes. Inspect for wear in linkage, pins and cams, weakness of springs, wear and condition of lining, smoothness of the drum, heat check crack and clearance between drum or disk. Inspect for improper solenoid air gap; evidence of overheating; damaged brass, and loose core laminations; delay or restriction in opening of brakes;
 - (t) Hoist brakes. Inspect for wear in linkage, pins and cams, weakness of springs, wear and condition of lining, smoothness of drum, heat check cracks and clearance between drum or disk. Inspect for improper solenoid air gap; evidence of overheating; damaged brass, and loose core laminations; delay or restriction in opening of brakes;
 - (u) Limit switches. Remove covers and inspect all electrical and mechanical components for malfunction including contacts, springs, ratchets, pins, arm and insulators, rollers, cams and dogs. Inspect cover gaskets, counterweight guides. Check all securing bolts and guards. Check for weather or moisture damage. Check for proper operation;
 - (v) Crane cleanliness and housekeeping. Inspect for trash, oil, grease, debris or excessive dirt on crane components and catwalks, if applicable;
 - (w) Operation of crane controls. Operate all crane controls and check for proper operation. Check for smooth and regular motions without abnormal sensations, hesitations, binding, vibrations, shimmy, or irregularity;
 - (x) Warning device/fire protection. Inspect for proper operation of sirens, horns, bells and lights. Check switches and inspect wiring and connections;
 - (y) A legible and applicable operator's manual and load chart is in the operator's cab or station;
 - (z) A portable fire extinguisher, with a basic minimum extinguishing rating of ten BC must be installed in the cab or at the machinery housing.
- (2) Annual proof load testing of bridge/overhead cranes.
- (a) Annual proof load testing. After the crane has passed the visual and operational tests, the accredited crane certifier must ensure a proof load test is conducted and must be performed according to the manufacturer's recommendations or a registered professional structural engineer (RPSE). This test must be documented on the form or in the format approved by the department. A copy of this completed form and inspection worksheets must be sent to the department within ten working days upon completion of the examination.
 - (b) The proof load test must be at least one hundred percent but not to exceed one hundred twenty-five percent of the rated capacity.

- (c) This test must be documented on the form or in the format approved by the department. A copy of this completed form and inspection worksheets must be sent to the department within ten working days upon completion of the examination.
- (d) Hoist the test load a distance to assure that the load is supported by the crane and held by the hoist brake(s).
- (e) Transport the test load by means of the trolley for the full length of the bridge, as practical.
- (f) Transport the test load by means of the bridge for the full length of the runway in one direction with the trolley as close to the extreme right-hand end of the crane as practical, and in the other direction with the trolley as close to the left-hand end of the crane as practical.
- (g) Lower the test load, and stop and hold the test load with the brake(s).
- (h) Mechanical load brake tests. Hoist test load and hold for five minutes.

Release the holding brake, either mechanically or electrically to verify mechanical load brake function or hoist the rated load then lower, monitoring the hoist for any speed control issues.

**WAC 296-155-53212 Additional inspection criteria and proof load testing--
Derricks.**

- (1) After it is determined that the derrick configurations meet the criteria in WAC 296-155-53200, the accredited derrick certifier must visually inspect the following items, if applicable, on derricks for sound physical condition and that they are functional within the manufacturer's recommendations (not including removal of inspection covers):
 - (a) All control and drive mechanisms for adjustments interfering with proper operation and for excessive wear or contamination by lubricants or other foreign matter;
 - (b) All chords and lacing, tension in guys, plumb of the mast, external indication of deterioration or leakage in air or hydraulic systems;
 - (c) Derrick hooks for deformation or cracks, distortion causing an increase in throat opening of five percent not to exceed one-quarter inch or as recommended by the manufacturer. Any wear exceeding ten percent (or as recommended by the manufacturer) of the original section dimension of the hook;
 - (d) Rope reeving for noncompliance with derrick manufacturer's specifications;
 - (e) Hoist brakes, clutches, and operating levers;

- (f) Electrical apparatus for malfunctioning, signs of excessive deterioration, dirt and moisture accumulation;
 - (g) Structural members for deformation, cracks, and corrosion;
 - (h) Crane cleanliness and housekeeping. Inspect for trash, oil, grease, debris or excessive dirt on crane components and catwalks, if applicable;
 - (i) Bolts and rivets for tightness;
 - (j) Parts such as pins, bearings, shafts, gears, sheaves, drums, rollers, locking and clamping devices, for wear, cracks, and distortion;
 - (k) Gudgeon pin for cracks, wear and distortion;
 - (l) Foundation or supports for continued ability to sustain the imposed loads;
 - (m) A legible and applicable operator's manual and load chart is in the operator's cab or station;
 - (n) A portable fire extinguisher, with a basic minimum extinguishing rating of ten BC must be installed in the cab or at the machinery housing.
- (2) Annual proof load testing of derricks.
- (a) Annual proof load testing. After the derrick has passed the visual and operational tests, the accredited derrick certifier must ensure a proof load test is conducted and must be performed at the maximum and minimum boom angles or radii or as close to these as practical and at such intermediate radii as the derrick manufacturer or RPSE may deem necessary. This test must be documented on the form or in the format approved by the department. A copy of this completed form and inspection worksheets must be sent to the department within ten working days upon completion of the examination.
 - (b) Proof load tests and safe working load ratings must be based on the designed load ratings at the ranges of boom angle or operating radii. Proof loads must be as per the manufacturer's recommendations. When the manufacturer recommendations are not available follow the requirements in Table 3 below:

Table 3 - Derrick Load Test

Safe Working Load SWL	Proof Load
Up to 20 tons	25 percent in excess
20-50 tons	5 tons in excess
Over 50 tons	10 percent in excess

- (c) Hoist the test load a few inches and hold to verify that the load is supported by the derrick and held by the hoist brake(s).
- (d) Swing the derrick, if applicable, the full range of its swing, at the maximum allowable working radius for the test load.
- (e) Boom the derrick up and down within the allowable working radius for the test load.
- (f) Lower the test load, stop and hold the load with the brake(s).
- (g) After satisfactory completion of a proof load test, the derrick and all component parts thereof shall be carefully examined in all applicable requirements in this section.
- (h) This test must be documented on the form or in the format approved by the department. A copy of this completed form and inspection worksheets must be sent to the department within ten working days upon completion of the examination.

WAC 296-155-53214 Crane decertification and reinstatement.

- (1) If any of the following occur, the certification becomes invalid:
 - (a) Contact with an energized power line;
 - (b) Any overload, other than proof load testing, or one that has been approved in writing in advance by the crane manufacturer or a RPE;
 - (c) Any significant modifications or significant repairs of a load sustaining/bearing part.

Note: Replacement of hoisting rope does not constitute decertification.

- (2) The owner or lessee must notify the crane certification section by phone within twenty-four hours if any of the above occurs.
- (3) The certification may be reinstated only after affected components have been reinspected by an accredited crane certifier. If the accredited crane certifier identifies any deficiencies during the reinspection, the deficiencies must be corrected before the certification can be reinstated. If the accredited crane certifier believes proof load testing should be conducted prior to reinstatement of the certification, proof load testing shall be conducted. In the case of major modifications or repairs to important load sustaining/bearing parts, proof load testing shall be performed prior to reinstatement. The accredited crane certifier must notify the department that the certification has been reinstated.

WAC 296-155-533 Crane operator qualifications and certification.

WAC 296-155-53300 Operator qualifications and certification.

- (1) Prior to operating any crane covered under chapter 296-155 WAC, Part L, with the exception of the trainee/apprentice requirements outlined in subsection (2) of this section, the employer must ensure that the crane operator:
 - (a) Has a valid crane operator certificate, for the type of crane to be operated, issued by a crane operator testing organization accredited by a nationally recognized accrediting agency. The operator certification must include a successful passing of a written and practical examination.

Notes:

An operator's certificate issued by the accredited testing agency is valid for a five-year period, and must be renewed to ensure operators maintain qualified operator status.

For self-erecting tower cranes, the department will accept a tower crane certification issued by a nationally accrediting testing agency.

For derricks, the department will accept, at a minimum, a lattice boom truck or crawler mobile crane operator's certificate.

- (b) Has crane hours of experience as shown in Table 1; and
- (c) Pass a substance abuse test conducted by a recognized laboratory.

Exemption: When it is necessary in the performance of their duties, manufacture representatives, factory representatives and maintenance personnel are not required to be certified crane operators.

**Crane Operator Experience for Cranes Used in the Construction Industry
Table 1**

The 5 Categories of Cranes and their Types	Number of Hours of Actual Crane Operating Experience	Number of Hours of Crane Related Experience
(1) Mobile Cranes		
(a) Lattice Boom Crawler Cranes (LBC)	300 tons and above 1000 Hours	300 tons and above 1000 Hours
	Under 300 tons 500 Hours	Under 300 tons 500 Hours
(b) Lattice Boom Truck Cranes (LBT)	300 tons and above 1000 Hours	300 tons and above 1000 Hours
	Under 300 tons 500 Hours	Under 300 tons 500 Hours
(c) Large Telescopic Boom Cranes (Swing Cab) (TLL)	Over 130 tons 750 Hours	Over 130 tons 750 Hours
	Over 40 tons to 130 tons 250 Hours	Over 40 tons to 130 tons 250 Hours
	40 tons and under 40 Hours	40 tons and under 40 Hours
(d) Small Telescopic Boom Cranes (Fixed Cab) (TSS)	15 tons and above 40 Hours	15 tons and above 40 Hours
	Over 5 tons to 15 tons 20 Hours	Over 5 tons to 15 tons 20 Hours
	5 tons and under 8 hours	5 tons and under 16 hours
(2) Articulating Boom Cranes	20 Hours	20 Hours

(3) Tower Cranes		
(a) Hammerhead	500 Hours	500 Hours
(b) Luffer	500 Hours	500 Hours
(c) Self-Erecting	50 Hours	50 Hours
(4) Overhead Cranes		
(a) Cab Operated	40 Hours	40 Hours
(b) Pendant/Remote	40 Hours	40 Hours
(5) Derricks	20 Hours	500 Hours
<p>Hours of actual crane operating experience. For all cranes: Time while the operator is at the controls of the crane; and/or has direct control of that crane; and/or a combination of operating hours within the same crane type. For mobile cranes: It also includes time while installing/removing boom sections, luffing boom, jib, extending and retracting outriggers/stabilizers, leveling crane, and replacing hoisting rope. For tower cranes: It includes time while jumping (increasing the height of the tower/mast).</p> <p style="text-align: center;"><i>Note: Additional actual crane operator experience may account for crane related experience.</i></p>		
<p>Hours of crane related experience: Time as a signalman/bellman, oiler, crane mechanic, crane inspector, formal classroom training, crane simulator operation, and a combination of operating hours on other categories of cranes.</p>		

Note: Cranes and other lifting machines that are exempt can be found in WAC 296-155-52900(2).

- (2) Prequalification/certification training period. An employee who is not a qualified crane operator as outlined in subsection (1) of this section is permitted to operate the crane as part of his/her training providing the following requirements are met:
- (a) The employee ("trainee/apprentice") must be provided with sufficient training prior to operating the crane to enable the trainee to operate the crane safely under limitations established by this section (including continuous supervision) and any additional limitations established by the employer.
 - (b) The tasks performed by the trainee/apprentice while operating the crane must be within the trainee's ability, as determined by the supervising qualified crane operator.

- (c) Qualified crane operator. While operating the equipment, the trainee/apprentice must be continuously supervised by a qualified crane operator who meets the following requirements:
 - (i) The qualified crane operator is an employee or agent of the trainee's/apprentice's employer.
 - (ii) The qualified crane operator under this section is familiar with the proper use of the equipment's controls.
 - (iii) While supervising the trainee/apprentice, the qualified crane operator performs no tasks that detract from the qualified crane operator's ability to supervise the trainee/apprentice.
 - (iv) For cranes other than tower cranes: The qualified crane operator and the trainee/apprentice must be in direct line of sight of each other. In addition, they must communicate verbally or by hand signal.
 - (v) For tower cranes: The qualified crane operator and the trainee/apprentice must be in direct communication with each other.
 - (d) The trainee/apprentice must not operate the crane in any of the following circumstances:
 - (i) If any part of the crane, load line or load (including rigging and lifting accessories), if operated up to the crane's maximum working radius in the work zone, could get within twenty feet of a power line that is up to three hundred fifty kV, or within fifty feet of a power line that is over three hundred fifty kV;
 - (ii) If the crane is used to hoist personnel;
 - (iii) In a multiple-crane lift situation; or
 - (iv) Multiple-lift rigging, as defined in WAC 296-155-52902, can only be accomplished by the trainee/apprentice when the qualified crane operator determines that the trainee's/apprentice's skills are sufficient for this high-skill work.
 - (v) Critical lifts, as defined in WAC 296-155-52902, can only be accomplished by the trainee/apprentice when the qualified crane operator determines that the trainee's/apprentice's skills are sufficient for this high-skill work.
- (3) The employer must obtain documentation showing hours of crane operator experience and crane related experience separated out by crane type and capacity.

- (4) The department may recognize crane operator certification from another state or territory of the United States as equivalent to qualified crane operator requirements if the department determines that the other jurisdiction's credentialing standards are substantially similar to the qualified crane operator requirements.
- (5) For experience obtained prior to January 1, 2010, the employer may accept a signed declaration from the crane operator attesting to actual hours of crane operator experience and crane related experience separated out by crane type and capacity. Hours documented prior to 2010 will count towards the hour requirements of actual crane operating experience and crane related experience.

Note: For experience obtained while working outside of the department's jurisdiction, the employer may accept a signed declaration from the crane operator attesting to actual hours of crane operator experience and crane related experience separated out by crane type and capacity.

- (6) Beginning January 1, 2010, crane operator experience and crane related experience must be documented and separated out by crane type and capacity. If the employer is documenting crane operating and/or related crane experience hours, the employer must provide a copy of the hours to the operator as soon as practical, if requested.

WAC 296-155-535 Base-mounted drum hoists.

- (1) General requirements.
 - (a) Exposed moving parts such as gears, projecting screws, setscrews, chain, cables, chain sprockets, and reciprocating or rotating parts, which constitute a hazard, shall be guarded.
 - (b) All controls used during the normal operation cycle shall be located within easy reach of the operator's station.
 - (c) Electric motor operated hoists shall be provided with:
 - (i) A device to disconnect all motors from the line upon power failure and not permit any motor to be restarted until the controller handle is brought to the "off" position;
 - (ii) Where applicable, an overspeed preventive device;
 - (iii) A means whereby remotely operated hoists stop when any control is ineffective.
 - (d) All base-mounted drum hoists in use shall meet the applicable requirements for design, construction, installation, testing, inspection, maintenance, and operation, as prescribed by the manufacturer.
- (2) Specific requirements. (Reserved.)

WAC 296-155-540 Overhead hoists.

- (1) General requirements.
 - (a) The safe working load of the overhead hoist, as determined by the manufacturer, shall be indicated on the hoist, and this safe working load shall not be exceeded.
 - (b) The supporting structure to which the hoist is attached shall have a safe working load equal to that of the hoist.
 - (c) The support shall be arranged so as to provide for free movement of the hoist and shall not restrict the hoist from lining itself up with the load.
 - (d) The hoist shall be installed only in locations that will permit the operator to stand clear of the load at all times.
 - (e) Air hoists shall be connected to an air supply of sufficient capacity and pressure to safely operate the hoist. All air hoses supplying air shall be positively connected to prevent their becoming disconnected during use.
 - (f) All overhead hoists in use shall meet the applicable requirements for construction, design, installation, testing, inspection, maintenance, and operation, as prescribed by the manufacturer.
- (2) Specific requirements. (Reserved.)

WAC 296-155-545 Conveyors.

- (1) All conveyors in use shall meet the applicable requirements for design, construction, inspection, testing, maintenance, and operation, as prescribed in ANSI B20.1-1976, Safety Code for Conveyors, Cableways, and Related Equipment.
- (2) Starting precautions.
 - (a) When the entire length of a conveyor is visible from the starting switch, the operator shall visually check to make certain that all persons are in the clear before starting the conveyor.
 - (b) When the entire length of the conveyor is not visible from the starting switch, a positive audible or visible warning system shall be installed and operated to warn persons that the conveyor will be started.
 - (c) All reasonable precautions shall be taken by the operator prior to starting a conveyor, to assure that no person is in a hazardous location where they may be injured when the conveyor is started.

- (3) Riding and walking on conveyors.
 - (a) Riding on conveyor chains, belt, or bucket elevators shall be prohibited.
 - (b) Persons shall not be allowed to walk on conveyors except for emergency purposes and then only after the conveyor has been de-energized and the person can do so safely.
 - (c) Riding of conveyors shall only be permitted on the manlift steps and platforms with handholds attached and other safety factors as specified in chapter 296-96 WAC, Safety regulations and fees for all elevators, dumbwaiters, escalators, and other conveyances.
- (4) Stop controls.
 - (a) Means for stopping the motor or engine of a conveyor shall be provided at the operator's station.
 - (b) If the operator's station is at a remote point, similar provisions for stopping the motor or engine shall be provided at the motor or engine location.
- (5) Emergency controls. Emergency stop switches shall be arranged so that the conveyor cannot be started again until the actuating stop switch has been reset to running or "on" position.
- (6) Screw type conveyors. Screw or auger type conveyors shall be guarded to prevent employee contact with turning flights.
- (7) Overhead conveyors.
 - (a) Where a conveyor passes over work areas, aisles, or thoroughfares, guards shall be provided to protect persons required to work below the conveyors.
 - (b) Where a conveyor crosses over an aisle or passageway, it shall be conspicuously marked by suitable signs, as required by Part E of this chapter.
 - (c) When the return strand of a conveyor operates within seven feet of the floor there shall be a trough provided of sufficient strength to carry the weight resulting from a broken chain. If the strands are over a passageway, a means shall be provided to catch and support the ends of the chain in the event of a break.
- (8) Emergency stop.
 - (a) Conveyors shall be provided with an emergency stopping device (panic-type) which can be reached from the conveyor.

- (b) The emergency stopping device shall be located near the material entrance and shall stop the conveyor a sufficient distance away from the hazard to prevent injury.
 - (c) Where the conveyor leading into such equipment is under constant control of an operator who has full view of the material entrance who is located or restrained where they cannot possibly fall onto the conveyor an emergency stopping device is not mandatory.
- (9) Conveyor lockout.
- (a) Conveyors shall be locked out with a padlock at any time repair, maintenance, or clean-up work is being performed on the conveyor.
 - (b) Tags or push-button stops are not acceptable.
- (10) Where conveyors are in excess of seven feet in height, means shall be provided to safely permit essential inspection and maintenance operations.
- (11) Conveyor repair.
- (a) Any part showing signs of significant wear shall be inspected carefully and replaced prior to reaching a condition where it may create a hazard.
 - (b) Replacement parts shall be equal to or exceed the manufacturer's specifications.

WAC 296-155-550 Aerial cableways.

- (1) Cableways shall be designed to withstand the maximum required load with a safety factor of five (5) on all its parts.
- (2) Safety stay lines shall be installed at anchor ends and equal in strength to the cableway.
- (3) Where towers are required they shall be securely guyed or constructed to carry the maximum sustained load.
- (4) Towers shall be provided with ladderways to facilitate safe access for repairs and inspections.
- (5) Towers shall have sufficient elevation to provide substantial clearance for cableway and loads carried over all contemplated work.
- (6) Running lines and sheaves, where accessible, shall be guarded.
- (7) The carrier, carrier sheaves, bearings, bucket latch and all working parts shall be lubricated and visually inspected daily.
- (8) All the wire ropes shall be kept lubricated with proper lubricant.

- (9) Daily visual inspection shall be made of the button line, especially at the buttons where abrasion is caused by the carrier rebound. Rubber and steel ferrule shock absorbers shall be placed at each end of buttons.
- (10) All loading, unloading and working stations shall be adequately lighted for night operation. Clearance lights shall be installed on all high points under cableway.

WAC 296-155-555 Gin poles.

- (1) Gin poles shall be properly guyed according to the type used.
- (2) Anchors may be of “dead men” or attached to some permanent stable structure.
- (3) When the guy lines are anchored to a permanent structure, the anchors shall be distant at least one-half the height of the pole from its base, and when “dead men” are used, they shall be located a distant from the base at least one and one-half times the height of the pole.
- (4) The pole shall be securely fastened at the foot to prevent kicking out during operation.
- (5) Gin poles shall be of selected timber, sound and free from knots or other injurious defects.
- (6) Allowable loads for spruce timbers used as gin poles. The allowable loads and the limiting lengths given are based on the U.S. Forest Products Laboratory Standard Recommendations for Spruce of Common Grade, based on pin connected ends for columns.

Actual	Length in feet	Allowable load capacity in tons
6"x6"	10	10.4
6"x6"	15	6.6
6"x6"	20	3.7
6"x6"	25 Max.	2.4
8"x8"	20	11.7
8"x8"	25	7.5
8"x8"	30	5.2
8"x8"	33 4" Max.	4.2
10"x10"	25	18.2
10"x10"	30	12.7
10"x10"	35	9.3
10"x10"	41 8" Max.	6.6
12"x12"	30	26.3
12"x12"	35	19.3
12"x12"	40	14.8
12"x12"	45	11.7
12"x12"	50 Max.	9.5

- (7) When gin poles are spliced to increase their length, the splicing shall be made with heavy planking at least four feet long securely bolted to all four (4) sides of the pole. If splicing planks are spiked, they shall be securely lashed at the same points.
- (8) Additional guy lines shall be attached at the point of splice.

WAC 296-155-560 Concrete bucket towers.

- (1) A concrete bucket tower located inside a structure, and which is three feet or less from any scaffold or the edge of the shaftway or floor opening in which it is installed, shall be enclosed on all sides with heavy wire netting formed of number sixteen U.S. gauge one and one-half inch mesh. Wood slats placed vertically and spaced not more than one and one-half inches apart may be used instead of the netting.

The enclosure shall extend at least eight feet above such scaffold or floor.

- (2) A concrete bucket tower located outside a structure shall be enclosed to a height of eight feet at lower landing with heavy wire netting formed of number sixteen U.S. gauge wire one and one-half inch mesh or other suitable material.
- (3) Openings with platforms shall be formed at each floor level, and the runway leading to the tower shall be guarded with standard railings and toeboards.
- (4) If the bucket is discharged into a chute, the chute shall be substantially constructed of wood or metal and extend from the tower to the point where the concrete is to be poured, or transferred to vehicles or hoppers, and the chute shall be substantially supported.
- (5) The pit shall be drained and deep enough so that any spill from the bucket will fall below the blocking on which the bucket rests while being filled.
- (6) Persons shall not be allowed to work in the pit without first resting the bucket on strong timbers supported on two sides of the tower.
- (7) The bucket tower shall be securely guyed at two or more elevations as may be necessary.
- (8) The guide rails shall be carefully aligned and kept in good condition to prevent the bucket being caught or clogged while being hoisted.
- (9) The sheaves over which the cable passes shall be firmly secured to overhead sheave beams and supporting frame work and the sheaves shall be kept lubricated.
- (10) The hoisting cable shall be frequently inspected and renewed when broken wires or other defects are discovered.

- (11) A platform provided with standard railings and toeboards shall be constructed at the point where the concrete is dumped into the chute. A ladder shall be fastened to one side of the tower to enable a person to reach the platform in safety.
- (12) Workers shall be prohibited from riding in or on the bucket.

WAC 296-155-565 Hoisting engines.

- (1) All gearing on hoisting engines shall be enclosed. Steam piping subject to contact shall be insulated and if electrical equipment is used, it shall be grounded.
- (2) Hoisting engines shall be of ample capacity and equipped with brakes capable of sustaining one hundred and fifty percent of rated load for stopping and sustaining the maximum load in any position.
- (3) Hoisting engines shall be protected against the weather and falling objects by a substantial cover.
- (4) All hoisting equipment shall be frequently inspected, and brakes, gears and operating levers kept in working condition.
- (5) Guards shall be provided to prevent persons coming in contact with hoisting cables.
- (6) Brake drums shall be kept free of oil or grease.
- (7) A positive operated pawl shall be used in addition to the brake to hold the load when it is suspended. Counter weight operated dogs are prohibited.
- (8) Hoisting engines shall not be set up in the street when it can be avoided; but, if so located, they shall be completely housed.
- (9) Only competent personnel shall operate material hoists.
- (10) The operator shall not lift a load when a person is on the hoist, and all towers shall be posted to that effect, except as provided in other sections of this part.
- (11) The operator shall be notified when any person goes up the tower ladder, or before any work is done on any part of the tower, overhead work, hoist or in the pit.
- (12) The operator shall make daily inspections of all equipment before starting operations.
- (13) When the hoisting engine is located close to the building operation, it shall be covered with a strong plank roof covering to protect the operator from falling objects.
- (14) Exhaust steam pipes shall discharge overhead so as not to obstruct the view of the operator or scald persons.

- (15) In the operation of hoists, the operator shall always give a warning sign or signal before starting.
- (16) When hoisting machinery is set on an elevated platform such platform shall be of substantial construction and standard guard rails and toeboards shall be provided along all open sides of the platform.
- (17) Material hoists of more than one drum capacity shall be equipped with brake controls.
- (18) A safety strap shall be provided on the foot block of all hoists.
- (19) When electric motors are used for hoisting equipment, they shall be operated only by qualified personnel.
 - (a) Installations shall be made in accordance with provisions of local and national electrical safety codes, and shall be made by experienced workers only.
 - (b) Enclosed switches and fuses shall always be used.
 - (c) Switchboards shall be screened, and a sign placed warning unauthorized persons to keep clear.

WAC 296-155-570 Rigging-Wire rope.

- (1) Whenever used in connection with work, employment, occupations or uses to which these standards are applicable, wire rope shall not be subjected to loads in excess of one-fifth the breaking load as given in the schedule of the cable manufacturer.
- (2) Any wire rope showing 10% of its wires broken in a three foot length shall not be used. When cables deteriorate through rusting, wear, undue strain or other conditions to the extent of 15% of their original strength, use of cable shall be discontinued.
- (3) Wire rope shall be frequently inspected for wear and other defects which may reduce the strength below the point of safe operation.
- (4) If wire rope is received in a coil it shall be rolled out, on a surface free from grit, like a hoop and straightened out before being put on the sheaves. If it is received on a reel, the reel shall be mounted on a spindle or turntable and the rope then unwound.
- (5) Wire rope shall be lubricated. A lubricant recommended by a wire rope manufacturer shall be used.
- (6) Wire rope shall be securely fastened to drums by zinc plugs or suitable clamps, and at least two full turns of the rope shall remain on the winding drum.
- (7) Wire rope shall be wound evenly on the drum and not allowed to lap one layer on another in an irregular fashion.

- (8) Care shall be taken to prevent friction of wire ropes with other objects which could cause chafing or breaking of wires.
- (9) In attaching U-type cable clamps, the U shall always be placed over the short end of the cable.
- (10) The clamp nuts shall be tightened up frequently during the operation to prevent slipping.
- (11) Thimbles shall be used in cable eyes whenever practicable.
- (12) Fair leads shall be used ahead of cable drums, whenever practicable, and the fleet angle kept as flat as possible to promote proper spooling.
- (13) All running lines of hoisting equipment, located within seven (7) feet of the ground or working level shall be boxed, railed off or otherwise guarded, or the operating area restricted.
- (14) Wire rope which has been welded or been subject to welding of any kind shall not be used.
- (15) No open hook shall be used to hoist a bucket, cage, spreader, or skip, nor in any circumstances where the dislodgement of the hook could cause a risk of injury to workers. A safety-hook, mousing, or shackle shall be employed in such circumstances.
- (16) When shackles are used, shackle pins shall be secured to prevent accidental withdrawal.
- (17) Where a wedge socket connector is used as a wire rope terminal, a single wire rope clip shall be installed in accordance with WAC 296-155-330 (3)(g).
- (18) The wire rope shall not be burned off with heat. This may weld the ends of the wires and strands together.

WAC 296-155-59901 Table 1.

TABLE 1
STANDARD 6 x 7 WIRE ROPE¹

DIAMETER Inches	Approximate Weight Per Foot Pounds	Breaking Strength in Tons of 2,000 Pounds		
		Improved Plow Steel	Plow Steel	Mild Plow Steel
¼	0.094	2.64	2.30	3.10
5/16	.15	4.10	3.56	3.10
3/8	.21	5.86	5.10	4.43
7/16	.29	7.93	6.90	6.00
½	.38	10.3	8.96	7.79
9/16	.48	13.0	11.3	9.82
5/8	.59	15.9	13.9	12.0
¾	.84	22.7	19.8	17.2
7/8	1.15	30.7	26.7	23.2
1	1.50	39.7	34.5	30.0
1 1/8	1.90	49.8	43.3	37.7
1 ¼	2.34	61.0	53.0	46.1
1 3/8	2.84	73.1	63.6	55.3
1 ½	3.38	86.2	75.0	65.

¹ For these ropes with steel centers, add 7 1/2% to the above strengths. For these ropes when galvanized, deduct 10% from the above strengths.

WAC 296-155-59902 Table 2.

TABLE 2
STANDARD 6 x 19 WIRE ROPE¹

DIAMETER Inches	Approximate Weight Per Foot Pounds	Breaking Strength in Tons of 2,000 Pounds		
		Improved Plow Steel	Plow Steel	Mild Plow Steel
¼	0.10	2.74	2.39	2.07
5/16	.16	4.26	3.71	3.22
3/8	.23	6.10	5.31	4.62
7/16	.31	8.27	7.19	6.25
½	.40	10.7	9.35	8.13
9/16	.51	13.5	11.8	10.2
5/8	.63	16.7	14.5	12.6
¾	.90	23.8	20.7	18.0
7/8	1.23	32.2	28.0	24.3
1	1.60	41.8	36.4	31.6
1 1/8	2.03	52.6	45.7	39.8
1 ¼	2.50	64.6	56.2	48.8
1 3/8	3.03	77.7	67.5	58.8
1 ½	3.60	92.0	80.0	69.6
1 5/8	4.23	107.0	93.4	81.2
1 ¾	4.90	124.0	108.0	93.6
1 7/8	5.63	141.0	123.0	107.0
2	6.40	160.0	139.0	121.0
2 1/8	7.23	179.0	156.0	---
2 ¼	8.10	200.0	174.0	---
2 ½	10.0	244.0	212.0	---
2 ¾	12.10	292.0	254.0	---

¹ For these ropes with steel centers, add 7 1/2% to the above strengths. For these ropes when galvanized, deduct 10% from the above strengths.

WAC 296-155-59903 Table 3.

**TABLE 3
STANDARD 8 x 19 WIRE ROPE¹**

		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER Inches	Approximate Weight per Foot Pounds	Improved Plow Steel	Mild Plow Steel
1/4	0.09	2.35	2.04
5/16	.14	3.65	3.18
3/8	.20	5.24	4.55
7/16	.28	7.09	6.17
1/2	.36	9.23	8.02
9/16	.46	11.6	10.1
5/8	.57	14.3	12.4
3/4	.82	20.5	17.8
7/8	1.11	27.7	24.1
1	1.45	36.0	31.3
1 1/8	1.84	45.3	39.4
1 1/4	2.27	55.7	48.4
1 3/8	2.74	67.1	58.3
1 1/2	3.26	79.4	69.1

¹ For these ropes with steel centers, add 7 1/2% to the above strengths. For these ropes when galvanized, deduct 10% from the above strengths.

WAC 296-155-59904 Table 4.

TABLE 4			
STANDARD 6 X 37 WIRE ROPE¹			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER Inches	Approximate Weight per Foot Pounds	Improved Plow Steel	Mild Plow Steel
¼	0.10	2.59	2.25
5/16	.16	4.03	3.50
3/8	.22	5.77	5.02
7/16	.30	7.82	6.80
½	.39	10.2	8.85
9/16	.49	12.9	11.2
5/8	.61	15.8	13.7
¾	.87	22.6	19.6
7/8	1.19	30.6	26.6
1	1.55	39.8	34.6
1 1/8	1.96	50.1	43.5
1 ¼	2.42	61.5	53.5
1 3/8	2.93	74.1	64.5
1 ½	3.49	87.9	76.4
1 5/8	4.09	103.0	89.3
1 ¾	4.75	119.0	103.0
1 7/8	5.45	136.0	118.0
2	6.20	154.0	134.0
2 1/8	7.00	173.0	150.0
2 ¼	7.85	193.0	168.0
2 ½	9.69	236.0	205.0
2 ¾	11.72	284.0	247.0
3	13.95	335.0	291.0
3 ¼	16.37	390.0	339.0
3 ½	19.40	449.0	390.0

¹ For these ropes with steel centers, add 7 1/2% to the above strengths. For these ropes when galvanized, deduct 10% from the above strengths.

WAC 296-155-59905 Table 5.

TABLE 5
STANDARD 6 x 19 ELEVATOR ROPE

DIAMETER	Approximate Weight Per Foot	Breaking Strength		
		Iron	Traction Steel	High Rise Traction Steel
Inches	Pounds	Pounds	Pounds	Pounds
3/16	0.06	1,300	---	---
1/4	.10	2,200	3,600	---
5/16	.16	3,200	5,600	---
3/8	.23	5,000	8,200	---
7/16	.31	6,400	11,000	---
1/2	.40	8,400	14,500	---
9/16	.51	10,600	18,500	---
5/8	.63	12,800	23,000	---
11/16	.76	---	27,000	30,000
3/4	.90	18,200	32,000	---
13/16	1.06	---	37,000	46,000
7/8	1.23	24,800	42,000	---
15/16	1.41	---	48,000	60,000
1	1.60	32,000	54,000	---
1 1/16	1.81	---	61,000	---

WAC 296-155-59906 Table 6.

TABLE 6
STANDARD 8 x 19 ELEVATOR ROPE

DIAMETER	Approximate Weight Per Foot	Breaking Strength		
		Iron	Traction Steel	High Rise Traction Steel
Inches	Pounds	Pounds	Pounds	Pounds
3/16	0.05	1,000	---	---
1/4	.09	1,800	3,600	---
5/16	.14	2,900	5,600	---
3/8	.20	4,200	8,200	---
7/16	.28	5,600	11,000	---
1/2	.36	7,200	14,500	---
9/16	.46	9,200	18,500	---
5/8	.57	11,200	23,000	---
11/16	.69	---	27,000	30,000
3/4	.82	16,000	32,000	---
13/16	.96	---	37,000	46,000
7/8	1.11	21,400	42,000	---
15/16	1.27	---	48,000	60,000
1	1.45	28,000	54,000	---
1 1/16	1.64	---	61,000	---

WAC 296-155-59907 Table 7.

TABLE 7 STANDARD 5 x 19 MARLINE CLAD ROPE ¹				
DIAMETER			Breaking Strength in Tons of 2,000 Pounds	
Before Serving	After Serving	Approximate Weight Per Foot		
Inches	Inches	Pounds	Plow Steel	Mild Plow Steel
1/4	9/16	0.21	2.17	1.89
5/16	5/8	.28	3.37	2.93
3/8	11/16	.36	4.82	4.20
7/16	3/4	.42	6.53	5.68
1/2	13/16	.51	8.50	7.39
9/16	7/8	.62	10.7	9.31
5/8	1	.81	13.2	11.4
3/4	1 1/8	1.10	18.8	16.4
7/8	1 1/4	1.70	25.5	22.1
1	1 3/8	1.32	33.7	28.7
1 1/8	1 1/2	2.12	41.6	36.2
1 1/4	1 5/8	2.58	51.1	44.4
1 3/8	1 3/4	3.14	61.4	53.4
1 1/2	1 7/8	3.69	---	---
1 5/8	2	4.29	---	---
1 3/4	2 1/8	5.00	---	---

¹ For these ropes with steel centers, add 7 1/2% to the above strengths. For these ropes when galvanized, deduct 10% from the above strengths.

WAC 296-155-59908 Table 8.

TABLE 8			
STANDARD 18 x 7 NONROTATING ROPE			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER	Approximate Weight per Foot	Improved Plow Steel	Mild Plow Steel
Inches	Pounds		
3/8	0.24	5.59	4.86
7/16	.33	7.58	6.59
1/2	.43	9.85	8.57
9/16	.55	12.4	10.8
5/8	.68	15.3	13.3
3/4	.97	21.8	19.0
7/8	1.32	29.5	25.7
1	1.73	38.3	33.3
1 1/8	2.19	48.2	41.9
1 1/4	2.70	59.2	51.5
1 3/8	3.27	71.3	62.0
1 1/2	3.89	84.4	73.4
1 5/8	4.57	98.4	85.6
1 3/4	5.30	114.0	98.8

WAC 296-155-59909 Table 9.

TABLE 9				
STANDARD 6 x 12 GALVANIZED RUNNING ROPE AND HAWSERS				
DIAMETER Inches	Approximate Weight Per Foot Pounds	Breaking Strength in Tons of 2,000 Pounds		
		Galvanized Improved Plow Steel	Galvanized Plow Steel	Galvanized Iron
5/16	0.10	2.34	2.04	0.905
3/8	.15	3.36	2.92	1.30
7/16	.20	4.55	3.95	1.76
½	.26	5.91	5.14	2.28
9/16	.33	7.45	6.48	2.88
5/8	.41	9.16	7.97	3.54
¾	.59	13.1	11.4	5.06
13/16	.6	15.3	13.3	5.92
7/8	.80	17.7	15.4	6.85
1	1.05	23.0	20.0	8.89
1 1/16	1.19	25.9	22.5	10.0
1 1/8	1.33	29.0	25.2	---
1 3/16	1.48	32.2	28.0	---
1 ¼	1.64	35.6	30.9	---
1 3/8	1.99	42.8	37.2	---
1 7/16	2.17	46.7	40.6	---
1 ½	2.36	50.7	44.1	---
1 5/8	2.77	59.2	51.4	---
1 11/16	2.99	63.6	55.3	---
1 ¾	3.22	68.3	59.4	---
1 13/16	3.45	78.0	63.5	---
1 15/16	3.94	83.0	72.2	---
2	4.20	88.2	76.7	---
2 1/16	4.47	93.6	81.4	---

WAC 296-155-59910 Table 10.

TABLE 10			
STANDARD 6 x 25 GALVANIZED STEEL MOORING LINES AND HAWSERS			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER	Approximate Weight per Foot	Galvanized Improved Plow Steel	Galvanized Plow Steel
Inches	Pounds		
3/8	0.194	4.77	4.14
1/2	.35	8.40	7.30
5/8	.54	13.0	7.30
3/4	.78	18.6	16.2
13/16	.91	21.8	19.0
7/8	1.06	25.2	21.9
1	1.38	32.8	28.5
1 1/16	1.56	36.9	32.1
1 1/8	1.75	41.2	35.9
1 3/16	1.95	45.9	39.9
1 1/4	2.16	50.7	44.1
1 3/8	2.61	61.0	53.0
1 7/16	2.85	66.5	57.9
1 1/2	3.11	72.3	62.9
1 5/8	3.64	84.5	73.4
1 11/16	3.93	90.9	79.0
1 3/4	4.23	97.5	84.8
1 13/16	4.53	104.0	90.0
1 15/16	5.18	119.0	103.0
2	5.52	126.0	110.0
2 1/16	5.87	134.0	116.0

WAC 296-155-59911 Table 11.

TABLE 11			
STANDARD 6 x 37 GALVANIZED STEEL HAWSERS			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER	Approximate Weight per Foot		
Inches	Pounds	Improved Plow Steel	Plow Steel
3/4	0.87	21.0	18.2
13/16	1.02	24.5	21.2
7/8	0.87	21.0	24.7
1	1.55	36.9	32.1
1 1/16	1.75	41.6	36.1
1 1/8	1.96	46.5	40.4
1 3/16	2.19	51.7	44.9
1 1/4	2.42	57.1	49.7
1 3/8	2.93	68.8	59.8
1 7/16	3.20	75.0	65.3
1 1/2	3.49	81.5	70.9
1 5/8	4.09	95.3	82.9
1 11/16	4.41	103.0	89.2
1 3/4	4.75	110.0	95.7
1 13/16	5.09	118.0	102.0
1 15/16	5.82	134.0	117.0
2	6.20	143.0	124.0
2 1/16	6.59	151.0	132.0
2 1.8	7.00	160.0	139.0
2 1/4	7.85	179.0	156.0
2 5/16	8.29	189.0	164.0
2 3/8	8.74	199.0	173.0

WAC 296-155-59912. Table 12.

TABLE 12 STANDARD 6 x 25 TYPE "B" FLATTENED STRAND WIRE ROPE ¹			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER	Approximate Weight per Foot	Improved Plow Steel	Plow Steel
Inches	Pounds		
3/8	0.25	6.71	---
1/2	.45	11.8	8.94
9/16	.57	14.9	11.2
5/8	.70	18.3	13.9
3/4	1.01	26.2	19.8
7/8	1.39	35.4	26.8
1	1.80	46.0	34.8
1 1/8	2.28	57.9	43.8
1 1/4	2.81	71.0	53.7
1 3/8	3.40	85.5	---
1 1/2	4.05	101.0	---
1 5/8	4.75	118.0	---
1 3/4	5.51	136.0	---
2	7.20	176.0	---
2 1/4	9.10	220.0	---
2 1/2	11.20	269.0	---
2 3/4	13.60	321.0	---

¹ For these ropes when galvanized, deduct 10 percent from the above strengths.

WAC 296-155-59913 Table 13.

TABLE 13			
STANDARD 6 x 30 TYPE "G" FLATTENED STRAND WIRE			
ROPE¹			
		Breaking Strength in Tons of 2,000 Pounds	
DIAMETER	Approximate Weight per Foot		
Inches	Pounds	Improved Plow Steel	Plow Steel
5/8	0.70	18.3	13.9
3/4	1.01	26.2	19.8
7/8	1.39	35.4	26.8
1	1.80	46.0	34.8
1 1/8	2.28	57.9	43.8
1 1/4	2.81	71.0	53.7
1 3/8	3.40	85.5	---
1 1/2	4.05	101.0	---
1 5/8	4.75	118.0	---
1 3/4	5.51	136.0	---
2	7.20	176.0	---
2 1/4	9.10	220.0	---
2 1/2	11.20	269.0	---
2 3/4	13.60	321.0	---

¹ For these ropes with steel centers, add 7 1/2% to above strengths.

WAC 296-155-59914 Table 14.

TABLE 14			
STANDARD 6 x 8 TYPE "D" FLATTENED STRAND WIRE ROPE			
DIAMETER	Approximate Weight per Foot	Breaking Strength in Tons of 2,000 Pounds	
		Improved Plow Steel	Plow Steel
Inches	Pounds		
1/2	0.45	11.1	8.37
5/8	.70	17.1	12.9
3/4	1.01	24.4	18.5
7/8	1.39	33.0	24.9
1	1.80	42.7	32.3
1 1/8	2.28	53.5	40.5
1 1/4	2.81	65.5	49.5
1 3/8	3.40	78.6	59.4
1 1/2	4.05	92.7	70.1

WAC 296-155-59915 Table 15.

TABLE 15			
STANDARD 6 x 6 x 7 TILLER ROPE¹			
DIAMETER	Approximate Weight per Foot	Breaking Strength in Tons of 2,000 Pounds	
		Plow Steel	Iron
Inches	Pounds		
1/4	0.07	1.31	0.584
5/16	.11	2.05	.908
3/8	.16	2.93	1.30
7/16	.21	3.98	1.77
1/2	.28	5.18	2.30
9/16	.35	6.53	2.90
5/8	.43	8.04	3.57

¹ For these ropes with steel centers, add 7-1/2% to above strengths.

WAC 296-155-59916 Table 16.

TABLE 16		
STANDARD 9 x 4 GALVANIZED MAST ARM ROPE		
Diameter (Inches)	Approximate Weight per Foot (Pounds)	Breaking Strength in Pounds
1/4	0.070	1,100
5/16	.107	1,530
3/8	.158	2,200

WAC 296-155-59917 Table 17.

TABLE 17 STANDARD FLAT ROPE				
Width and Thickness Inches	Number Of Ropes	Approximate Weight per Foot Pounds	Breaking Strength in Tons of 2,000 Pounds	
			Plow Steel	Mild Plow Steel
1/4 x 1-1/2	7	0.69	16.8	14.6
1/4 x 2	9	.88	21.7	18.8
1/4 x 2-1/2	11	1.15	26.5	23.0
1/4 x 3	13	1.34	31.3	27.2
5/16 x 1-1/2	5	.77	18.5	16.0
5/16 x 2	7	1.05	25.8	22.4
5/16 x 2-1/2	9	1.33	33.2	28.8
5/16 x 3	11	1.61	40.5	35.3
5/16 x 3-1/2	13	1.89	47.9	41.7
5/16 x 4	15	2.17	55.3	48.1
3/8 x 2	6	1.25	31.4	27.3
3/8 x 2-1/2	8	1.64	41.8	36.4
3/8 x 3	9	1.84	47.1	40.9
3/8 x 3-1/2	11	2.23	57.5	50.0
3/8 x 4	12	2.44	62.7	54.6
3/8 x 4-1/2	14	2.83	73.2	63.7
3/8 x 5	15	3.03	78.4	68.2
3/8 x 5-1/2	17	3.42	88.9	77.3
3/8 x 6	18	3.63	94.1	81.9
1/2 x 2-1/2	6	2.13	54.5	47.4
1/2 x 3	7	2.47	63.6	55.4
1/2 x 3-1/2	8	2.82	72.7	63.3
1/2 x 4	9	3.16	81.8	71.2
1/2 x 4-1/2	10	3.82	90.9	79.1
1/2 x 5	12	4.16	109.0	94.9
1/2 x 5-1/2	13	4.50	118.0	103.0
1/2 x 6	14	4.85	127.0	111.0
1/2 x 7	16	5.85	145.0	126.0
5/8 x 3-1/2	6	3.40	85.8	74.6
5/8 x 4	7	3.95	100.0	87.1
5/8 x 4-1/2	8	4.50	114.0	99.5
5/8 x 5	9	5.04	129.0	112.0
5/8 x 5-1/2	10	5.59	143.0	124.0
5/8 x 6	11	6.14	157.0	137.0
5/8 x 7	13	7.23	186.0	162.0

TABLE 17 STANDARD FLAT ROPE (Cont.)				
Width and Thickness Inches	Number Of Ropes	Approximate Weight per Foot Pounds	Breaking Strength in Tons of 2,000 Pounds	
			Plow Steel	Mild Plow Steel
5/8 x 8	15	8.32	214.0	186.0
3/4 x 5	8	6.50	165.0	143.0
3/4 x 6	9	7.31	185.0	161.0
3/4 x 7	10	8.13	206.0	179.0
3/4 x 8	11	9.70	227.0	197.0
7/8 x 5	7	7.50	190.0	165.0
7/8 x 6	8	8.56	217.0	188.0
7/8 x 7	9	9.63	244.0	212.0
7/8 x 8	10	10.69	271.0	236.0

WAC 296-155-59918 Table 18.

TABLE 18 STANDARD 6 x 12 MARLINE CLAD GRAIN-SHOVEL ROPE			
Before Serving (Inches)	After Serving (Inches)	Approximate weight per Foot (Pounds)	Breaking Strength Tons of 2,000 Pounds
3/4	5/8	0.25	2.50
7/8	3/4	.43	5.50

WAC 296-155-59919 Table 19.

TABLE 19 STANDARD 6 x 7 IRON, BRIGHT, AND GALVANIZED SASH CORDS				
DIAMETER	Approximate Weight Per Foot	BREAKING STRENGTH		Annealed Bright or Galvanized
		Hand Drawn (Iron)	Bright Galvanized	
Inches	Pounds	Pounds	Pounds	Pounds
1/16	0.006	140	126	77
3/32	.103	315	283	172
1/8	.023	560	504	306
5/32	.038	840	756	478
3/16	.053	1,150	1,035	688
7/32	.072	1,570	1,413	940
1/4	.094	2,040	1,836	1,225

WAC 296-155-59920 Table 20.

TABLE 20 STANDARD 6 x 7 GALVANIZED IRON RIGGING AND GUY ROPE		
Diameter (Inches)	Approximate Weight Per Foot (Pounds)	Breaking Strength in Tons of 2,000 Pounds
6 Strands		
1/4	0.94	0.918
5/16	.15	1.42
3/8	.21	2.04
7/16	.29	2.76
1/2	.38	3.58
9/16	.48	4.51
5/8	.59	5.54
3/4	.84	7.90
13/16	.99	9.23
7/8	1.15	10.7
1	1.50	13.8
1 1/16	1.70	15.5
1 1/8	1.90	17.3
1 3/16	2.12	19.2
1 1/4	2.34	21.2