

Chapter 2-0

Scope, Definitions, References, and Personnel Competence

SECTION 2-0.1: SCOPE OF B30.2

Volume B30.2 includes provisions that apply to the construction, installation, operation, inspection, and maintenance of hand-operated and power-driven overhead and gantry cranes that have a top-running single girder or multiple girder bridge, with one or more top-running trolley hoists used for vertical lifting and lowering of freely suspended, unguided loads consisting of equipment and materials (see [Figures 2-0.2-1](#) through [2-0.2-5](#)). The requirements included in this Volume also apply to cranes having the same fundamental characteristics such as cantilever gantry cranes, semigantry cranes, and wall cranes.

Requirements for a crane used for a special purpose such as, but not limited to, non-vertical lifting service, lifting a guided load, or lifting personnel are not included in this Volume.

(22) SECTION 2-0.2: DEFINITIONS

abnormal operating conditions: environmental conditions that are unfavorable, harmful, or detrimental to or for the operation of a crane, such as excessively high or low ambient temperatures, exposure to adverse weather, corrosive fumes, dust-laden or moisture-laden atmospheres, and hazardous locations.

accessory: a secondary part or assembly of parts that contributes to the overall function and usefulness of a crane.

auxiliary hoist: a supplemental hoisting unit usually of lower load rating and higher speed than the main hoist.

brake: a device, other than a motor, used for retarding or stopping motion by friction or power means.

brake, holding: a friction brake for a hoist that is automatically applied and prevents motion when power to the brake is off.

brake, mechanical load: an automatic type of friction brake used for controlling loads in a lowering direction. This unidirectional device requires torque from the motor to lower a load but does not impose any additional load on the motor when lifting a load.

braking means: a method or device used for stopping/holding motion by friction or power.

braking, control: a method of controlling speed by removing energy from the moving body or by imparting energy in the opposite direction.

braking, countertorque (plugging): a method of controlling speed by reversing the motor line voltage polarity or phase sequence to develop torque in the direction opposite the rotation of the motor.

braking, dynamic: a method of controlling speed by using the motor as a generator, with the energy being dissipated in resistors.

braking, eddy current: a method of controlling or reducing speed by means of an electrical induction load brake.

braking, emergency: a method of decelerating a drive when power is not available. The braking effort may be established as a result of action by the operator or automatically when power to the drive is interrupted.

braking, hydraulic: a method of controlling or reducing speed by means of displacement of a liquid.

braking, mechanical: a method of controlling or reducing speed by friction.

braking, pneumatic: a method of controlling or reducing speed by means of compressed gas.

braking, regenerative: a method of controlling speed in which the electrical energy generated by the motor is fed back into the power system.

braking, service: a method to decelerate crane motion during normal operation.

bridge: that part of a crane consisting of one or more girders, trucks, end ties, footwalks, and drive mechanism, which carries the trolley or trolleys.

bridge travel: the crane movement in a direction parallel to the crane runway.

bumper (buffer): a device for reducing impact when a moving crane or trolley reaches the end of its permitted travel, or when two moving cranes or trolleys come into contact. This device may be attached to the bridge, trolley, or runway stop.

cab: the operator's compartment on a crane.

cab, skeleton: an operator's compartment used for occasional cab operation of a normally floor- or remote-operated crane.

cantilever frame: a structural member that supports the trolley of a wall crane.

clearance: distance from any part of the crane to the nearest obstruction.

collectors, current: contacting devices for collecting current from runway or bridge conductors.

conductors, bridge: the electrical conductors located along the bridge structure of a crane that transmit control signals and power to the trolley(s).

conductors, runway (main): the electrical conductors located along a crane runway that transmit control signals and power to the crane.

controller: a device, or group of devices, that serves to govern, in a predetermined manner, the power delivered directly to the apparatus to which it is connected.

controller, manual: a controller having all of its basic functions performed by devices that are operated by hand.

controller, spring-return: a controller that, when released, will return automatically to a neutral (off) position.

control panel: an assembly of components (magnetic, static, hydraulic, pneumatic, etc.) that governs the flow of power to or from a motor or other equipment in response to signals from a master switch, push-button station, remote control, automatic program control, or other similar device.

crane: a machine for lifting and lowering a load and moving it horizontally, with the hoisting mechanism being an integral part of the machine.

crane, automatic: a crane which, when activated, operates through a preset cycle or cycles.

crane, cab-operated: a crane whose movements are controlled by an operator through the use of controllers located in a cab that is attached to the crane.

crane, cantilever gantry: a gantry or semigantry crane in which the bridge girders or trusses extend transversely beyond the crane runway on one or both sides (see [Figure 2-0.2-1](#)).

crane, floor-operated: a crane whose movements are controlled by an operator through the use of controllers contained in a pendant station suspended from the crane.

crane, gantry: a crane similar to an overhead crane except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more legs running on fixed rails or other runway (see [Figure 2-0.2-2](#)).

crane, manually operated: a crane whose hoist mechanism is driven by pulling an endless chain, or whose travel mechanism is driven in the same manner or by manually moving the load or hook.

crane, molten-material-handling: an overhead crane used for transporting or pouring molten material.

crane, outdoor: an overhead or gantry crane that operates outdoors and for which provisions are not available for storage in an area that provides protection to the crane from weather conditions. An indoor crane that may operate outdoors on a periodic basis is not classified as an outdoor crane.

crane, overhead: a crane with a single or multiple girder movable bridge carrying a movable or fixed hoisting mechanism and traveling on an overhead fixed runway structure (see [Figure 2-0.2-3](#)).

crane, polar: an overhead or gantry crane that travels on a circular runway.

crane, power-operated: a crane whose mechanism is driven by electric, pneumatic, hydraulic, or internal combustion means.

crane, pulpit-operated: a crane whose movements are controlled by an operator through the use of controllers located in a control room or a fixed or movable cab or platform, that is independent of the crane.

crane, remote-operated: a crane whose movements are controlled by an operator through the use of controllers contained in a portable operating station not attached to the crane.

crane, semigantry: a gantry with one end of the bridge rigidly supported on one or more legs that run on a fixed rail or runway, the other end of the bridge being supported by an end truck running on an elevated rail or runway (see [Figure 2-0.2-4](#)).

crane, standby: a crane not in regular service that is used occasionally or intermittently as required.

crane, wall: a crane having a cantilever frame with or without trolley, and supported from a side wall or line of columns of a building. It is a traveling type and operates on a runway attached to the side wall or columns (see [Figure 2-0.2-5](#)).

crane service, heavy: service that involves operating at 85% to 100% of rated load or in excess of 10 lift cycles/hr as a regular specified procedure.

crane service, normal: service that involves operating at less than 85% of rated load and not more than 10 lift cycles/hr except for isolated instances.

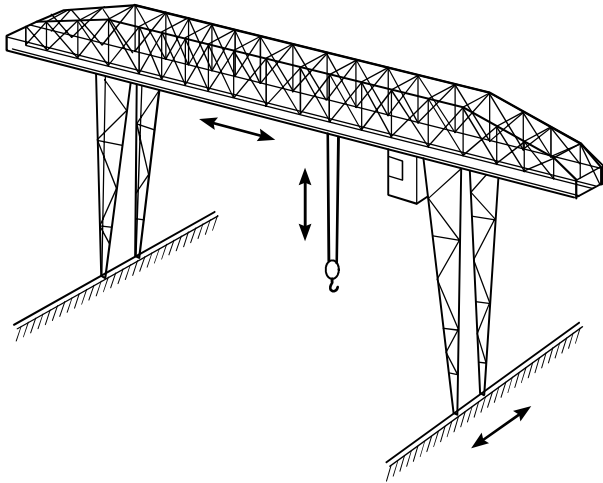
crane service, severe: service that involves normal or heavy service with abnormal operating conditions.

drift point: a point on a travel motion master switch or on a manual controller that maintains the brake released while the motor is not energized. This allows for coasting.

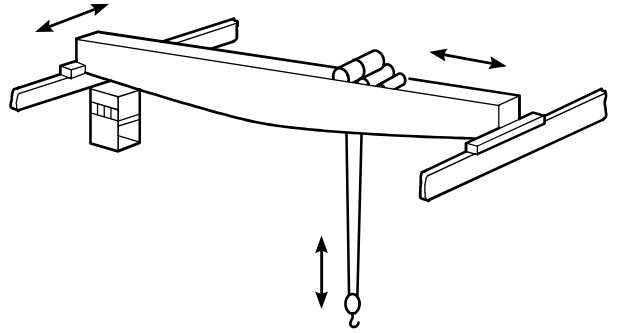
drum: the cylindrical member around which the ropes are wound for lifting or lowering the load.

end tie: a structural member that connects the ends of the bridge girders to maintain squareness of the bridge.

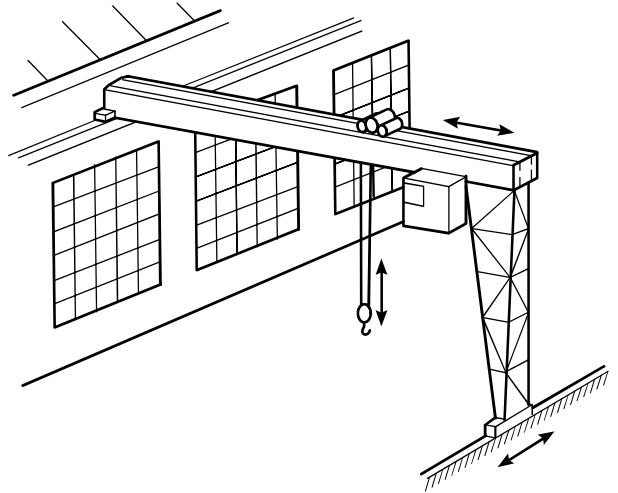
**Figure 2-0.2-1
Cantilever Gantry Crane**



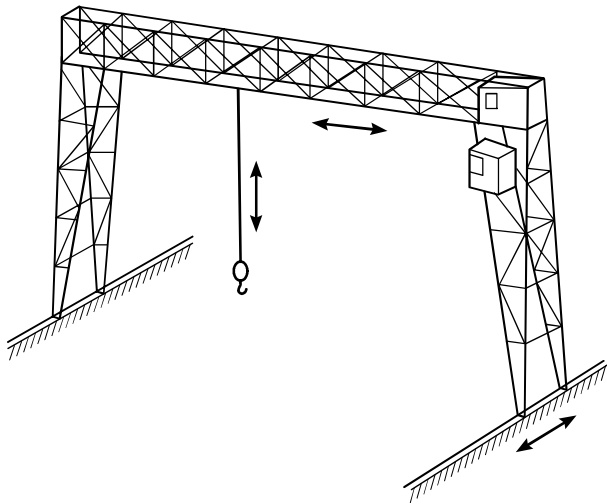
**Figure 2-0.2-3
Overhead Crane**



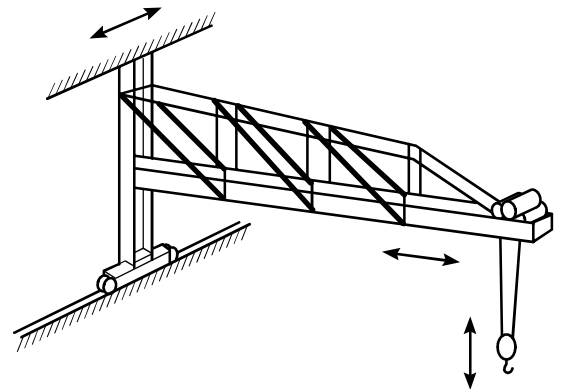
**Figure 2-0.2-4
Semigantry Crane**



**Figure 2-0.2-2
Gantry Crane**



**Figure 2-0.2-5
Wall Crane**



equalizer: a device that compensates for unequal length or stretch of a rope.

exposed: applies to hazardous objects not guarded or isolated and capable of being contacted inadvertently.

gantry leg: the structural member that supports a bridge girder or end tie from the sill.

hazardous (classified) locations: locations where fire or explosion hazards may exist. Locations are classified depending on the properties of the flammable vapors, liquids, or gases, or combustible dusts or fibers that may be present and the likelihood that a flammable or combustible concentration or quantity is present (see National Electrical Code, ANSI/NFPA 70).

hoist: a machinery unit that is used for lifting or lowering a freely suspended (unguided) load.

hoist motion: the motion that lifts or lowers a load.

hook, latch-equipped: a type of hook with a mechanical device to close the throat opening of the hook.

lifting device: a device, other than a load block, used for attaching a load to a hoist. The device may contain components such as slings, hooks, and rigging hardware addressed by other ASME B30 volumes or standards. The weight of these devices is to be considered part of the rated load if it is not reeved onto the hoist ropes.

limit device: a device that is operated by some part or motion of a power-driven hoist, trolley, or bridge to limit motion.

load: the total superimposed weight on the load block or hook.

load block: the assembly of hook or shackle, swivel, bearing, sheaves, pins, and frame suspended by the hoisting rope or load chain.

lockout/tagout: the placement of a lock/tag on the energy-isolating device in accordance with an established procedure.

main hoist: the primary hoist mechanism provided for lifting and lowering the rated load.

minimum breaking force: the minimum load at which a new and unused wire rope will break when loaded to destruction in direct tension.

noncoasting mechanical drive: a drive that automatically results in decelerating a trolley or bridge when power is not available.

normal operating conditions (of cab-operated cranes): conditions during which a crane is performing functions within the scope of the original design. Under these conditions, the operator is at the operating control devices, and there is no other person on the crane.

normal operating conditions (of floor-operated cranes): conditions during which a crane is performing functions within the scope of the original design. Under these con-

ditions, the operator is at the operating control devices that are attached to the crane but operated with the operator off the crane, and there is no person on the crane.

normal operating conditions (of remote-operated cranes): conditions during which a crane is performing functions within the scope of the original design. Under these conditions, the operator is at the operating control devices that are not attached to any part of the crane, and there is no person on the crane.

operational aid: 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: upper and lower limit devices, travel limit devices, rated capacity (load) limiter, and wind speed indicator.

overload: any load greater than the rated load (see para. 2-3.4.2).

parts of line: the number of lines of rope supporting the load block.

pendant station: controls suspended from the crane for operating the unit from the floor.

primary upper-limit device: the first device that, when actuated, limits hoisting motion in the upward direction.

qualified person: a person who, by possession of a recognized degree in an applicable field or a 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.

rail sweep: a device attached to the crane and located in front of the crane's leading wheels to remove obstructions.

rated load (capacity): the maximum load designated by the manufacturer for which a crane or individual hoist is designed and built.

rated speed: the maximum speed designated by the manufacturer for each motion (bridge, trolley, and hoist) for which a crane is designed and built.

reeving: a system in which a rope travels around drums or sheaves.

rope: refers to wire rope unless otherwise specified.

runway: an assembly of rails, beams, girders, brackets, and framework on which the crane travels.

service platform: a means provided for workers to perform maintenance, inspections, adjustments, and repairs of cranes.

shall: a word indicating a requirement.

sheave: a grooved wheel or pulley used with a rope to change direction and point of application of a pulling force.

sheave, nonrunning (equalizer): a sheave used to equalize tension in opposite parts of the rope. Because of its slight movement, it is not termed a running sheave.

sheave, running: a sheave that rotates as the load block is lifted or lowered.

should: a word indicating a recommendation.

side pull: the portion of the hoist pull acting horizontally when the hoist lines are not operated vertically.

sills: horizontal structural members that connect the lower ends of two or more legs of a gantry crane on one runway.

span: the horizontal distance, center to center, between runway rails.

stop: a device to limit travel of a trolley or crane bridge. This device normally is attached to a fixed structure and normally does not have energy-absorbing ability.

switch (valve): a device for making, breaking, or changing the connections in an electric, hydraulic, or pneumatic circuit.

switch, emergency stop: a manually actuated switch to disconnect power independently of the regular operating controls.

switch, limit: a device that is actuated by the motion of a part of a power-driven machine or equipment to alter or disconnect the electric, hydraulic, or pneumatic circuit associated with the machine or equipment.

switch, main (crane disconnect): a switch on the crane controlling the main power supply from the runway conductors.

switch, master: a switch that dominates the operation of contactors, relays, or other remotely operated devices.

switch, master, spring-return: a master switch that, when released, will return automatically to a neutral (off) position.

switch, runway disconnect: a switch, usually at floor level, controlling the main power supply to the runway conductors.

trolley: the unit that travels on the bridge rails and supports the load block.

trolley travel: the trolley movement.

truck: a unit consisting of a frame, wheels, bearings, and axles that supports the bridge girders, the end ties of an overhead crane, or the sill of a gantry crane.

unattended: a condition in which the operator of a crane is not at the operating control devices. However, on a floor-operated crane, if the operating control devices are within sight of the operator and within a distance equal to the span of the crane, the crane should be considered attended.

upper block: a fixed block located on a trolley that, through a system of sheaves, bearings, pins, and frame, supports the load block and its load.

SECTION 2-0.3: REFERENCES

(22)

Within the text, references are made to the following publications, copies of which may be obtained from the publishers as indicated.

AIST Technical Report No. 6, June 2018, Specification for Electric Overhead Traveling Cranes for Steel Mill Service

Publisher: Association of Iron and Steel Technology (AIST), 186 Thorn Hill Road, Warrendale, PA 15086 (www.aist.org)

ANSI Z244.1 2016, Safety Requirements for the Lock Out/Tag Out of Energy Sources

Publisher: American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036 (www.ansi.org)

ANSI A14.3-2018, Safety Requirements for Fixed Ladders¹

ANSI A1264.1-1995 (R2002), Safety Requirements for Workplace Floor and Wall Openings, Stairs, and Railing Systems¹

Publisher: The American Society of Safety Professionals [ASSP; formerly the American Society of Safety Engineers (ASSE)], 520 N. Northwest Highway, Park Ridge, IL 60068 (www.assp.org)

ANSI Z535.4-2011, Product Safety Signs and Labels¹

Publisher: National Electrical Manufacturers Association (NEMA), 1300 North 17th Street, Rosslyn, VA, 22209 (www.nema.org)

ANSI/AISC 360-16, Specification for Structural Steel Buildings

Publisher: American Institute of Steel Construction (AISC), 130 East Randolph Street, Suite 2000, Chicago, IL 60601 (www.aisc.org)

ANSI/ASCE 7-2016, Minimum Design Loads for Buildings and Other Structures¹

Publisher: American Society of Civil Engineers (ASCE), 1801 Alexander Bell Drive, Reston, VA 20191-4400 (www.asce.org)

ANSI ECMA 15-2018, Specifications for Cable-less Controls for Electric Overhead Traveling Cranes

Publisher: Material Handling Industry of America (MHI), 8720 Red Oak Boulevard, Charlotte, NC 28217-3992 (www.mhi.org)

¹ May also be obtained from American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036.

ANSI/NFPA 70-2020, National Electrical Code¹

Publisher: National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471 (www.nfpa.org)

ANSI/SAE Z26.1-1996, Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicles Operating on Land Highways — Safety Standard¹

Publisher: Society of Automotive Engineers (SAE International), 400 Commonwealth Drive, Warrendale, PA 15096 (www.sae.org)

ASME B15.1-2000, Safety Standard for Mechanical Power Transmission Apparatus

ASME B30.9-2018, Slings

ASME B30.10-2019, Hooks

ASME B30.20-2018, Below-the-Hook Lifting Devices

ASME B30.26-2015 (R2020), Rigging Hardware

ASME P30.1-2019, Planning for Load Handling Activities

Publisher: The American Society of Mechanical Engineers (ASME), Two Park Avenue, New York, NY 10016-5990 (www.asme.org)

AWS D1.1-2020, Structural Welding Code — Steel¹

AWS D14.1M:2005, Specification for Welding of Industrial and Mill Cranes and Other Material Handling Equipment¹

Publisher: American Welding Society (AWS), 550 NW Le Jeune Road, Miami, FL 33126 (www.aws.org)

CMAA Specification No. 70-2020, Specifications for Top Running Bridge and Gantry Type Multiple Girder Electric Overhead Traveling Cranes

Publisher: Crane Manufacturers Association of America, Inc. (CMAA), 8720 Red Oak Boulevard, Charlotte, NC 28217 (www.mhi.org/cmaa)

ISO 7000-2012 Graphical symbols for use on equipment — Registered symbols

ISO 7296-1991 Cranes — Graphical symbols — Parts 1–3
Publisher: International Organization for Standardization (ISO), Central Secretariat, Chemin de Blandonnet 8, Case Postale 401, 1214 Vernier, Geneva, Switzerland (www.iso.org)

SECTION 2-0.4: PERSONNEL COMPETENCE

Persons performing the functions identified in this Volume shall meet the applicable qualifying criteria stated in this Volume and shall, through education, training, experience, skill, and physical fitness, as necessary, be competent and capable to perform the functions as determined by the employer or employer's representative.

Chapter 2-1

General Construction and Installation

SECTION 2-1.1: MARKINGS

2-1.1.1 Rated Load Markings — Crane

The rated load of the crane shall be marked on each side of the crane and shall be legible from the ground or floor.

2-1.1.2 Rated Load Markings — Hoists

(a) The rated load of the hoist shall be marked on the hoist or trolley unit or its load block and shall be legible from the ground or floor.

(b) If the crane has more than one hoisting unit, each hoist shall have its rated load marked as per (a).

2-1.1.3 Manufacturer's Identification Markings

The crane shall be marked with manufacturer's identification information, on a plate or label attached to the crane, as follows:

- (a) name and address of manufacturer
- (b) manufacturer's model or serial number
- (c) voltage of AC or DC power supply and phase and frequency of AC power supply

2-1.1.4 Multiple Hoist Identification Markings

If the crane has more than one hoisting unit, each hoist shall have an identification marking on the hoist or trolley unit or its load block (i.e., 1 and 2; A and B; north and south; etc.) and shall be legible from the ground or floor. These markings shall also appear on the controllers used by the operator to indicate the controllers that operate each hoist.

2-1.1.5 Warnings

(a) Floor-operated and remote-operated cranes shall have a safety label or labels affixed to the pendant station, portable operating station, or load block. The label or labels shall be in compliance with ANSI Z535.4, and shall include, but not be limited to, cautionary language against

- (1) lifting more than rated load
- (2) operating hoist when load is not centered under hoist
- (3) operating hoist with twisted, kinked, or damaged chain or rope
- (4) operating damaged or malfunctioning crane

- (5) lifting people
 - (6) lifting loads over people
 - (7) operating a rope hoist with a rope that is not properly seated in its groove
 - (8) operating manual motions with other than manual power
 - (9) removing or obscuring safety label
- (b) Cab-operated and pulpit-operated cranes shall have a safety label or labels affixed in the cab or pulpit. The label or labels shall be in compliance with ANSI Z535.4 and shall include, but not be limited to, cautionary language against

- (1) lifting more than rated load
- (2) operating hoist when load is not centered under hoist
- (3) operating hoist with twisted, kinked, or damaged chain or rope
- (4) operating damaged or malfunctioning crane
- (5) lifting people
- (6) lifting loads over people
- (7) operating a rope hoist with a rope that is not properly seated in its groove
- (8) removing or obscuring safety label

(c) A safety label shall be affixed on all electrical control enclosures. The label shall be in compliance with ANSI Z535.4 and shall include, but not be limited to, information such as the following:

- (1) Disconnect power and lockout disconnecting means before removing cover or servicing this equipment.
 - (2) Do not operate without cover in place.
- (d) Control panels and other electrical equipment, such as switchboards and panelboards, that are likely to require inspection, adjustment, servicing, or maintenance while energized shall be marked to warn of potential electric arc flash hazards. The marking shall be located as to be clearly visible to personnel before inspection, adjustment, servicing, or maintenance of the equipment.

2-1.1.6 Controls

- (a) Each controller shall be legibly marked to indicate the function and direction of movement.
- (b) In locations or areas where multiple cranes are used, the arrangement of control markings for function and direction should be the same.

(c) Directional markings (e.g., north, south, east, west or forward, reverse, left, and right) shall be provided on the equipment or facility. These markings shall be legible to the operator and consistent with the direction of movement markings on the controllers.

SECTION 2-1.2: CLEARANCES

2-1.2.1 Clearance From Obstruction

(a) Clearance shall be maintained between the crane and the building, as well as parallel running cranes and cranes operating at a different elevation, under all normal operating conditions. In the design of new cranes, all factors that influence clearance, such as wheel float, truss sag, bridge skewing, or trolley positions and configurations shall be considered.

(b) Where passageways or walkways are provided on the structure supporting the crane, obstructions shall not be placed so that personnel will be jeopardized by movements of the crane.

2-1.2.2 Clearance Between Parallel Cranes

If the runways of two cranes are parallel and there are no intervening walls or structures, there shall be clearance provided and maintained between the two bridges.

SECTION 2-1.3: GENERAL CONSTRUCTION — RUNWAYS AND SUPPORTING STRUCTURE

(22) 2-1.3.1 Foundations and Anchorages

(a) Permanent concrete or masonry foundations shall rest on footings below the frost line except in permafrost.

(b) Every outdoor crane shall be provided with secure fastenings convenient to apply and to hold the crane against a wind pressure of 30 lb/ft² (1 436 Pa). Parking brakes may be considered minimum compliance with this rule.

(c) Where wind forces are specified to be in excess of 30 lb/ft² (1 436 Pa), special anchorages, such as latches or tie-downs at the home position or remotely operated rail clamps for all positions to supplement the primary braking system, shall be provided (ANSI/ASCE 7-98 may be used as a reference for this condition).

(d) Outdoor gantry cranes shall be provided with remotely operated rail clamps or other equivalent devices. Parking brakes may be considered minimum compliance with this rule.

(e) Rail clamps should only be applied when the crane is not in motion.

(f) When rails are used for anchorages, they shall be secured to withstand the resultant forces applied by the rail clamps. If the clamps act on the rail, any projection or obstruction in the clamping area shall be avoided.

(g) A wind speed indicating device shall be provided for cranes used outdoors. The device shall be mounted on the crane or the crane runway structure and shall give a visible and audible alarm to the crane operator at a predetermined wind speed. A single wind speed indicating device may serve as an alarm for more than one crane.

2-1.3.2 Crane Runways

(22)

(a) Construction of Runways and Rails

(1) The crane runways and supporting structures shall be designed to withstand the loads and forces imposed by the crane. Steel crane runways and supporting structures should conform to the design parameters as specified in ANSI/AISC 360-16.

(2) Runway columns shall be securely anchored to foundations.

(3) The structure shall be free from detrimental vibration under normal operating conditions.

(4) Rails shall be level, straight, joined, and spaced to the crane span within tolerances as specified in CMAA Specification No. 70, or within tolerances that are compatible with special conditions specified by the crane manufacturer or a qualified person.

(5) Where curves are required, special design will be necessary.

(6) Where grades are required, special design will be necessary.

(b) Runway Stops

(1) Stops shall be provided at the limits of travel of the bridge or gantry structure.

(2) Stops shall engage the bumpers mounted on the bridge or gantry structure.

(3) Stops shall be designed to withstand the forces applied by the bumpers, as specified in [para. 2-1.8.2\(b\)](#).

SECTION 2-1.4: CRANE CONSTRUCTION

2-1.4.1 Welded Construction

All welding procedures and welding operator qualifications to be used on load-sustaining members shall be in accordance with ANSI/AWS D1.1, except as modified by ANSI/AWS D14.1. Where special steels or other materials are used, the manufacturer or qualified person shall provide welding procedures.

2-1.4.2 Structural Components

All crane load-bearing structural components such as, but not limited to, bridge girders, end ties, end trucks, and trolleys should conform to the design parameters as specified, and applicable, in CMAA Specification No. 70 or AIST Technical Report No. 6.

2-1.4.3 Modifications

Cranes may be modified or rerated provided such modifications and the supporting structure are analyzed thoroughly and approved by a qualified person or manufacturer of cranes. A rerated crane or one whose load-supporting components have been modified shall be tested in accordance with [para. 2-2.3.2](#). The new rated load shall be displayed in accordance with [paras. 2-1.1.1](#) and [2-1.1.2](#).

SECTION 2-1.5: CABS — NORMAL OR SKELETON (IF PROVIDED)

2-1.5.1 Cab Location

(a) The general arrangement of the cab and the location of the control and protective equipment should be such that all operating handles are within reach of the operator when facing the area to be served by the load block or while facing the direction of travel of the cab.

(b) The arrangement of the cab should allow the operator a full view of the load block in all positions. This is an important and desirable condition, but it is recognized that there are physical arrangements that may make this impossible, and, when the load block is in these positions, the operator shall be aided by other means such as, but not limited to, closed-circuit TV, mirrors, radio, telephone, or a signalperson.

(c) The cab shall be clear of all fixed structures within the area of possible movement.

(d) The clearance of the cab above the working floor or passageway should be not less than 7 ft (2.1 m), except when operations require dimensions that are less. In this case, precautions shall be taken during the operation of the crane to keep personnel and other obstructions clear of the low overhead.

2-1.5.2 Cab Construction

(a) The cab shall be constructed and attached to the crane to minimize swaying or vibrations.

(b) If an integral outside platform is provided, the door (if provided) shall be a sliding type or shall open outward.

(c) In the absence of an outside platform, the door (if provided) shall open inward or slide and shall be self-closing. It shall be equipped with positive latching devices to prevent inadvertent opening.

(d) The width of a doorway shall have a clear opening of not less than 18 in. (460 mm).

(e) A trapdoor (if provided) above the cab or in the cab roof shall have a clear opening of not less than 24 in. (610 mm) on each side. There should be no obstructions in the opening path of the trap door that prevents opening of the trap door for the purpose for which it is designed.

(f) Guard railings and toeboards shall be in compliance with ANSI A1264.1.

(g) Outdoor cabs should be enclosed. All cab glazing shall be safety-glazing material, as defined in ANSI/SAE Z26.1.

(h) The cab construction shall offer protection from falling objects, if this possibility exists. The protection shall support 50 lb/ft² (2 400 Pa) static load.

(i) If the cab of a molten material crane is exposed to heat, it shall be provided with the following, or equivalent, protection:

(1) cab enclosed as for outdoor protection

(2) windows with metal sash and heat-resisting, safety-glazing material, as defined in ANSI/SAE Z26.1

(3) floor insulated with heat-resistant material

(4) a shield of metal at least $\frac{1}{8}$ in. (3 mm) thick located at least 6 in. (152 mm) below bottom of cab floor

(5) materials that will not propagate combustion or rekindle

2-1.5.3 Access to Crane

Access to the cab or bridge walkway shall be by a fixed ladder, stairs, or platform. The ladder shall be in conformance with ANSI A14.3, except as modified to meet the requirements of this Volume.

2-1.5.4 Toolbox

If a receptacle is provided for the stowing of tools and oil cans, it shall be made of a noncombustible material and shall be securely fastened in the cab or on the service platform.

2-1.5.5 Fire Extinguisher

A portable fire extinguisher, with a basic minimum extinguisher rating of 10 BC, shall be installed in the cab.

2-1.5.6 Lighting

Cab lighting, either natural or artificial, shall provide a level of illumination that enables the operator to observe the operating controls.

SECTION 2-1.6: LUBRICATION

If lubrication is required, accessible means for lubrication should be provided.

SECTION 2-1.7: SERVICE PLATFORMS (FOOTWALKS)

2-1.7.1 Construction of Service Platforms

Service platforms, when provided with or added to the crane and attached to the crane, shall conform to the following requirements:

(a) The dimension of the working space in the vertical direction from the floor surface of the platform to the nearest overhead obstruction shall be a minimum of