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4123:1-3-07 Cranes, hoists, and derricks.

(A) Reserved.

(B) Definitions.

(1) "Derrick" means an apparatus consisting of a mast or equivalent members held at the top by guys or braces, with or without a boom, for use with a hoisting mechanism and operating ropes.

(2) "Derrick, A-frame" means a derrick in which the boom is hinged from a crossmember between the bottom ends of two upright members spread apart at the lower ends and united at the top, the upper ends of the boom being secured to the upper junction of the side members and the side members braced or guyed from the junction point.

(3) "Derrick, basket" means a derrick without a boom, similar to a gin pole, with its base supported by ropes attached to corner posts or other parts of the structure. The base is at a lower elevation than its supports. The location of the base of a basket derrick can be changed by varying the length of the rope supports. The top of the pole is secured with multireeved guys to position the top of the pole to the desired location. By varying the length of the upper guy lines, the load is raised and lowered by ropes through the sheave or block secured to the top of the pole.

(4) "Derrick, breast" means a derrick without a boom, the mast consisting of two side members spread farther apart at the base than at the top, tied together at the top and bottom by rigid members, the top held from tipping by guys and the load raised and lowered by ropes through a sheave or block secured to the top crosspieces.

(5) "Derrick, Chicago boom" means an ordinary derrick boom so installed as to utilize a building column or tower hoist as the mast, and to depend upon the structural steel beam connections or bracing to take the place of the stiff legs. The lower end of the boom is attached to the building columns by means of a combination hinge pin and swivel pin to a heavy steel plate clamp attached to the column. The derrick is completed with load fall line and boom fall line.

(6) "Derrick, gin pole" means a derrick consisting only of a mast with guys so arranged as to permit leaning the mast in any direction, the load being raised or lowered by ropes leading through sheaves or blocks at the top of the mast.

(7) "Derrick, guy" means a fixed derrick consisting of a mast capable of being rotated, supported in a vertical position by three or more guys and a boom whose bottom end is hinged or pivoted to move in a vertical plane, with lines between the head of the mast and the head of the boom for raising and lowering the boom lines from the head of the boom for raising and lowering the load.

(8) "Derrick, stiff leg" means a derrick similar to a guy derrick except that the mast is supported or held in place by two or more stiff members capable of resisting either tensile or compressive forces. Sills are generally provided to connect the lower ends of the two stiff legs to the foot of the mast.

(9) "Derrick, tripod" means a derrick consisting of three upright legs or members securely fastened together at the top, supporting a hoisting mechanism and operating ropes. The legs can be spread to various angles.

(10) "Hoist, mast" means a hoist having no less than two upright parallel members forming the mast, on which the cage is suspended outside of the parallel members. The entire unit is portable, but not self-propelled.

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(11) "Hoist, material" means a hoist for raising and lowering material only, with the hoisting of persons being prohibited.

(12) "Hoist, personnel" means a mechanism for use in connection with construction, alteration, maintenance, or demolition of buildings, structures, or other work. It is used for hoisting and lowering employees or material or both, is equipped with a car that moves on guide members during its vertical movement, and includes a hoistway.

(13) "Hoist tower" means a tower constructed of sections forming a shaftway in which a cage or platform travels.

(14) "Prime mover" means equipment used as the primary source of power, such as engines and motors.

(C) Cranes.

(1) Load rating chart.

A substantial and durable manufacturer's load rating chart with clearly legible letters and figures shall be maintained in each crane and securely fixed to the crane cab in a location easily visible to the operator while seated at the operator's control station. The data and information to be provided on such charts shall include, but not necessarily be limited to, the following data:

(a) A full and complete range of manufacturer's approved crane load ratings at all stated operating radii and boom angles, and for all permissible boom lengths, jib lengths, and angles, also alternate ratings for use and non-use of optional equipment on the crane such as outriggers and extra counterweights which affect ratings~~.~~;

(b) An operating manual shall be provided, showing recommended parts of hoist reeving, size and type of rope for various crane loads and the operating manual shall be maintained with the equipment.

(2) Boom hoist.

When using the manufacturer's recommended boom hoist reeving with rated loads suspended, the boom hoist shall be capable of raising the boom, holding it stationary without attention from the operator, and lowering it only when coupled to its prime mover.

(a) The boom hoist drum shall have sufficient rope capacity to operate the boom at all positions from horizontal to the highest angle recommended when using the manufacturer's reeving and rope size~~.~~;

(i) No less than two full wraps of rope shall remain on the drum with the boom point lowered to the level of the crane supporting surface.

(ii) The drum end of the rope shall be anchored by a clamp securely attached to the drum or a wedge socket arrangement approved by the crane manufacturer.

(b) The drum diameter shall be sufficient to provide a first layer rope pitch diameter of no less than ~~fifteen~~ eighteen times the nominal diameter of the rope used.

(3) Main hoist mechanism.

Load hoist drums shall have sufficient rope capacity with recommended rope size and reeving to

perform crane service within the range of boom lengths, operating radii and vertical lifts stipulated by the manufacturer.

(a) No less than two full wraps of rope shall remain on the drum when the hook is in its extreme low position.

(b) The drum end of the rope shall be anchored by a clamp securely attached to the drum or a wedge socket arrangement approved by the crane or rope manufacturer.

(4) Ropes.

(a) The hoisting rope shall be of a construction recommended for crane service. Non-rotating rope shall not be used for boom hoist reeving or multiple reeving.

(b) Socketing shall be done in the manner specified by the manufacturer of the assembly.

(c) If a load is supported by more than one part of the rope, the tension in the parts shall be equalized.

(d) Wherever exposed to temperatures at which fiber cores would be damaged, rope having an independent wire rope or wire strand core, or other temperature damage-resistant core shall be used.

(e) Replacement rope shall be the same size, grade and construction as the original rope furnished by the crane manufacturer, unless otherwise recommended by a rope manufacturer due to actual working condition requirements.

(f) Factor of safety.

The employer shall, when re-reeving boomed equipment, provide ropes which will meet the manufacturer's specifications and the factor of safety shall be no less than three and one-half.

(g) Splicing.

~~The splicing of all wire ropes shall conform to the manufacturer's specifications and in no case, whether of ordinary or preformed wire rope, shall the overall length of splice be less than thirty-two times the rope diameter in feet and the length of the tucked ends shall be no less than twenty-four times the rope diameter in inches.~~ If the deficiency is localized, the problem is corrected by serving the wire rope in two; the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited.

(h) Fastening.

Wire rope shall not be secured by knots. Thimbles shall be used where wire rope is looped. Wire rope clips shall conform to the manufacturer's specifications. The loop ends of wire rope clips shall be on the dead end of the wire rope and the grooved plate of the wire rope clip shall take the load of the pulling part for which it is designed. In looping or in short bends, wire rope clips and turnback of rope shall conform to the following table and spacing of clips shall be uniform between the loop and the dead end.

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Number and Spacing of U-Bolt Wire Rope Clips			
Improved Plow Steel, rope diameter (inches)	Number of Clips		Minimum Spacing Drop forge
	Drop forge	Other Material	
1/2	3	4	3
5/8	3	4	3 3/4
3/4	4	5	4 1/2
7/8	4	5	5 1/2
1	5	6	6
1 1/8	6	6	6 3/4
1 1/4	6	7	7 1/2
1 3/8	7	7	8 1/4
1 1/2	7	8	9

~~Clip size~~	~~Minimum number of clips~~	~~Amount of rope to turn back~~
~~1/8~~	~~2~~	~~3-1/4~~
~~3/16~~	~~2~~	~~3-3/4~~
~~1/4~~	~~2~~	~~4-3/4~~
~~5/16~~	~~2~~	~~5-1/4~~
~~3/8~~	~~2~~	~~6-1/2~~
~~7/16~~	~~2~~	~~7~~
~~1/2~~	~~3~~	~~11-1/2~~
~~9/16~~	~~3~~	~~12~~
~~5/8~~	~~3~~	~~12~~
~~3/4~~	~~4~~	~~18~~
~~7/8~~	~~4~~	~~19~~
~~1~~	~~5~~	~~26~~
~~1-1/8~~	~~6~~	~~34~~
~~1-1/4~~	~~7~~	~~44~~
~~1-3/8~~	~~7~~	~~44~~
~~1-1/2~~	~~8~~	~~54~~
~~1-5/8~~	~~8~~	~~58~~
~~1-3/4~~	~~8~~	~~61~~
~~2~~	~~8~~	~~71~~
~~2-1/4~~	~~8~~	~~73~~
~~2-1/2~~	~~9~~	~~84~~
~~2-3/4~~	~~10~~	~~100~~

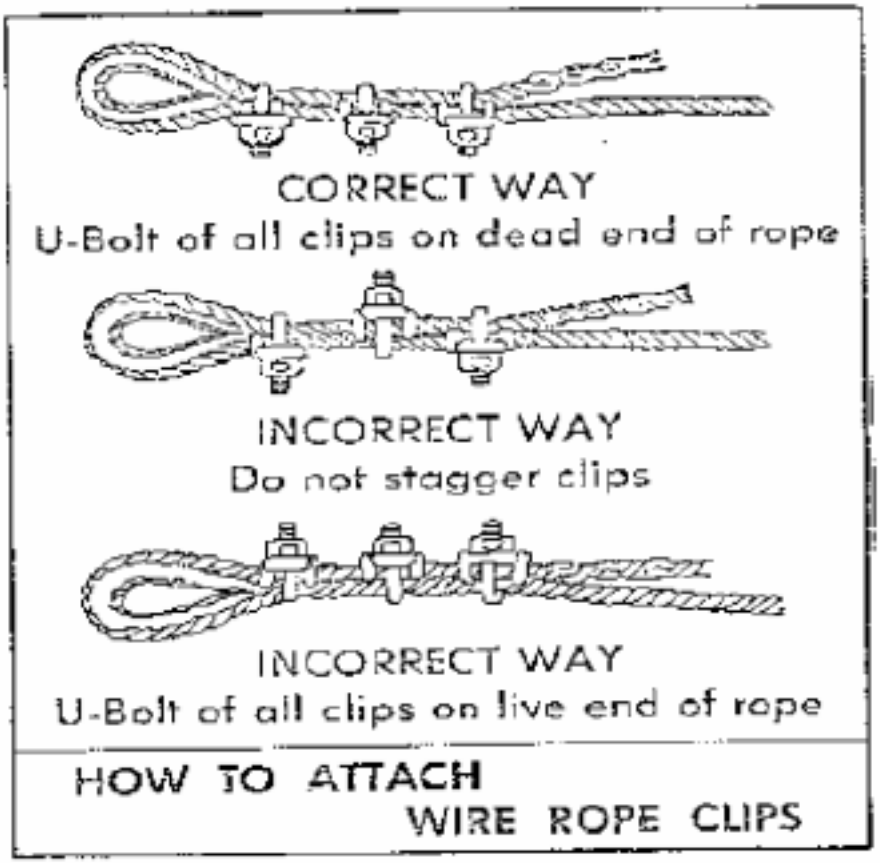

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Figure: How to attach wire rope clips

(5) Reeving accessories.

Eye splices shall be made in accordance with the requirements of paragraph (C)(4)(g) of this rule and thimbles shall be used in all eye splices.

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(6) Sheaves.

(a) Sheave grooves shall be smooth and free from surface defects.

(b) Sheaves carrying wire ropes shall be provided with close-fitting guards or other suitable devices to guide the rope back into the groove when the load is applied again.

(7) Cabs.

(a) Construction.

(i) Power driven cranes shall be provided with a cab to protect the operator in case the cable should break or material fall from the dipper or bucket.

(ii) All windows shall be of safety glass or equivalent.

(iii) A clear passageway shall be provided from the operator's station to an exit door on the operator's side.

(b) Platform to cab.

(i) Principal walking surfaces shall be of an anti-skid type.

(ii) ~~Outside platforms shall be provided with standard guardrails.~~ Originally-equipped steps, handholds, ladders and guardrails, railings, grab rails shall be maintained in good condition.

(8) Roof.

Where necessary for rigging or service requirements, a ladder or steps shall be provided to give access to the cab roof.

(9) Booms.

(a) Boom stops shall be provided on all mobile cranes.

(b) A boom angle indicator shall be provided.

(c) All repairs on booms, boom sections and jibs shall meet the manufacturer's specifications.

(10) Exhaust pipes.

All exhaust pipes shall be guarded or insulated in areas where employees are exposed to contact in the performance of normal duties. (See rule 4121:1-3-18 of the Administrative Code for ventilating exhaust gases.)

(11) Miscellaneous equipment.

(a) Portable fuel containers shall be equipped with a self-closing filler cap. Where gasoline is the fuel, a flame arrestor shall be provided.

(b) An effective warning and operating signal device shall be provided.

(c) Means shall be provided for the operator to visually determine the levelness of the crane.

(d) Barricades shall be provided to prevent an employee from being struck or crushed by the rotating superstructure of the crane.

(D) Hoists.

(1) General requirements.

(a) Rated load capacity - posting.

Rated load capacities, recommended operating speeds, and special hazard warnings or instructions shall be posted on cars and platforms.

(b) Hoisting ropes shall be installed in accordance with the wire rope manufacturer's recommendations.

(c) The installation of live booms on hoists is prohibited.

(d) The use of endless belt type manlifts on construction sites is prohibited.

(e) Hoist platforms.

Blocking and cleats shall be provided on hoist platforms when wheelbarrows or other rolling equipment is transported.

(f) Landing platforms.

(i) Landing platforms shall be of sufficient strength to support the maximum working loads imposed upon them, and no less than seventy-five pounds per square foot, without exceeding the allowable working stresses specified in the appendix to this rule.

(ii) Standard guard railing, toeboards and side screens shall be provided on both sides of landing platforms.

(iii) Clearance between adjacent edges of the hoist platform and the landing platform shall not exceed two inches.

(2) Material hoists.

(a) 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".

(b) No employee shall be required to ride on material hoists except for the purposes of inspection and maintenance.

(c) All entrances of the hoistway shall be guarded 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 no less than two-inch by four-inch wooden bars or the equivalent, located two feet from the hoistway line. Bars shall be located no less than twenty-six inches or more than forty-two inches above the floor.

(ii) Gates or bars protecting the entrances to hoistways shall be equipped with a latching device.

(d) Overhead protective covering of two-inch planking, three-fourths-inch plywood, or other solid material of equivalent strength, shall be provided on the top of every material hoist cage or platform.

(e) The operator's station of a hoisting machine shall be provided with overhead protection equivalent to tight planking no less than two inches thick. The support for the overhead protection shall be of equivalent strength.

(f) 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 one-half-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 one-half-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 six-foot high enclosure shall be provided on the unused sides of the hoist tower at ground level.

(g) Car arresting devices shall be installed to function in case of rope failure.

(h) Material hoists shall be securely fastened to the structure at no less than twenty-five-foot intervals.

(3) Personnel hoists.

(a) 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 no less than ten feet. Other sides of the tower adjacent to floors or scaffold platforms shall be enclosed to a height of ten feet above the level of such floors or scaffolds.

(b) Towers inside of structures shall be enclosed on all four sides throughout the full height.

(c) Towers shall be anchored to the structure at intervals not exceeding twenty-five 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 no less than one-half inch in diameter, securely fastened to anchorage to ensure stability.

(d) A minimum of two and one-half square feet shall be provided for each person riding on hoist car.

(e) Whenever a hoist tower extends twenty-five feet or more above the roof line or last possible tie-ins to the structure, it shall be guyed.

(f) Hoistway doors or gates shall be no less than six feet six inches high and shall be provided with mechanical locks which cannot be operated from the landing side, and shall be accessible only to employees on the car.

(g) Cars shall be permanently enclosed on all sides and the top, except sides used for entrance and exit which have car gates or doors.

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(h) A door or gate shall be provided at each entrance to the car which shall guard the full width and height of the entrance opening.

(i) Overhead protective covering of two-inch planking, three-fourths-inch plywood or other solid material of equivalent strength shall be provided on the top of every personnel hoist.

(j) Doors or gates shall be provided with electric contacts which do not allow movement of the hoist when door or gate is open.

(k) Cages of all hoists upon which employees are permitted to ride shall be equipped with a down speed governor to operate the car safety.

(l) Safeties shall be capable of stopping and holding the car and rated load when traveling at governor tripping speed.

(m) Cars shall be provided with a capacity and data plate secured in a conspicuous place on the car or crosshead.

(n) Internal combustion engines for direct drive are prohibited.

(o) Normal and final terminal stopping devices shall be provided.

(p) An emergency stop switch shall be provided in the car and marked "STOP".

(q) 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 one-half inch.

(iii) Factor of safety.

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

(r) Following assembly and erection of hoists, and before they are put in service, an inspection and test of all functions and safety devices shall be made at full rated capacity under the supervision of the manufacturer or the manufacturer's authorized representative. A similar inspection and test is required following major alteration of an existing installation. All hoists shall be inspected and tested no less often than at three-month intervals. Records shall be maintained and kept on file for the duration of the job.

(s) 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.

(i) 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 three-fourths-inch mesh of "No. 14 U.S. Gauge" wire or equivalent. The hoist platform enclosure shall include the required gates for loading and unloading.

(ii) These hoists shall be inspected and maintained on a weekly basis. Whenever the hoisting equipment is exposed to winds exceeding thirty-five miles per hour it shall be inspected and put in operable condition before re-use.

(iii) Wire rope shall be taken out of service when any of the following conditions exist:

(a) In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay;

(b) 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;

(c) Evidence of any heat damage from any cause;

(d) Reductions from nominal diameter of more than three-sixty-fourths-inch for diameters to and including three-fourths-inch, one-sixteenths-inch to one and one-eighth inches inclusive, three-thirty-seconds-inch for diameters one and one-fourth inches to one and one-half inches inclusive;

(e) 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.

(4) Overhead hoists.

(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) All overhead hoists in use shall meet the applicable requirements for construction, design, installation, testing, maintenance, and operation as prescribed by the manufacturer.

(E) Proximity to overhead electric conductors.

When it is necessary to move or operate cranes, derricks, or any other type of hoisting apparatus or construction equipment within ~~ten~~ twenty feet of an electrical conductor carrying one hundred ten volts or more, the employer shall:

(1) Arrange with the owner of the conductor, or the owner's authorized representative, to deenergize the conductor, or

(2) Arrange with the owner of the conductor, or the owner's authorized representative, to move the conductor, or

(3) Arrange with the owner of the conductor, or the owner's authorized representative, to guard the conductor from accidental contact and the employer shall designate an employee to act as signalman to direct the operator in the movement of derricks, cranes, or any other type of hoisting apparatus or construction equipment, or

(4) Install an insulated type guard about the boom or arm of the equipment and a dielectric insulator link between the load and the block and the employer shall designate an employee to act as a signalman to direct the operator in the movement of derricks, cranes, or any other type of hoisting apparatus or construction equipment.

(F) No employee shall be permitted to pass or be under loads handled by power shovels, derricks, or hoists. Employees who are not engaged in vehicle loading shall be required to stand back from any such vehicle during the loading.

(G) Derricks.

The following types of derricks are covered by the requirements in this section wherever such requirements apply to the specific type of derrick: gin poles, tripod derricks, A-frame derricks, Chicago boom derricks, stiff leg derricks, breast derricks and guyed masts. (See appendix to this rule for diagrams of derricks.)

(1) Design.

(a) Derricks and all appurtenances thereof, including anchorage, shall be designed to carry the maximum working loads to be imposed upon them and shall provide a factor of safety of no less than four, including wind loads calculated on the basis of the following table:

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Wind loads to be used in design of derricks

Height Zone (Feet)	Wind Load (lbs./sq. ft. of Vertical Surface)
Less than 20	10
20 to less than 30	15
30 to less than 50	20
50 to less than 100	25
100 to less than 500	30
500 to less than 1200	35
Over 1200	40

NOTES:

1. For cylindrical sections in excess of two inch diameter, multiply by factor of 0.80.

2. For cylindrical sections two inches or less in diameter, multiply by factor of 1.00.

3. For flat sections, multiply by factor of 1.30.

4. When height under consideration is fifty feet or more, interpolate wind load for such height from table.

5. Design shall be checked for wind loading in all directions. No allowance shall be made for sheltering from adjacent structures.

(b) All equipment shall be designed and erected in a substantial manner and securely fastened in place.

(2) Foundations and anchoring.

(a) Foundations.

Derricks shall be set upon substantial foundations.

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(b) Anchoring and securing.

(i) Independent of building or structure.

(a) Derricks independent of a building or structure shall be substantially anchored at the top of each corner post and at intermediate intervals of no more than forty feet with no less than three-eights-inch steel wire rope or material of equal or greater strength. Anchorage for the guys of derricks shall be designed to resist the loads imposed.

(b) Under no circumstances shall less than ~~four~~ six guys be used on a derrick supported solely by guys.

(c) The anchoring of derricks shall be such as to ensure that with the boom in any position, the righting moment will exceed the overturning moment, imposed under service conditions with rated load or under storm conditions.

(ii) Secured to building or structure.

Derricks shall be securely fastened to the building or structure, at intervals of no more than forty feet.

(3) Hoist hooks.

Hoist hooks used with bucket, cage or skip shall be equipped with a safety latch designed to prevent the load from being accidentally detached.

(4) Braking systems.

Derricks shall be provided with a brake which will operate in case of power failure. The braking system shall be capable of holding the maximum rated load at any point of the lift.

(5) Protection from falling material or objects.

A substantial overhead guard shall be provided which will protect the operator of the derrick from falling material and objects.

(6) Running lines.

Running lines and pinch points where a wire rope runs onto sheaves, blocks or pulleys of derricks, located six feet or less from the ground or working level shall be guarded, except when loads are moved horizontally.