HAWAII ADMINISTRATIVE RULES

TITLE 12 DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS

SUBTITLE 8

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH

CHAPTER 232

PERSONNEL HOISTS

Historical note: Chapter 232 of title 12 is based upon chapter 363 of the Hawaii Occupational Safety and Health Standards, Rules and Regulations. [Eff. 7/11/74; am 6/7/76; R 7/12/82]

§12-232-1 Definitions. As used in this chapter:

"Alteration" means any change or addition to the equipment other than ordinary repairs or replacements.

"Approved" means accepted as satisfactory by a duly constituted administrative or regulatory authority.

"Buffer" means a device designed to stop a descending car or counterweight beyond its normal limit of travel by storing or by absorbing and dissipating the kinetic energy of the car or counterweight:

(1) "Buffer, hydraulic" means a buffer using fluid as a medium which absorbs and dissipates the kinetic energy of the descending car or counterweight.

(2) "Buffer stroke, hydraulic" means the fluid-displacing movement of the buffer plunger or piston, excluding the travel of the buffer-plunger accelerating device.

(3) "Spring buffer" means a buffer which stores in a spring the kinetic energy of the descending car or counterweight.

(4) "Spring-buffer load rating" means the load required to compress the spring an amount equal to its stroke.

(5) "Spring-buffer stroke" means the distance the contact end of the spring can move under a compressive load until all coils are essentially in contact.

"Car (cage)."

(1) "Car-door" or "gate electric contact" means an electrical device, the function of which is to prevent operation of the driving machine by the normal operating device unless the car door or gate is in the closed position.

(2) "Car enclosure" means the top and the walls of the car resting on, and attached to, the car platform.

(3) "Car frame (sling)" means the supporting frame to which the car platform, upper and lower sets of guide shoes, car safety, and the hoisting ropes or hoisting-rope sheaves or other lifting mechanism are attached.

(4) "Car platform" means the structure which forms the floor of the car and which directly supports the load.

(5) "Hoist car" means the load-carrying unit including its platform, car frame, enclosure, and car door or gate.

"Car-switch operation" means an operation wherein the movement and direction of travel of the car are directly and solely under the control of the operator by means of a manually operated car switch in the car.

"Clearance."

(1) "Bottom car clearance" means the clear vertical distance from the pit floor (ground or foundation) to the lowest structural or mechanical part, equipment, or device installed beneath the car platform, except guide shoes or rollers, safety-jaw assemblies, and platform aprons or guards, when the car rests on its fully compressed buffers.

(2) "Top car clearance" means the shortest vertical distance between the top of the car crosshead, or between the top of the car where no crosshead is provided, and the nearest part of the overhead structure, or any other obstruction when the car floor is level with the top terminal landing.

(3) "Top counterweight clearance" means the shortest vertical

distance between any part of the counterweight structure and the nearest part of the overhead structure, or any other obstruction when the car floor is level with the bottom terminal landing.

"Compensating-rope-sheave switch" means a device which automatically causes the electric power to be removed from the hoist driving-machine motor and brake when the compensating sheave approaches its upper or lower limit of travel.

"Control" means a system governing the starting, stopping, direction of motion, acceleration, speed, and retardation of the car.

"Controller" means a device which serves to control in some predetermined manner the apparatus to which it is connected.

"Counterweight-way" means a temporary shaftway; the space traveled by the counterweight.

"Door" or "gate."

(1) "Car" or "hoistway door or gate" means the sliding portion of the car or the hinged or sliding portion in the hoistway enclosure which closes the opening, giving access to the car or to the landing.

(2) "Biparting door" means a vertically or horizontally sliding door consisting of two or more sections so arranged that the sections or groups of sections open away from each other and so interconnected that all sections operate simultaneously.

(3) "Manually operated door or gate" means a door or gate which is opened and closed by hand.

"Emergency stop switch" means a device located in the car which, when manually operated, causes the power to be removed from the driving-machine motor, thereby causing the brake to be applied.

"Guide members" means fixed vertical steel sections designed to prevent lateral movement of the car. Guide members may be standard elevator T rails or other suitable sections.

"Guide shoes or rollers" means devices attached to the car frame or counterweight which cause the car to be guided by the guide members.

"Hoist."

(1) "Material hoist" means a hoist for raising and lowering materials only, with the hoisting of persons being prohibited.

(2) "Personnel hoist (hereinafter referred to as hoist)" means a mechanism for use in connection with the construction, alteration, maintenance, or demolition of a building, structure, or other work. It is used for hoisting and lowering workers or materials, or both, is equipped with a car that moves on guide members during its vertical movement, and includes its hoistway.

"Hoistway" means temporary shaftway; the space traveled by the car.

(1) "Car-door or gate separate mechanical lock" means a mechanical device, the function of which is to lock a car door or gate in the closed position as the car leaves the receiving landing and to prevent the door or gate from

being opened unless the car is within the landing zone.

(2) "Hoistway-door or gate interlock" means a device having the following two related and interdependent functions:
    (A) Preventing the operation of the driving machine by the normal operating device unless the hoistway door or gate is locked in the closed position.
    (B) Preventing the opening of the hoistway door or gate from the landing side unless the car is within the landing zone and is either stopped or being stopped.

(3) "Hoistway enclosure" means the structure which isolates the hoistway from all other parts of the building and on which the hoistway doors or gates, and door or gate assemblies are installed.

(4) "Hoistway unit system" means a series of hoistway-door or gate interlocks, the function of which is to prevent operation of the driving machine by the normal operating device unless all hoistway doors or gates are in the closed position and locked.

"Installation."

(1) "Existing installation" means a completed and approved hoist, including its hoistway, hoistway enclosures, and related construction, and all machinery and equipment necessary for its operation.

(2) "New installation" means any installation not classified as an existing installation by definition, or a hoist moved to a new location.

"Landing."

(1) "Hoist landing" means that portion of a floor, balcony, or platform used to receive and discharge passengers or material.

(2) "Landing zone" means a zone extending from a point 12 inches below a landing to a point 12 inches above the landing.

"Machine."

(1) "Driving machine" means the power unit which applies the energy necessary to raise and lower a hoist car and counterweight where applicable.

(2) "Electric driving machine" means a machine whose energy is applied by an electric motor.

(3) "Geared-drive machine" means a direct-drive machine in which the energy is transmitted from the motor to the driving sheave, drum, or shaft through gearing.

(4) "Gearless traction machine" means a traction machine without intermediate gearing, which has the traction sheave and the brake drum mounted directly on the motor shaft.

(5) "Rack-and-pinion machine" means a machine in which the motion of a car is obtained by power-driven rotating pinion mounted on the car, traveling on a stationary rack mounted on the supporting mast (tower).

(6) "Traction machine" means a machine in which the motion of a car is obtained through friction between the suspension ropes and a traction sheave.

(7) "Winding-drum machine" means a geared-drive machine in

which the hoisting ropes are fastened to and wound on a drum.

(8) "Worm-geared machine" means direct-drive machine in which the energy from the motor is transmitted to the driving sheave or drum through worm gearing.

"Mast (tower)" means a vertical structure which supports and guides the car (and the counterweight and overhead when used) outside of the mast structure.

"May" means permissive.

"Operating device" means the car switch, push button, lever, or other manual device used to actuate the control.

"Operation" means the method of actuating the control.

"Overhead structure (cathead)" means all of the structural members or platforms supporting the hoist machinery, sheaves, or equipment at the top of the hoistway.

"Pit" means that portion of a hoistway extending from the threshold level of the lowest landing door to the floor (ground or foundation) at the bottom of the hoistway.

"Rated load" means the load for which the hoist is designed and installed to lift at the rated speed.

"Rated speed" means the speed in the up direction, with rated load in the car, at which a hoist is designed to operate.

"Rope" means hoist wire ropes, governor wire ropes, and compensating wire ropes.

"Runby."

(1) "Bottom hoist-car runby" means the distance between the car-buffer striker plate and the striking surface of the car buffer when the car floor is level with the bottom terminal landing.

(2) "Bottom hoist-counterweight runby" means the distance between the counterweight-buffer striker plate and the striking surface of the counterweight buffer when the car floor is level with the top terminal landing.

"Safety, car or counterweight" means a mechanical device attached to the car frame or to an auxiliary frame, or to the counterweight frame, to stop and hold the car or counterweight in case of predetermined over-speed or free fall, or if the hoisting ropes slacken.

"Shall" means mandatory.

"Should" means advisory.

"Slack-rope switch" means a device which automatically causes the power to be removed from the hoist driving-machine motor and applies the brake when the hoisting ropes of winding-drum machine become slack.

"Standard railing" means a railing substantially constructed of wood or metal, which shall consist of a top rail having a smooth surface and located at a vertical height of approximately 42 inches between the upper surface of the top rail and the floor, an intermediate rail located approximately halfway between the top rail and the floor, and posts located not more than 8 feet apart.

"Stopping device."

(1) "Final-terminal stopping device" means a device which automatically causes the power to be removed from a hoist driving-machine motor and applies the brake independent of

the functioning of the normal-terminal stopping device, the operating device, or an emergency terminal stopping device, after the car has passed terminal landings.

(2) "Normal-terminal stopping device" means a device or devices to slow down and stop a hoist car automatically at or near a terminal landing, independently of the functioning of the operating device.

(3) "Terminal speed-limiting device" means a device which automatically reduces the speed as a car approaches a terminal landing, independently of the functioning of the operating device and the normal-terminal stopping device, if these devices fail to slow down the car as intended.

"Suspension-rope equalizer" means a device installed on a hoist car or counterweight to equalize automatically the tensions in the hoisting wire ropes.

"Tower" means a vertical structure which supports and guides the car (and the counterweight and overhead when used) within the tower structure.

"Travel (rise)" means the vertical distance between the bottom terminal landing and the top terminal landing of a hoist.

"Traveling cable" means a cable made up of electric conductors, which provides electrical connection between the hoist car and fixed outlet in or adjacent to the hoistway.

"Weatherproof" means constructed or protected so that exposure to the weather, to falling moisture, or to external splashing will not impair the effectiveness of the enclosed equipment.

[Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-3) (Imp: HRS §397-3)

§12-232-2 General requirements. (a) Reasonable safety required.

(1) Any installation of a personnel hoist shall be required to be reasonably safe for the protection of persons and property and shall conform with the requirements of this chapter and other applicable laws, rules and regulations of the State and all orders issued by the State. A personnel hoist constructed, installed, and operated in conformity with applicable provision of the American National Standards Institute Safety Standard A10.4, Safety Requirements for Personnel Hoists, and this chapter shall be prima facie evidence that the installation is reasonably safe for the protection of persons and property.

(2) Conditions found not in conformance with applicable requirements of this chapter and which the owner could not reasonably have been aware of, shall be regarded as discrepancies. All discrepancies shall be satisfactorily resolved as soon as possible. When in the opinion of the department a discrepancy constitutes a potentially serious or imminent hazard it shall make an order to abate the condition within an appropriate time and may prohibit the use of the equipment until the condition is abated. Failure to correct discrepancies or failure to abate an unsafe condition within the time specified shall be a

violation.

(b) Scope.

(1) This chapter applies to the design, construction, installation, operation, inspection, testing, maintenance, alterations, and repair of structures and hoists which are not a permanent part of the buildings when installed inside or outside buildings during construction, alteration, or demolition, and used to raise and lower workers and other parts connected with or related to the building project. The hoist may also be used for transportation of materials.

(2) This chapter shall not apply to the following:

(A) Temporary elevators installed in the hoistways during the construction of buildings and incorporating a part of the permanent elevator to be installed later;

(B) Hoists for raising and lowering materials with no provision for carrying personnel;

(C) Manlifts, counterbalanced or endless-belt type;

(D) Mine hoists; and

(E) Wire-rope-guided and nonguided hoists.

(c) Purpose. The purpose of this chapter is to provide minimum safety requirements for life, limb, and property for those engaged in occupations requiring the use of personnel hoists.

(d) Exceptions. In cases of practical difficulties, unnecessary hardships, or new developments, and for hoists previously approved for use, exceptions to the literal requirements of this chapter may be granted by the enforcing authority to permit the use of other devices or methods, but only when it is clearly indicated that equivalent safety is secured. [Eff. 7/12/82; comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-3 Related standards. This chapter is supplemented by the following:

(1) American Institute of Steel Construction. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, 1969, with supplements to 1974;

(2) American National Standard Building Code Requirements for Reinforced Concrete, ANSI/ACI 318-77;

(3) American National Standard Safety Code for Elevators and Escalators, ASME A17.1-1996;

(4) American National Standard Safety in Welding and Cutting, Z49.1-1973;

(5) National Electrical Code, NFPA No. 70-1996; and

(6) National Standard Safety Requirements for Floor and Wall Openings, Railings, and Toeboards, A12.1-1973.

[Eff. 7/12/82; comp 12/6/90; am 7/6/98] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-4 Construction of towers, masts, and hoistway enclosures. (a) Tower or mast construction. The tower or mast construction forming the supports for the machinery and guide members shall be designed and installed to support the load and forces specified. Welding of parts upon which safe operation depends shall

be performed in accordance with the requirements of section 12-232-15(g)(3).

(b) Protection of spaces below hoistways not extending to the lowest floor of the building. Where the space below the hoistway is used for a passageway or is occupied by persons or, if unoccupied, is not secured against unauthorized access, the following requirements shall be met:

(1) Hoist counterweights shall be provided with a Type "A" or "B", or rack-and-pinion safety;

(2) The cars and counterweights shall be provided with spring or oil buffers conforming to the following:

(A) Spring or oil buffers shall conform with section 12-232-13; and

(B) Spring buffers for hoists shall be so designed and installed that they will not be fully compressed when struck by the car with its rated load and by the counterweight at governor-tipping speed where the safety is governor-operated and at 125 per cent of rated speed where the safety is not governor-operated; and

(3) Car- and counterweight-buffer supports shall be of sufficient strength to withstand without permanent deformation the impact resulting from buffer engagement of governor-tripping speed where the safety is governor-operated and 125 per cent of rated speed where the safety is not governor-operated.

(c) Hoistway enclosures.

(1) For hoists located outside of structures, the enclosures, except those at the lowest landing, may be omitted on the sides where there is no floor or scaffold adjacent to the hoistway. Enclosures on the building side of the hoistway shall be full height or a minimum of 10 feet (3 m) at each floor landing. Enclosures at the pit shall be not less than 8 feet (2.4 m) on all sides.

(2) For hoists located inside of structures, the hoistway shall be enclosed throughout its height.

(3) Design. Hoistway enclosures shall be so supported and braced that when subjected to a pressure of 100 pounds applied horizontally at any point, the deflection shall not exceed one inch and shall not reduce the running clearance below the minimum required in section 12-232-10(a) (1). Hoistway enclosures, if of openwork, shall be provided on all sides within the building or structure with an unperforated kickplate extending not less than 12 inches (30 cm) above the level of each floor above the lowest. Openwork shall be of at least 16 gauge wire and shall reject a 1-1/2 inch (3.8 cm) diameter ball.

(d) Hoist structure.

(1) Hoists shall be supported by a firm foundation of such dimensions as to adequately distribute the transmitted load so as not to exceed the safe load-bearing capacity of the ground upon which such hoists are erected.

(2) Each hoist structure shall be anchored to the building or other structure at vertical intervals as recommended by

the manufacturer, but in any case not exceeding 25 feet (7.6 m). Where the building or other structure is of such character that tie-ins cannot be made, the hoist structure shall be guyed by means of a suitable number of guys. Such guys shall be fastened to adequate anchorages to ensure hoist structure stability. When wire rope is used for guys, the rope shall be at least 1/2 inch (1.3 cm) in diameter. Tie-ins or guys shall be fastened to the building or other structure by cast-in inserts or by through bolting.

(3) Tie-ins shall conform to, or be equal to, the manufacturer's specifications and shall remain in place until the tower or mast is dismantled.

(4) The free-standing portion of the hoist structure shall be in accordance with manufacturer's specifications.

(5) Cars in multiple hoistways are prohibited when one or more cars are designed according to the requirements of American National Standard Safety Requirements for Material Hoists, A10.5-1975.

(6) Each personnel hoist shall be independently powered and operated.

(7) Chicago booms shall be prohibited on hoist structures. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-233-5 Strength of wire ropes. The wire rope strength on which the designer shall base the calculations for factor of safety shall be determined as follows:

(1) Where the wire rope manufacturer lists the minimum guaranteed breaking strength of the finished rope, this value is to be used as safe strength, and is referred to in this chapter as "Catalog Breaking Strength"; and

(2) Where the wire rope manufacturer lists breaking strengths which are obtained by multiplying the guaranteed minimum ultimate unit stress of the individual wire by the published area of the rope, these values are referred to herein as "aggregate" strengths. In these cases, rope strength shall be determined as "aggregate" strengths, and the rope strength shall be reduced by applying the manufacturer's published efficiency factor. The result is referred to in this chapter as the "calculated breaking strength." Rope strength shall be taken as 94 per cent of the calculated breaking strength. [Eff. 12/19/83; am and ren §12-233-5 and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-6 Overhead beams, foundations, and flooring over hoistway. (a) Overhead beams and foundations for the direct support of the machinery or sheaves, or both, shall conform to the requirements given in paragraphs (1) through (4) below.

(1) Machines, machinery, and sheaves shall be so supported and maintained in place as to effectually prevent any part from becoming loose or displaced under the conditions imposed in service. Supporting beams, if used, shall be

of steel or reinforced concrete. Beams are not required under machines, sheaves, and machinery or control equipment which are supported on floors provided such floors are designed and installed to support the load.

(2) Loads on machinery and sheave beams, floors, or foundations and their supports.

(A) Overhead beams, floors, and their supports shall be designed for not less than the sum of the following loads:

(i) The load resting on the beams and supports which shall include the complete weight of the machine, sheaves, controller, governor, and any other equipment, together with that portion, if any, of the machine-room floor; and

(ii) Twice the sum of the tensions in all wire ropes supporting the car, passing over sheaves or drums supported by the beams, with rated load in the car. These tensions are doubled to take care of impact, acceleration, stresses, etc.

(B) For machines and sheaves located below or at the sides of the hoistway, the foundation for the machine and sheave beams and their supports shall be designed to withstand the following loads:

(i) The foundation shall support the total weight of the machine, sheaves, and other equipment, and the floor;

(ii) The sheave beams and the foundation bolts shall withstand twice the vertical component of the tensions in all hoisting ropes passing over sheaves or drums on the foundation or beams, less the weight of the machine or sheaves;

(iii) The sheave beams and the foundation bolts shall withstand twice the horizontal component, if any, of the tensions in all hoisting ropes passing over sheaves or drums on the foundation or beams; and

(iv) The foundation shall withstand twice the overturning moment, if any, developed by the tensions in all the hoisting ropes passing over sheaves or drums on the foundation or beams.

(3) Securing of machinery and equipment to beams, foundations, or floors.

(A) Machinery or equipment shall be secured to and supported on or from the top of overhead beams or floors. Exceptions are secondary or deflecting sheaves of traction hoists, and devices and their accessories for limiting or retarding car speed.

(B) Machines and sheaves located below, or at one side of, a hoistway shall be anchored to beams, foundations, or floors with bolts, shall conform to ASME Specification SA-307, and shall be of sufficient size and number to withstand the applicable load conditions specified under paragraph (2)(B) above. Based on these initial loads, total tension in anchor

bolts shall not exceed 12,000 psi of net section and the total shear shall not exceed 8,600 psi of actual area in the shear plane. Where bolts are used through sloping flanges of structural shapes, the bolt heads shall be of the tipped or beveled-head type or shall be fitted with beveled steel washers, and nuts on sloping flanges shall seat on beveled steel washers. Exception: Bolts made of steel having a greater strength than that specified by ASME Specification SA-307 may be used and the maximum allowable stresses increased proportionally based on the ratio of the ultimate strengths. Elongation must conform to the requirements of ASME Specification SA-307.

(C) Where hoisting ropes are secured to the structure above a hoist-way, the hitch plates and hitch-plate blocking beams, where used, shall be secured to, and mounted on top of, overhead beams, machine beams, or on top of auxiliary beams connected to the webs of overhead beams. Hitch plates, blocking beams, or auxiliary beams shall be secured by bolting, or welding, and shall be so located that the tension in the hoisting ropes will not develop direct tensions in the bolts. Bolts shall conform to ASME Specification SA-307 or SA-325. Welding shall conform to American National Standard Safety in Welding and Cutting, Z49.1. Where bolts are subject to shearing stresses due to tensions in the hoist ropes, the total sheer shall not exceed 8,600 psi of actual area in the shear plane. The stresses in welds due to tensions in the hoisting ropes shall not exceed 12,000 psi based on the throat area of the weld. The hitch-plate supporting beams shall be designed to withstand twice the sum of the tensions in all hoisting ropes attached to the hitch plates. Total stresses in tension plus bending in hitch plates and hitchplate shapes shall not exceed 12,000 psi. Exception: Bolts made of steel having a greater strength than specified by ASME Specification SA-307 may be used and the maximum allowable stresses increased proportionally based on the ratio of the ultimate strengths. Elongation must conform to the requirements of the corresponding American National Standard.

(D) Cast metals in tension or bending. Cast metals having an elongation of less than 20 per cent in a length of 2 inches, (5 cm), which are subject to tension or bending, shall not be used to support machinery or equipment from the underside of overhead beams or floors.

(4) The unit stresses for all machinery and sheave beams and floors, based upon the loads computed as specified in paragraph (2) above, shall not exceed 80 per cent and the unit stresses in the tower or mast structures shall not

exceed 100 per cent of those permitted for static loads by the following standards:

(A) Structural steel: AISC S310. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings; and

(B) Reinforced concrete: American National Standard Building Code Requirements for Reinforced Concrete, ANSI/ACI 318.

(b) Where the hoisting machine is installed at the top of the hoistway, a solid floor shall be provided for maintenance, inspection, and lubrication. The floor shall be of 2-inch (5 cm) plank, or the equivalent, secured against movement with guardrails installed on all open sides. Where the hoisting machine is located at the bottom of the hoistway, suitable access shall be provided for maintenance, inspection, and lubrication of top cathead and sheaves.

(c) All personnel hoists shall have overhead protection equivalent to 2-inch (5 cm) plank whenever the building exceeds the height of the personnel-hoist tower. These planks shall be secured. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-7 Electrical wiring, fittings, and fixtures. (a) Installation of raceways and wiring in hoistway and machine room.

(1) Wiring, raceways, and cables in hoistways. Main feeders for supplying power to the hoist may be installed inside or outside the hoistway. Only such electrical wiring, raceways, and cables used directly in connection with the hoist may be installed inside the hoistway.

(2) Stationary electrical conductors located in hoistways shall be encased in rigid metal conduits or electrical metallic tubing or metal wireways.

(A) Exception 1: Cabled conductors without metal encasement may be used for the hoistway wiring provided they are securely fastened to the hoistway construction. Where exposed to the weather, as in open shafts outside the building, such conductors shall be weatherproof.

(B) Exception 2: Weatherproof flexible conduit or armored cables may be used between hoistway risers and limit switches, hoistway-door interlocks or contacts, and signal or stop buttons and similar devices.

(3) All conduits, armored cables, electrical metallic tubing, metal wireways, and flexible conduits carrying electrical conductors located within hoistways shall be securely fastened to the hoistway construction or to the guide member, or to the guide-member supports.

(4) The installation of all electrical wiring in hoistways and machine rooms, except as may be provided elsewhere in this standard, shall conform to the requirements of National Electrical Code, ANSI/NFPA 70. Traveling cables, where used between the car and hoistway wiring, shall be Type E.O., or equivalent.

(5) All live parts of electrical apparatus, located in or on

hoist cars or in their hoistways, shall be suitably enclosed to protect against accidental contact. The maximum circuit voltage of control or operating circuits permitted in or on hoist cars and their hoistways shall not exceed that specified in section 12-232-23(c)(1).

(b) Fittings, fixtures, and switches. Where the hoistway is exposed to the weather, as in open shafts outside the structure, the electrical fittings, fixtures, and switches shall be weatherproof. Slack-rope switches, where required, lower normal-terminal and lower final-terminal hoistway limit switches, slowdown switches,and pit stop switches shall be located as far above the bottom of the pit as practicable. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-8 Protection of, and access to, machinery and control equipment, and lighting of machinery spaces. (a) Access shall be provided to the machinery and control spaces to permit proper lubrication and maintenance of the equipment.

(b) Machinery and control equipment shall be protected from the weather and from access by unauthorized persons.

(c) Spaces containing driving machines and control equipment shall be provided with adequate lighting. [Eff. 7/12/82; comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-9 Bottom and top clearances and runbys for personnel-hoist cars and counterweights. (a) Bottom car clearances. When the car rests on its fully compressed buffer, there shall be a vertical clearance of not less than 2 feet (60 cm) between the pit area (ground or foundation) and the lowest structural or mechanical part, equipment, or device installed beneath the car platform except guide shoes or rollers, safety-jaw assemblies, and platform aprons, guards or other equipment located within 12 inches (30 cm) horizontally from the sides of the car platform. See figure 232-1. When the car rests on its fully compressed buffer, no part of the car or any equipment shall strike any part of the pit or any part of the equipment. The bottom clearance should be determined as shown in figure 232-1 and should be not less than the following:

(1) Where no equipment under the car platform, except as noted in figure 232-1, projects below the bottom of the car-frame plank channel, c=(2'--0"); and

(2) Where any equipment under the car platform, except as noted in figure 232-1, projects a distance, d, below the bottom of the car-frame plank channel, c=d+(2'--0").

(b) The bottom runby of cars and counterweights for counterweighted hoists shall be not less than 6 inches (15 cm). Exceptions: Where practical difficulties prevent a sufficient pit depth, or where a top clearance cannot be provided to obtain the runby specified, it may be reduced. Where spring-return-type oil buffers are used, the runby may be eliminated so that the buffers are compressed by amounts not exceeding those permitted by section 12-232-13(c), when the car floor is level with the terminal landings. Where spring buffers are used, a minimum of 6 inches (15 cm) shall be required where generator-field is used; where rheostatic control is

used, not less than the following minimum runbys shall apply:

Rated Speed (feet per minute)	Runby (inches)
51 to 200	9
201 to 600	12

(c) The bottom runby of uncounterweighted hoists shall be not less than 6 inches (15 cm).

(d) In no case shall the maximum bottom runby exceed 24 inches (60 cm) for cars or 36 inches (90 cm) for counterweights.

(e) The top car clearance for counterweighted hoists shall be not less than the sum of the following:

(1) The bottom counterweight runby;

(2) The stroke of the counterweight buffer used;

(3) Two feet or the distance which any cable clip, sheave, or any other equipment mounted in or on the car crosshead projects above the top of the car crosshead, whichever is greater; and

(4) Where an oil buffer is used for the counterweight and no provision is made to prevent the jump of the car at counterweight-buffer engagement, add:

(A) One-half the gravity stopping distance based on 115 per cent of rated speed. See subsection (j) below; or

(B) One-half the counterweight-buffer stroke if a reduced-stroke buffer conforming to section 12-232-13(c) is used. Where counterweight spring buffers are used, add 1/2 the gravity stopping distance based on governor-tripping speed. See section 12-232-13(c).

(f) The top car clearance for uncounterweighted hoists shall be not less than 2 feet 6 inches (75 cm).

(g) The top counterweight clearance shall be not less than the sum of the following:

(1) The bottom car runby;

(2) The stroke of the car buffer used;

(3) Six inches (15 cm); and

(4) Where an oil buffer is used for the car and no provision is made to prevent the jump of the counterweight at car-buffer engagement, add:

(A) One-half the gravity stopping distance based on 115 per cent of rated speed. See subsection (j) below; or

(B) One-half the car-buffer stroke if a reduced-stroke buffer conforming to section 12-232-18(c) is used. Where car spring buffers are used, add 1/2 the gravity stopping distance based on governor-tripping speed. See subsection (j) below.

(h) Overhead clearances where overhead beams are not over car crosshead. Where overhead beams or other overhead hoistway

construction except sheaves are located vertically over the car, but not over the crosshead, the clearance from the car top to such beams or construction, when the car is level with the top landing, shall be not less than the amount specified in subsections (e) and (f) above.

(i) When the car crosshead, or car top where no crosshead is provided, is at a distance of 2 feet (60 cm) from the nearest obstruction above it, no equipment on top of the car shall strike any part of the overhead structure or the equipment located in the hoistway.

(j) Gravity stopping distances. The following formula gives the value of the stopping distance based on gravity retardation from any initial velocity:

$$S = \frac{(V)^2}{19,320}$$

where

V = initial velocity, in feet per minute
S = free fall, in inches (gravity stopping distance)

Figure 232-2 shows the gravity stopping distances from various initial velocities. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-10 Horizontal car and counterweight clearance for personnel hoists. (a) Clearances between cars counterweights and hoistway enclosures.

(1) The clearance between the car and the hoistway enclosure shall be not less than 3/4 inch (1.9 cm) except on the sides used for loading and unloading.

(2) Clearance between car and counterweight and counterweight screen. The clearance between the car and the counterweight shall be not less than one inch (2.5 cm). The clearance between counterweight and the hoistway enclosure, shall be not less than 3/4 inch (1.9 cm).

(3) The clearance between the car-platform sill and the hoistway edge of any landing sill, or the hoistway side of any vertically sliding counterweighted hoistway door or of any vertically sliding counterbalanced biparting hoistway door, shall be not less than 1/2 inch (1.2 cm) where side guides are used. The maximum clearance shall be not more than 1-1/2 inches (3.7 cm).

(4) For installation within buildings, the clearance between the edge of the car-platform sill and the hoistway enclosure or facia plate for the full width of the clear hoistway-door opening shall be not more than 8 inches (20 cm).

(b) The clearances specified in this section shall be measured with no load on the car platform. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-11 Location and guarding of counterweights for hoists. (a) Counterweights shall be located either in or on the hoist

structure which they serve.

(b) Guards shall extend from a point not more than 12 inches (30 cm) above the pit floor to a point not less than 6 feet (1.8 m) or more than 8 feet (2.4 m) above such floor, and shall be fastened to a metal frame properly reinforced and braced to be at least equal in strength and stiffness to No. 14 U.S. gauge sheet steel.

(c) Enclosure of counterweight by the hoisting enclosure.

(1) For hoists located outside of structures, the enclosures, except those at the lowest landing, may be omitted on the sides where there is no floor or scaffold adjacent to the counterweight-way. Enclosures on the building side of the counterweight-way shall be full height or a minimum of 10 feet (3 m) at each floor landing. Other enclosures, where required, shall not be less than 8 feet (2.4 m) high.

(2) For hoists located inside of structures, the counterweight-way shall be enclosed its full height. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-12 <u>Car and counterweight guide members, guide-member supports, and fastenings</u>. (a) Personnel hoists shall be provided with car and counterweight guide members.

(b) Material. Guide members, guide-member brackets, rail clips, fishplates, and their fastenings shall be of steel or other metals conforming to the requirements under paragraphs (1) and (2) below.

(1) Steel, where used, shall conform to the following requirements:

(A) Members, brackets, fishplates, and rail clips shall be made of open-hearth steel, or its equivalent, having a tensile strength of not less than 55,000 psi and having an elongation of not less than 22 per cent in a length of 2 inches (5 cm);

(B) Bolts shall conform to ASME Specification SA-307 or SA-325; and

(C) Rivets shall conform to American National Standard Specification for Steel Structural Rivets, ANSI/ASTM A-502-76.

(2) Metals other than steel may be used provided the factor of safety is not less than, and the deflections not more than, the values specified in paragraph (1) above, and provided that cast iron is not used.

(c) Stresses and deflections.

(1) The stresses in a guide member, or in the member and its reinforcement, due to the horizontal forces imposed on the member during loading, unloading, or running, calculated with impact, shall not exceed 15,000 psi based upon the class of loading, and the deflection shall not exceed 1/4 inch (0.6 cm). Exception: Where steels of greater strength than those specified under subsection (b)(1) above are used, the stresses specified may be increased proportionately based on the ratio of the ultimate strengths.

(2) The guide-member fastenings and supports shall be capable of resisting the horizontal forces imposed by the loading

with a total deflection at the point of support not in excess of 1/8 inch (0.3 cm).

(d) Overall length of guide members. The top and bottom ends of each run of guide member shall be so located in relation to the extreme positions of travel of the car and counterweight that the car and the counterweight guide shoes or rollers cannot travel beyond the ends of the guide members.

(e) Guide-member fastenings and supports.

(1) The supports of the guide members, and the guide-member fastenings, shall be of such design as to:

(A) Safely withstand the application of the car or counterweight safety when stopping the car and its rated load or the counterweight; and

(B) Withstand the forces specified in subsection (c)(2) above within the deflection limits specified.

(2) Guide-member fastenings, when used, shall be secured to their supporting structure by means of structural bolts, clips, rivets, or by welding. Fastening bolts and bolt holes in fastenings and their supporting beams shall conform to the requirements of subsection (f) below. Welding shall conform to the requirements of American National Standard Safety in Welding and Cutting, Z49.1.

(f) Guide members shall be secured by clips, rivets, bolts, or welds. Bolts used for fastening shall be of such strength as to withstand the forces specified under subsection (c) above. Welding, where used, shall conform to the requirements of American National Standard Z49.1. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-13 Car and counterweight buffers. (a) Type and location.

(1) Buffers of the spring or oil type shall be installed under the cars and counterweights of personnel hoists. Note that section 12-232-4(b)(2) requires buffers under all cars and counterweights in hoistways which are above accessible spaces. Spring buffers or their equivalent may be used where the rated speed is not in excess of 300 feet (90.9 m) per minute. Exception: For rated speeds of 301 to 600 feet (91 to 181.8 m) per minute, spring buffers having a stroke of not less than 12 inches (30 cm) may be used provided a terminal speed-limiting device conforming to the requirements given under section 12-232-22(d) is provided.

(2) Buffers shall be located symmetrically with reference to the vertical center line of the car frame or the counterweight frame within a tolerance of 2 inches (5 cm).

(b) Construction and requirements for spring buffers.

(1) Buffer stroke. The stroke of the buffer spring, as marked on its marking plate, shall be equal to, or greater than, the following:

Rated Car Speed (feet per minute)	Stroke (inches)
100 or less	1-1/2
101 to 150	2-1/2
151 to 200	4
201 to 250	6
251 to 300	9

(2) Buffers for cars and counterweights shall be the following:
(A) Capable of supporting, without being compressed solid, a static load having a minimum of twice the total weight of the car and its rated load for car buffers, and the counterweight for counterweight buffers; and
(B) Compressed solid with a static load of three times the weight of the car and its rated load for car buffers, and the counterweight for counterweight buffers. Exception: When the requirements of section 12-232-4(b)(2) necessitate a greater load rating, an exception prevails.
(3) Each spring buffer shall have permanently attached to it a metal plate marked in a legible and permanent manner to show its stroke and load rating.
(c) Construction and requirements for oil buffers.
(1) When oil buffers are used they shall comply with Part II, Section 201, Rule 201.4 of American National Standard Safety Code for Elevators and Escalators, ANSI/ASME A17.1.
(2) When oil buffers are used and when the air temperature is below 0^{o} F (-17.7^{o} C), means to maintain the temperature of the oil above 0^{o} F (-17.7^{o} C) or above the pour point of the oil, whichever is lower, shall be provided.
(3) Terminal-speed-limiting devices installed in connection with reduced-stroke oil buffers shall conform to the requirements of section 12-232-22. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-14 Counterweights. (a) General requirements.
(1) Sectional counterweights and frames shall be so designed as to retain the weights securely in place.
(2) The clearance between the car and the counterweight shall be not less than one inch (2.5 cm). The clearance between counterweight and the counterweight screen and between counterweight and the hoistway enclosure shall be not less than 3/4 inch (1.9 cm).
(b) The weight of the counterweight shall be equal to the total weight of the car plus approximately 40 per cent of the rated load.
(c) Cars counterbalancing one another. A hoist car shall not be used to counterbalance another hoist car.
(d) Compensating chains or ropes, when used, shall be fastened to the counterweight or to the counterweight frame and shall not be fastened to tie rods. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS

§397-4) (Imp: HRS §397-4)

§12-232-15 Car frames and platforms. (a) Every hoist car shall have a frame. The car frame and platform may be an integral part of the car construction.

(b) Car frames shall be guided on each guide member by upper and lower guide shoes or rollers attached to the frame.

(c) The frame and its guide shoes or rollers shall be designed to withstand the forces resulting under the loading conditions for which the hoist is designed. See section 12-232-20.

(d) The vertical distance between the top and bottom guide shoes of a hoist car having a subpost car frame, or having an under-slung car frame located entirely below the car platform, shall be not less than 40 per cent of the distance between guide rails.

(e) Every car shall have a platform consisting of a fire-retardant nonperforated floor attached to a platform frame supported by the car frame and extending over the entire area within the car enclosure. The platform-frame members and the floor shall be designed to withstand the forces developed under the loading conditions for which the hoist is designed and installed.

(f) Materials for car frames and platforms frames.

(1) Materials permitted. Materials used in the construction of car frames and platforms shall conform to the following:

(A) Car frames and outside members of platform frames shall be made of steel or other metals; and

(B) Cast iron shall not be used for any part subject to tension, torsion, or bending. Exceptions are guide rollers, guide shoes, and compensating-rope anchorages.

(2) Steel, where used in the construction of car frames and platforms, shall conform to the requirements in subparagraphs (A) and (B) below. Exception: Steels of greater strength than those specified may be used provided they have an elongation of not less than 22 per cent in a length of 2 inches (5 cm) and provided that the stresses and deflections conform to the requirements of subsections (h) and (i) below, respectively.

(A) Car-frame and platform-frame members. Steel shall be rolled, forged, or cast, conforming to the requirements of the following American National Standards:

(i) Rolled and formed steel: ASME Specification SA-36 or SA-283;

(ii) Forged steel: American National Standard Specification for Special Requirements for Forgings and Bars for Nuclear and other Special Applications, ANSI/ASTM A654-79; and

(iii) Cast steel: American National Standard Specifications for Mild-to-Medium Strength Carbon-Steel Castings for General Application, ANSI/ASTM A-27-80.

(B) Steel used for bolts and rods shall conform to ASME Specification SA-307.

(3) Metals other than steel may be used in the construction of car frames and platforms provided the metal used has the essential properties to meet all the requirements in accordance with good engineering practice, and provided the stresses and deflections conform to the requirements of subsections (h) and (i) below, respectively.

(4) Wood used for platform stringers and for platform floors and subfloors shall be of clear-structural-quality fire-retardant lumber, conforming to the requirements of American National Standard Methods for Establishing Structural Grades for Visually Graded Lumber, ANSI/ASTM D245-70, and American National Standard Methods of Static Tests of Timbers in Structural Sizes, ANSI/ASTM D198-76.

(g) Connections between members of car frames and platforms shall be riveted, bolted, or welded, and shall conform to the following:

(1) Bolts used through sloping flanges of structural members shall have bolt heads of the tipped-head type or shall be fitted with beveled washers;

(2) Nuts used on sloping flanges of structural members shall seat on beveled washers; and

(3) Welding of parts upon which safe operation depends shall be performed in accordance with American National Standard Safety in Welding and Cutting, Z49.1. All welding of such parts shall be performed by welders qualified in accordance with the requirements of the American Welding Society. At the option of the manufacturer, the welders may be qualified by one of the following:

(A) The manufacturer;

(B) A professional consulting engineer; or

(C) A recognized testing laboratory. Exception: Tack welds not later incorporated into finished welds carrying calculated loads are an exception.

(h) Maximum allowable stresses in car-frame and platform members and their connections, based on the static load imposed upon them, shall be as follows:

(1) For steels meeting the requirements of subsections (f)(2)(A) and (B) above, stresses shall not exceed the stresses listed in table 232-1;

(2) For steels of greater strength, as permitted by the exception to subsection (f)(2) above, the stresses listed in table 232-1 may be increased proportionately based on the ratio of the ultimate strengths; and

(3) For metals other than steel, as permitted by subsection (f)(3) above, the factor of safety shall be not less than is required for steel as given in subsections (f)(2)(A) and (B) above, based on the allowable stress specified in table 232-1.

(i) Maximum allowable deflections of car-frame and platform members, based on the static load imposed upon them, shall be not more than the following:

(1) For crosshead, 1/960 of the span;

(2) For plank, 1/960 of the span; and

(3) For platform-frame members, 1/960 of the span.

For uprights (stiles), the moment of inertia shall be not less than determined by the following formula:

$$I = \frac{KL^3}{18\ EH}$$

where

I = moment of inertia of member, gross section, in in^4
K = turning moment, in inch-pounds
L = free length of uprights, in inches
E = modulus of elasticity
H = vertical center distance between upper and lower guide shoes

Note: The aforementioned deflection limits apply irrespective of the type of steel or other metal used.

(j) Car frames with crosshead sheaves. Where a hoisting-rope sheave is mounted on the car frame, the construction shall conform to the following requirements:

(1) Where multiple sheaves mounted on separate sheave shafts are used, provision shall be made to take the compressive forces, developed by tension in the hoist ropes between the sheaves, on a strut or struts between the sheave-shaft supports, or by providing additional compressive strength in the car frame or car-frame members supporting the sheave shafts;

(2) Where the sheave shaft extends through the web of a car-frame members, the reduction in area of the member shall not reduce the strength of the member below that required. Where necessary, reinforcing plates shall be welded or riveted to the member to provide the required strength. The bearing pressure shall in no case be more than that permitted in table 232-1 for bolts in clearance holes; and

(3) Where the sheave is attached to the car crosshead by means of a single threaded rod or specially designed member or members in tension, the requirements given in subparagraphs (A) and (B) below shall be met.

(A) The single rod, member, or members in tension shall have a factor of safety 50 per cent higher than the factor of safety required for the suspension wire ropes, but in no case less than 15.

(B) The means for fastening the single threaded rod, member, or members in tension to the car frame shall conform to the requirements of subsection (k) below.

TABLE 232-1

MAXIMUM ALLOWABLE STRESSES* IN CAR-FRAME AND PLATFORM

Members and Connections for Steels Specified in Sections 12-232-15(f)(2)(A) and (B)

Member	Type of Stress	Maximum Stress (psi)	Area Basis
Car crosshead	Bending	12,500	Gross section
Car-frame plank, normal loading	Bending	12,500	Gross section
Car-frame plank, buffer reaction	Bending	25,000	Gross section
Car-frame uprights (stiles)	Bending plus tension	15,000 18,000	Gross section Net section
Hoisting-rope hitch shapes or plates	Bending plus tension	8,000	Net section
Platform framing	Bending	12,500	Gross section
Platform stringers	Bending	15,000	Gross section
Threaded brace rods and other tension members except bolts	Tension	8,000	Net section
Bolts	Tension	7,000	Net section
Bolts in clearance holes	Shear	7,000	Actual area in shear plane
Bolts in clearance holes	Bearing	16,000	Gross section
Rivets or tight body-fit bolts	Shear	10,000	Actual area in shear plane
Rivets or tight body-fit bolts	Bearing	18,000	Gross section
Any framing member normal loading	Compression	14,000-59L R	Gross section

*Stresses shall be determined on the basis of a uniformly distributed load over the entire area of the car platform or a single concentrated load placed at the center of the car platform.

(k) Where cars are suspended by hoisting ropes attached to the car frame by means of rope shackles, the shackles shall be attached to steel hitchplates or to structural or formed steel shapes. Such plates or shapes shall be secured to the underside or to the webs of the car-frame member with bolts or welds so located that the tensions in the hoisting ropes will not develop direct tension in the bolts. The stresses shall not exceed those permitted in section 12-232-6(a)(3)(C).

(l) Where side bracing and similar members are attached to car-frame uprights, the reduction in area of the upright shall not reduce the strength of the upright below that required by this section. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-16 Car enclosures. (a) Material for enclosures and enclosure linings. Materials for car enclosures and car-enclosure linings shall be metal or fire-retardant wood.

(b) Extent of enclosures. Personnel-hoist cars shall be permanently enclosed on the top and on all sides except the entrance and exit.

(c) The enclosure shall be securely fastened to the car platform and so supported that it cannot loosen or become displaced in ordinary service, on the application of the car safety, or on buffer engagement.

(d) Deflection of enclosure walls. The enclosure walls shall be of such strength and so designed and supported that, when subjected to a pressure 100 pounds (45.4 kg) applied horizontally on any 4-square-inch (10 cm^2) area of the walls of the enclosure, the deflection will not reduce the running clearance below 3/4 inch (1.9 cm).

(e) Cars shall have not more than one compartment.

(f) An emergency exit with a cover shall be provided in the top of all cars and shall conform to these requirements.

(1) The exit opening shall have an area of not less than 400 square inches (1000 cm^2) and shall measure not less than 16 inches (40 cm) on any one side;

(2) The exit shall be so located as to provide a clear passageway unobstructed by fixed hoist equipment located in, or on top of, the car; and

(3) The exit cover shall open outward.

(g) Tops of car enclosures shall be so designed and installed as to be capable of sustaining a load of 300 pounds (136.4 kg) on any square area 2 feet (60 cm) on a side and 100 pounds (45.4 kg) applied at any point. Simultaneous application of these loads is not required.

(h) Equipment on top of cars. A working platform or equipment which is not required for the operation of the hoist or its appliances, except where specifically provided in this standard, shall not be located on the top of a hoist car.

(i) Use of glass in hoist cars. Wire glass or the equivalent shall be used for vision panels. Plain glass may be used only for car operating appliances. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-17 Car doors, gates, and electrical contracts. (a) Car doors and gates.

(1) A door or gate shall be provided at each entrance to the car.

(2) Type of doors. Doors shall be of the horizontally or vertically sliding type.

(3) Type of gates. Gates shall be either of the horizontally or vertically sliding type, subject to the requirements given below under paragraphs (5) and (9) below. Scissor-type gates shall be prohibited.

(4) Doors and gates and their guides, guide shoes, tracks, and hangars shall be so designed, constructed, and installed that when the fully closed door or gate is subjected to a force of 75 pounds (34.1 kg), applied on an area of one foot square at right angles to, and approximately at the center of, the door or gate, it will not deflect beyond the line of the car sill. When subjected to a force of 250 pounds (113.6 kg), similarly applied, doors and vertically sliding gates shall not break or be permanently deformed and shall not be displaced from their guides or tracks. Where multisection doors or gates are used, each panel shall withstand the forces specified.

(5) Sliding doors or gates shall conform to the following requirements:

(A) Vertically sliding gates shall be of the balanced counterweighted type or the biparting counterbalanced type;

(B) Gates or doors shall be constructed of metal or fire-retardant reinforced plastic and shall be of a design which will reject a ball 1-1/2 inches (3.7 cm) in diameter.

(C) Doors or gates shall guard the full width and height of the car entrance opening; and

(D) Balanced counterweighted doors or gates may be either single or multiple section, and may slide either up or down to open.

(6) Weights used to close or balance doors or gates shall be located outside the car enclosure and shall run in guides or be boxed in. Guides shall be of metal, and the bottom of the guides or boxes shall be so constructed as to retain the weight if the suspension members fails.

(7) Suspension members of vertically sliding car doors or gates, and of weights used with car doors or gates, shall have a factor of safety of not less than 5.

(8) Manual opening of car doors or gates. Car doors or gates shall be arranged so that when the car is stopped they may be opened by hand from inside the car, subject to the requirements of subsection (b)(3) below.

(9) There shall be not more than two entrances to the car.

(b) Car doors or gates shall be provided with car-door or gate electric contacts.

(1) Car-door or gate electric contacts shall be so located that they are not readily accessible from the inside of the car.

(2) General design requirements. Car-door or gate electric contacts shall conform to the following requirements:
    (A) Car-door or gate electric contacts shall be positively opened by a lever or other device attached to and operated by the door or gate; and
    (B) Car-door or gate electric contacts shall be maintained in the open position by the action of gravity or by a restrained compression spring, or both, or by positive mechanical means.
(3) A mechanical lock shall be provided to prevent opening of the car gate on the side opposite the building or structure, unless the car is at the ground-level landing or equivalent.
(4) Closed position of car doors or gates. Car doors or gates shall be considered to be in the closed position under these conditions:
    (A) Horizontally sliding doors or gates shall be considered to be in the closed position when the clear open space between the leading edge of the door or gate and the nearest face of the jamb does not exceed 2 inches (5 cm);
    (B) Vertically sliding counterweighted doors or gates shall be considered to be in the closed position when the clear open space between the leading edge of the door or gate and the car-platform sill does not exceed 2 inches (5 cm); and
    (C) Horizontally sliding biparting doors, or vertically sliding biparting counterbalanced doors, shall be considered to be in the closed position when the door panels are with 2 inches (5 cm) of contact with each other. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-18 Car and counterweight safeties. (a) The car of every personnel hoist shall be provided with one or more car safety devices of one of the types identified under subsection (d). The safeties shall be attached to the car frame or supporting structure. All car safeties shall be mounted on a single car frame and shall operate either on one pair of guide members or on one vertical rack.

(b) Function and stopping distance of safeties. The safety device, or the combined safety devices, when furnished, shall be capable of stopping and sustaining the entire car with its rated load from governor-tripping speed. Type B safeties shall stop the car with its rated load from governor-tripping speed within the range of the maximum and minimum stopping distances as determined by the following formulas:

$$S = \frac{(V)^2}{81,144} + 0.84$$

and

$$S' = \frac{(V)^2}{231,840}$$

where

S = maximum stopping distance, in feet
S'= minimum stopping distance, in feet
V = governor-tripping speed, in feet per minute

Table 232-2 shows the maximum and minimum stopping distances for various governor-tripping speeds when tested in conformance with section 12-232-25(b)(1).

(c) Counterweight safeties. Counterweight safeties, where furnished, see section 12-232-4(b), shall conform to the requirements for car safeties. Exceptions are the following:

(1) Where otherwise specified in this section; and

(2) For rated speeds of not over 150 feet per minute, counterweight safeties may be operated as a result of the breaking or slackening of the hoisting ropes and may be of the inertia or other approved type without governors. See sections 12-232-18(f) and 12-232-20(a).

(d) Identification and classification of types of safeties. Car safety devices (safeties) are identified and classified on the basis of performance characteristics. In general, there are three types of safeties that operate to apply pressure on the guide rails and one type that uses a separately mounted rack and accompanying pinion gear. The former are classified A, B, and C based upon how the safety begins to apply pressure on the guide members.

TABLE 232-2

Maximum and Minimum Stopping Distances for Other Than Instantaneous Safeties

Rated Speed (feet per minute)	Maximum Governor-Trip Speed (feet per minute)	Stopping Distances (feet-inches)	
		Minimum	Maximum
0 to 125	175	1	1-3
150	210	2	1-4
175	250	3	1-7
200	280	4	1-10
225	308	5	2-0
250	337	6	2-3
300	395	0-8	2-9
350	452	0-10	3-4
400	510	1-1	4-0
450	568	1-5	4-10
500	625	1-8	5-8
600	740	2-4	7-7

(1) Type A safeties. These are safeties which develop a rapidly increasing pressure on the guide members during the stopping interval, the stopping distance being very short due to the inherent design of the safety. The operating force is derived entirely from the mass and the motion of the car or the counterweight being stopped. These safeties apply pressure on the guide members through eccentrics, rollers, or similar devices without any flexible medium purposely introduced to limit the retarding force and increase the stopping distance.

(2) Type B safeties. These are safeties which apply limited pressure on the guide members during the stopping interval and which provide stopping distances that are related to the mass being stopped and the speed at which application of the safety is initiated. Retarding forces are reasonably uniform after the safety is fully applied. Continuous tension in the governor rope may or may not be required to operate the safety during the entire stopping interval. Minimum and maximum distances are specified on the basis of governor-tripping speed. See subsection (b) above.

(3) Type C safeties (Type A with oil buffers). These are safeties which develop retarding forces during the compression stroke of one or more oil buffers interposed between the lower members of the car frame and a governor-operated Type A auxiliary safety plank applied on the guide or tension members. The stopping distance is equal to the effective stroke of the buffers.

(4) Rack-and-pinion safeties. These are safeties in which a freely rotating safety pinion, a governor, and a safety

device may form an integral unit mounted on the car. The freely rotating pinion travels on a stationary rack mounted vertically on the hoist structure. The rotating pinion drives the governor. When the downward speed of the car reaches the tripping value, the rotating governor actuates the safety device which, in turn, slows down the rotation of the safety pinion, bringing the car to a gradual stop.

(e) Safeties shall not stop ascending car or counterweight.

(f) Car safeties and counterweight safeties, where provided, shall be actuated by separate speed governors. Exception: Speed governors are not required for the operation of counterweight safeties or hoists having a rated speed of not more than 150 feet (45.4 m) per minute.

(1) Every car safety shall be provided with a switch operated by the car safety mechanism. This switch shall conform to the requirements given under section 12-232-19(d).

(g) Limits of use of various types of safeties.

(1) Type A (instantaneous) safeties. Type A safeties may be used on hoists having a rated speed of not more than 150 feet (45.4 m) per minute. When overspeed occurs for any reason, such safeties shall be actuated by the governor.

(2) Type C safeties. Spring buffers may be substituted for oil buffers on Type C car safeties for rated speeds up to and including 300 feet (90.9 m) per minute provided that the springs do not fully compress during the operation of the car safety with rated load in the car, and the rate of retardation conforms to the requirements of section 12-232-13(c)(1).

(h) Application and release of safeties.

(1) Safeties shall be applied mechanically. Electric, hydraulic, or pneumatic devices shall not be used to apply the safeties required by this section nor to hold such safeties in the retracted position.

(2) Level of car on safety application. The application of the safety to stop the car, with 1/4 of its rated load distributed on each quarter of the platform symmetrically with relation to the center lines of the platform, shall not cause the platform to be out of level more than 3/8 inch (0.9 cm) per foot in any direction.

(3) When car safeties are applied, no decrease in tension in the governor rope or motion of the car in the down direction shall release the safeties, but such safeties may be released by the motion of the car in the up direction.

(4) Safeties shall be so designed that on their application the forces which provide the stopping action shall be compressive forces on either side of the guide-member section. Exception: For rack-and-pinion safeties, the stopping action is obtained by the engagement of the teeth of the safety pinion on the car and the stationary vertical rack.

(i) Minimum permissible clearance between guide member-gripping faces of safety parts. In the normally retracted position

of the safety, the distance between the member-gripping faces of the safety parts shall not be less than the thickness of the guide member plus 0.1406(9/64) inch (3.5 mm), and the clearance on any side between the gripping face and the guide member shall be not less than 0.0625(1/16) inch (1.5 mm) as measured on the side of the rail toward which the car frame is pressed with sufficient force to take up all clearances in the guide-shoe assembly. Safety jaws, while in the retracted position, shall be so restrained as to prevent a reduction of this minimum clearance.

(j) Maximum permissible movement of governor rope or car to operate the safety mechanism.

(1) Type B and C safeties. For all Type B and C safeties, the movement of the governor rope relative to the car or the counterweights, respectively, required to operate the safety mechanism from its fully retracted position to a position where the safety jaws begin to exert pressure against the guide members shall not exceed the following values based on rated speed:

(A) For car safeties: 200 feet (60.6 m) per minute or less, 42 inches (105 cm); 201 to 375 feet (60.9 m to 113.6 m) per minute, 36 inches (90 cm); over 375 feet (113.6 m) per minute, 30 inches (75 cm); and

(B) For counterweight safeties: all speeds, 42 inches (105 cm). Drum-operated and counterweight safeties, requiring continual unwinding of the safety drum rope to fully apply the safety, shall be so designed that not less than 3 turns of the safety rope will remain on the drum after the overspeed test of the safety has been made with rated load in the car. See sections 12-232-25(b) (3) and 12-232-25(d)(6).

(2) Rack-and-pinion safeties. For rack-and-pinion safeties, the travel of the car measured from the governor-tripping time to the full stop time shall not exceed the following values based on rated speed:

(A) For car safeties: 200 feet (60.6 m) per minute or less, 64 inches (160 cm); 201 to 375 feet (60.9 m to 113.6 m) per minute, 76 inches (190 cm); over 375 feet (113.6 m) per minute, 78 inches (195 cm); and

(B) For counterweight safeties: all speeds, 78 inches (195 cm).

(k) Parts of safeties, except springs, shall have a factor of safety of not less than 3.5, and the materials used shall have an elongation of not less than 15 per cent in a length of 2 inches (5 cm). Forged, cast, or welded parts shall be stress-relieved.

(1) Exception (A): Safety-rope drums, leading sheaves, and their supporting brackets and safety-jaw gibs shall be made of metal and shall have a factor of safety of not less than 10.

(2) Exception (B): Minimum factor of safety for pinion gear and vertical rack shall be not less than 8.

(3) Rope used as a connection from the safety to the governor rope, including rope wound on the safety-rope drum, shall be not less than 3/8 inch (0.9 cm) in diameter and shall be made of a corrosion-resistant metal. Tiller rope

construction shall not be used. The factor of safety of the rope shall be not less than 5.

(4) The factors of safety shall be based upon the maximum stresses developed in the parts during the operation of the safety when stopping rated load from governor-tripping speed.

(5) Springs may be used in the operation of car or counterweight safeties. Where used, and where partially loaded prior to safety operation, the loading on the spring shall not produce a fiber stress exceeding 1/2 the elastic limit of the material. During operation of the safety, the fiber stress shall not exceed 85 per cent of the elastic limit of the material. Helical springs, where used, shall be in compression.

(6) Safety-rope loading-sheave brackets and other safety operating parts shall not be attached to, or supported by, wood platform members.

(l) Bearings in safeties and of the safety operating mechanisms shall be of corrosion-resistant construction with one or both members of a bearing made of, or electroplated with, a corrosion-resistant material.

(m) A metal plate shall be securely attached to each safety so as to be readily visible and shall be marked in a legible and permanent manner with letters and figures not less than 1/4 inch (0.6 cm) in height, indicating the following:

(1) The maximum tripping speed, in feet per minute, for which the safety may be used; and

(2) The maximum weight, in pounds, which the safety as installed is designed to stop and sustain.

(n) The governor-rope releasing carrier on the car (or on the counterweight) shall be set to require a tension in the governor rope, to pull the rope from the carrier, of not more than 60 per cent of the pull-through tension developed by the governor, and the carrier shall be designed so that the pullout tension cannot be adjusted in a normal manner to exceed the amount specified.

(o) Rail lubricants or coatings which will reduce the holding power of the safety or prevent its functioning as required in subsection (b) above, shall not be used. The use of graphite for lubricants shall be prohibited.

(p) Safeties that apply on tension members suspended from the top of the hoistway and anchored in the pit in lieu of guide members shall be in conformity with the following requirements:

(1) The tension members shall have a minimum factor of safety of ten when the car and its rated load is stopped, with an average retardation of 32 feet (9.7 m) per second; and

(2) Steel-wire-rope tension members shall be inspected by the procedure set forth under section 12-232-24(j) and (k).

[Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-19 <u>Speed Governors</u>. (a) Car safeties, and counterweight safeties, where furnished, shall be actuated by a speed governor. The governor shall be located where it cannot be struck by the car or the counterweight in case of over-travel and where there

is adequate space for full movement of governor parts.

(b) Tripping speeds for speed governors.

(1) Car speed governors. Speed governors for car safeties shall be set to trip at overspeeds as follows:

(A) At not less than 115 per cent of rated speed; and

(B) At not more than the tripping speed listed opposite the applicable rated speed in table 232-3. Maximum tripping speeds for intermediate rated speeds shall be determined from figure 232-3.

(2) Counterweight speed governors. Speed governors for counterweight safeties, where provided, shall be set to trip at an overspeed greater than, but not more than 10 per cent above, that at which the car speed governor is set to trip.

(c) Speed governors shall have their means of speed adjustment sealed after test. If speed governors are painted after sealing, all bearing and rubbing surfaces shall be kept free from paint and a hand test made to determine that all parts operate freely as intended. Seals shall be of a type which will prevent readjustment of the governor-tripping speed without breaking the seal.

(d) Speed-governor overspeed and car safety-mechanism switches.

(1) A switch shall be provided on the speed governor and operated by the overspeed action of the governor. A switch shall be provided on the speed governor when used with a counterweight safety. Every car safety shall be provided with a switch operated by the car safety mechanism when the safety is applied. These switches shall, when operated, remove power from the driving-machine motor and brake before, or at the time of, application of the safety.

TABLE 232-3

Maximum Speeds, in Feet per Minute, at Which Speed Governor Trips and Governor Overspeed Switch Operates

Rated Speed	Maximum Governor-Trip Speed	Maximum Speed at Which Governor Overspeed Switch Operates, Down
0-125	175	175*
150	210	210*
175	250	225
200	280	252
225	308	277
250	337	303
300	395	355
350	452	407
400	510	459
450	568	512
500	625	563
600	740	703

*Governor overspeed switch not required on car speed governors.

(2) Setting of speed-governor overspeed switches. The setting of the car speed-governor overspeed switch shall open in the down direction of the hoist at not more than 100 per cent of the speed at which the governor is set to trip in the down direction and shall open in the up direction at not more than 100 per cent of the speed at which the governor is set to trip in the down direction.

(3) Type of speed governor overspeed switches and car safety-mechanism switches required. Switches used to perform the functions specified shall be positively opened and shall remain in the open position until manually reset. Switches operated by the car safety mechanisms shall be of a type which will not reset unless the car safety mechanism has been returned to the "off" position.

(e) Governor ropes and tripping mechanism.

(1) Material and factor of safety. Governor ropes shall be of iron, steel, nickel-copper alloys (monel metal, or the equivalent), phosphor bronze, or stainless steel, of regular-lay construction, and shall be not less than 3/8 inch (0.9 cm) in diameter. Tiller-rope construction shall not be used. The factor of safety of governor ropes or governor-tripping mechanisms shall be not less than 5.

(2) Replacement governor ropes shall be of the same size, material, and construction as the rope originally furnished by the hoist manufacturer, except that a rope of the same size but of either different material or construction may be employed provided there is conformance with the requirements of subsection (g) below and a test

is made of the car or counterweight safety and speed governor with the new rope to demonstrate that the safety will function as required by section 12-232-18(b).

(3) During normal operation of the hoist, the governor rope shall run free and clear of the governor jaws, rope guards or other stationary parts.

(4) Governor ropes shall not be lengthened or repaired by splicing.

(f) Design of governor rope grip jaws for Type B and C safeties. Type B and C car and counterweight safeties shall be actuated by a speed governor equipped with rope grip jaws which will permit the governor rope to pull through the jaws. The maximum tension in the governor rope to cause it to slip through the governor jaws shall not exceed 1/5 of the rated ultimate strength of the rope. Governor jaws shall be of such shape and minimum length that no appreciable damage to, or deformation of, the rope shall result from the stopping action of the jaws in operating the car or counterweight safety.

(g) Design of speed governor sheaves and traction between speed-governor rope and sheaves. The arc of contact between the governor rope and the governor sheave shall, in conjunction with a governor-rope tension device, provide sufficient traction to cause proper functioning of the governor. Governor-sheave grooves shall have machine-finished surfaces. Governor tension sheaves shall have machine-finished grooves for rated car speeds of more than 200 feet (60.6 m) per minute. Machined governor-sheave grooves shall have a groove diameter of not more than 1-1/8 times the diameter of the governor rope. The pitch diameter of governor sheaves and governor tension sheaves shall be not less than the product of the diameter of the rope and the applicable multiplier in the following list, based on the rated speed and the number of strands in the rope:

Rated Speed	No. of Strands	Multiplier
200 feet per minute or less	6	42
200 feet per minute or less	8	30
Over 200 feet per minute	6	46
Over 200 feet per minute	8	32

(h) A metal plate shall be securely attached to each speed governor and shall be marked in a legible and permanent manner with letters and figures not less than 1/4 inch (0.6 cm) in height, indicating the following:

(1) The speed, in feet per minute, at which the governor is set and sealed to trip the governor rope-grip jaws; and

(2) The size, material, and construction of the governor rope on which the governor jaws were designed to operate.

[Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-20 Capacity and loading. (a) Inside net platform area. The inside net platform area (see figure 232-4) of the hoist car is determined by the rated capacity of the hoist and shall be no greater than that given in table 232-4.

TABLE 232-4

Relationship of Hoist Rated Capacity to Inside Net Platform Area

Rated Load (pounds)	Inside Net Platform Area (square feet)
2,000	24.2
2,500	29.1
3,000	33.7
3,500	38.0
4,000	42.2
4,500	46.2
5,000	50.0
10,000	88.0

(b) Every hoist car shall be provided with a capacity and data plate securely fastened in a conspicuous place inside the car.

(c) Information required on plates. Capacity and data plates shall indicate the following:

(1) The rated capacity of the car in pounds and the number of persons (200 pounds (90.0 kg) per person);

(2) The weight of the car, including safety and all auxiliary equipment attached thereto;

(3) The rated maximum speed; and

(4) The wire-rope data required under section 12-232-24(b).

(d) Letters and figures shall be stamped or printed on the surface of a durable plate in such a manner as to be readily legible at all times. The height of the letters and figures shall not be less than:

(1) One inch (2.5 cm) for the information required by subsection (c)(1) above; and
(2) One-eight inch (0.3 cm) for the information required by subsections (c)(2), (3), and (4) above.

(e) Overload devices. Overload devices shall not be permitted. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-21 Driving machines, sheaves, and drums. (a) Type of driving machines. Driving machines shall be powered by electric or hydraulic motors. Hydraulic units, where used, shall be electrically driven.

(b) Requirements for use of hydraulic motors. The hydraulic drive shall consist of an oil storage tank, a hydraulic pump, and a hydraulic motor brake, and shall conform to the following requirements:

(1) Valves, piping, and fittings shall not be subjected to working pressures exceeding those recommended by the manufacturer for the type of service in which they are used;
(2) Pipe supports. Piping shall be supported so as to eliminate undue stresses at joints and fittings, particularly at any section of the line subject to vibration;
(3) Flexible connections shall, where installed in high pressure lines, have a bursting strength of not less than three times the working pressure. Flexible joints may be used in hydraulic lines connecting control or check valves to the motor, provided the failure of the flexible sealing element shall not permit separation of the parts connected;
(4) Each pump or group of pumps shall be equipped with a relief valve conforming to the following requirements:
    (A) The relief valve shall be located between the pump and the check valve and shall be of such a type and so installed in a bypass connection that the valve cannot be shut off from the hydraulic system;
    (B) The relief valve shall be preset to open at a pressure not greater than 125 per cent of the working pressure at the pump;
    (C) The size of the relief valve and bypass shall be sufficient to pass the maximum rated capacity of the pump without raising the pressure more than 20 per cent above that at which the valve opens. Two or more relief valves may be used to obtain the required capacity; and
    (D) Sealing. Relief valves having exposed pressure adjustments, if used, shall have their means of adjustment sealed after being set to the correct pressure;
(5) An electric interlock shall be provided to prevent the start or the movement of the hoist car unless the pump operates at the normal operating speed and pressure;
(6) The brake shall remain in the applied position until the

pump operates at the normal operating speed and pressure and the movement of the hoist car is initiated; and

(7) All components of the hydraulic system shall be shielded.

(c) Winding-drum machines may be used irrespective of car travel provided that the drums are grooved for hoisting wire rope. Grooves shall be machine-finished and shall be of the helical or parallel type. If drums are equipped with helical grooving, only one layer of rope shall be permitted on the drum. If drums are equipped with parallel grooving, more than one, but not more than four layers of rope shall be permitted on the drum.

(d) The car speed for all drives shall not exceed 600 feet (181.8 m) per minute.

(e) Diameter of drums and sheaves. Driving sheaves and drums shall have a pitch diameter of not less than 40 times the diameter of the hoisting wire rope. Overhead and deflector sheaves shall have a diameter of not less than 30 times the rope diameter.

(f) Worms and worm gears, where used in the drive machine, shall be of steel and bronze, respectively.

(1) Helical or parallel drives must run in oil.

(2) Means shall be provided for visual inspection of all drives.

(g) Friction gearing or clutch mechanisms shall be prohibited.

(h) The driving machine shall be equipped with a friction brake applied by a spring or by gravity and released electrically or hydraulically. The brake shall be designed to have a capacity sufficient to stop and hold the car at rest at 125 per cent of its rated load.

(i) Requirements for use of rack-and-pinion drive. The rack-and-pinion drive shall consist of one or more power-driven rotating pinions mounted on the car and arranged to travel on a stationary vertical rack mounted on the hoist structure. The drive shall have at least one pinion, one rack, and two backup rollers. The pinions and rack shall be of steel with a minimum safety factor of eight for the pinion and the rack. Driving machines located within the car shall be fully enclosed with solid or open metal which shall be locked. The pinion gear or any section of rack gear shall be renewed when any tooth is damaged or when tooth wear exceeds the limits established by the manufacturer. If manufacturer's limits aren't available, renew gears when tooth thickness at the pitch line is less that 90 per cent of the design thickness.

(j) The factor of safety to be used in the design of driving machines and in the design of sheaves used with hoisting and compensating ropes shall be not less than the following:

(1) Eight for steel, bronze, or for other metals having an elongation of at least 14 per cent in a length of 2 inches (5 cm); or

(2) Ten for cast iron or for other metals having an elongation of less than 14 per cent in a length of 2 inches (5 cm). The load to be used in determining the factor of safety shall be the resultant of the maximum tensions in the ropes leading from the sheave or drum with car at rest and with rated load in the car.

(k) Disengagement and engagement of the driving machine shall be permitted on hoists subject to the following requirements:

(1) A direct means, such as an axially adjustable gear-type coupling, shall be permitted to provide direct power transmission while in the engaged position between the motor and the gearing or drum, and to be disengaged by manually controlled means at the hoist;
(2) The direct means shall be interlocked with an independent manually set brake and brake lock or manually set holding means to prevent disengagement until the brake and brake lock or holding means are set;
(3) Upon disengagement of the direct means, a second interlock shall prevent release of the brake and brake lock or holding means;
(4) The hoist shall be operated by an operator stationed adjacent to the driving machine, conforming to the requirements given under section 12-232-25(f);
(5) The solenoid brake is located on the winding drum or sheave side of the direct disconnect means, and a constant-pressure switch shall be provided to instantly set the brake when the drive is disconnected;
(6) An automatic overspeed governor and braking system shall be provided on the winding drum or sheave side of the direct disconnect means to automatically prevent free running of the drum or sheave; and
(7) When the driving motor is disengaged and engaged to more than one drum or sheave, the direct disconnect means shall be so interlocked with the other disconnect means that no more than one drum or sheave can be operated at any time. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-22 Terminal stopping device. (a) General requirements. Normal-terminal and stopping-device switches shall conform to the following requirements:
(1) Where located on the car or on the hoist structure, normal-terminal stopping device switches shall be of the enclosed type and securely mounted in such a manner that the movement of the switch level or roller to open the contacts shall be as nearly as possible in a direction at right angles to a vertical plane through the face of the car guide members;
(2) Operating cams shall be of metal and shall be rigid; and
(3) The switch contact shall be directly opened mechanically. Arrangements which depend on a spring or gravity, or both, to open the contacts shall not be used.
(b) Normal-terminal stopping devices.
(1) Upper and lower normal-terminal stopping devices shall be provided to stop the car automatically, at or near the top and bottom terminal landings, with any load up to and including rated load in the car and from any speed attained in normal operation. Such devices shall function independently of the normal stopping means and of the final-terminal stopping device. The device shall be so designed and installed that it will continue to function until the final-terminal stopping device operates. Note:

The normal-terminal stopping device may be used as the normal stopping means.

(2) Location of stopping switches. Stopping switches for normal-terminal stopping devices shall be located:

(A) For traction machines, on the car, on the hoist structure, or in the machine room, and shall be operated by the movement of the car or the counterweight;

(B) For winding-drum machines, on the car or on the hoist structure and shall be operated by the movement of the car; and

(C) For rack-and-pinion hoists, on the cage and operated by cams attached to the hoist structure.

(3) Stopping switches located in a machine room shall conform to the following requirements:

(A) The stopping-switch contacts shall be mounted on, and operated by, a stopping device mechanically connected to and driven by the car. Stopping devices depending on friction or traction shall not be used;

(B) Tapes, chains, ropes, or similar devices mechanically connecting the stopping device to the car and used as a driving means shall be provided with a device which will cause the electric power to be removed from the elevator driving-machine motor and brake if the driving means fails; and

(C) Only one set of floor-stopping contacts is necessary for each terminal landing on floor controllers or other similar devices used to stop the car automatically at the landings (such as automatic operation, signal operation, etc.), provided these contacts and the means for operating them conform to the requirements of subparagraphs (A) and (B) above. These contacts may then serve also normal-terminal stopping devices.

(c) Final-terminal stopping devices.

(1) Where stopping devices are required and function. Final-terminal stopping devices shall be provided and arranged to cause the electric power to be removed automatically from the hoist driving-machine motor and brake after the car has passed a terminal landing. The device shall be set to function as close to the terminal landing as practicable but so that under normal operating conditions it will not function when the car is stopped by the normal-terminal stopping device. Where spring buffers are provided, the device shall function before the buffer is engaged. The device shall be so designed and installed that it will continue to function at the top terminal landing, until the car has traveled above this landing a distance equal to the counterweight runby plus 1-1/2 times the buffer stroke, but in no case less than 2 feet (5 cm) and at the bottom terminal landing, until the car rests on its fully compressed buffer. The operation of final-terminal stopping devices shall prevent movement of the car by the normal operating devices in both directions of

travel and shall be reset manually.

(2) Location.

(A) Hoists having traction machines shall have final-terminal stopping switches located on the hoist structure and operated by cams attached to the car or counterweight.

(B) Hoists having winding-drum machines shall have final-terminal stopping switches located on, and operated by, the driving machine and also stopping switches located on the hoist structure and operated by cams attached to the car. See paragraph (4)(B) below.

(C) Rack-and-pinion hoists shall have final-terminal stopping devices located on the cage and operated by cams attached to the hoist structure.

(3) Controller switches controlled by final-terminal stopping device. The normal-and final-terminal stopping device shall not control the same controller switches unless two or more separate and independent switches are provided, two of which shall be closed to complete the driving-machine motor-and-brake circuit in either direction of travel. Where a two- or three-phase driving-machine motor is used, these switches shall be of the multipole type. The control shall be so designed and installed that a single ground or short circuit may permit either, but not prevent both, the normal-or final-terminal stopping-device circuits from stopping the car.

(4) Final-terminal stopping devices for drum machines shall conform to these requirements:

(A) Stopping switches located on, and operated by, the driving machine shall not be driven by chains, ropes, or belts; and

(B) Where a two- or three-phase ac driving-machine motor is used, the main-line circuit to the driving-machine motor and the circuit of the driving-machine brake coil shall be directly opened either by the contacts of the machine stop switch or by stopping switches mounted in the hoistway and operated by a cam attached to the car. The opening of these contacts shall occur before, or coincident with, the opening of the final-terminal stopping switch as provided in paragraph (1) above. Exceptions are driving machines equipped with a dc brake and having a dc main-line control switch in the driving-machine motor circuit controlled by a final-terminal stopping switch located in the hoistway and operated by a cam attached to the car.

(d) Terminal speed-limiting devices shall be installed when: reduced-stroke oil buffers are used, and car speed exceeds 300 feet (90.9 m) per minute. These devices shall conform to the requirements given in paragraphs (1) through (4) below.

(1) Terminal speed-limiting devices shall operate independently of the normal-terminal stopping device should this device fail to slow down the car at the terminal as intended.

(2) Terminal speed-limiting devices shall provide a retardation not in excess of 32.2 feet (9.7 m) per second per second.
(3) Terminal speed-limiting devices shall not apply the car safety.
(4) Terminal speed-limiting devices shall be so designed and installed that a single short circuit caused by a combination of grounds or by other conditions shall not prevent their functioning. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-23 Operating devices and control equipment. (a) Operation and operating devices.
(1) Types of operating devices. All operating devices shall be of the enclosed electric type. Rope or rod operating devices actuated directly by hand, or rope operating devices actuated by wheels, levers, or cranks, shall not be used. For hydraulic drives, deadman lever (self-centering) controls may be used.
(2) Handles of lever-type operating devices of car-switch operation hoists shall be so arranged that they will return to the stop position and latch there automatically when the hand of the operator is removed. Car-switch push buttons should be of the constant-pressure type so that when the hand is removed from the button the car will stop.
(3) Top-of-car operation during inspection. When an inspector is stationed on top of a car in performance of the normal duties, the car shall be operated, when required, by an operator inside the car and by means of the normal operating devices. In addition, the car shall be operated in response to voice command of the inspector and only in the slowest speed. An emergency stop button located on top of the car shall be provided for use by the inspector to stop the car at any point of travel. A guardrail shall be provided on top of cantilever-type cars. The guardrail shall be approximately 42 inches (105 cm) in height with an intermediate rail.

(b) Electrical protective devices shall be provided in accordance with the requirements given in paragraphs (1) through (15) below.
(1) Slack-rope switch. Hoists having winding-drum machines shall be provided with a slack-rope device equipped with a switch of the enclosed manually reset type which shall cause the electric power to be removed from the hoist driving-machine motor and brake if the hoisting ropes become slack.
(2) Motor-generator running switch. Where generator-field control is used, means shall be provided to prevent the application of power to the hoist driving-machine motor and brake unless the motor-generator-set connections are properly switched for the running condition of the hoist. It is not required that the electrical connections between the hoist driving-machine motor and the generator be

opened in order to remove power from the hoist motor.

(3) Where generator-field control is used, a motor-field excitation switch shall be provided which shall cause the electric power to be removed from the hoist driving-machine motor and brake unless current is flowing in the shunt-field circuit of the hoist driving-machine motor.

(4) An emergency stop switch shall be provided in the car and located in, or adjacent to, the car operating panel. When opened, this switch shall cause the electric power to be removed from the hoist driving-machine motor and brake. Emergency stop switches shall have the following characteristics:
    (A) They shall be of the manually opened and closed type;
    (B) They shall have red operating handles or buttons;
    (C) They shall be conspicuously and permanently marked "Stop"; and
    (D) They shall be positively opened mechanically and their opening shall not be solely dependent on springs.

(5) Broken-rope tape or chain switches used in connection with machine-room normal-terminal stopping switches. Broken-rope, tape, or chain switches conforming to section 12-232-22(b)(3)(B) shall be provided in connection with normal-terminal stopping devices located in machine rooms of traction hoists. Such switches shall be opened by a failure of the rope, tape, or chain.

(6) Stop switch on top of car. A stop switch conforming to the requirements of paragraph (4) above shall be provided on the top of every electrically controlled hoist car.

(7) A switch conforming to the requirements of sections 12-232-18(f), 12-232-19(d)(l), and 12-232-19(d)(3) shall be required where a car safety is provided.

(8) A speed-governor overspeed switch shall be provided when required by section 12-232-19(d)(1) and shall conform to the requirements given under sections 12-232-19(d)(2) and (3).

(9) Final-terminal stopping devices conforming to the requirements given under section 12-232-22(c) shall be provided.

(10) Terminal speed-limiting devices. Where reduced-stroke oil buffers are provided or car rated speed exceeds 300 feet (90.9 m) per minute, emergency terminal stopping devices conforming to the requirements given under section 12-232-22(d) shall be provided.

(11) Compensating-rope sheaves, when used, shall be provided with a compensation-rope-sheave switch or switches mechanically opened by the compensating-rope sheave before the sheave reaches its upper or lower limit of travel, to cause the electric power to be removed from the elevator driving-machine motor and brake.

(12) A primary magnetic contactor shall be provided for main power disconnect, in addition to the normal service disconnect switch as required by subsection (d) below. The primary magnetic contactor shall perform its power

disconnect function upon any interruption of the final-terminal stopping devices and all other electrical safety devices.

(13) Car-door or gate electric contacts conforming to the requirements given under section 12-232-17(b) shall be provided for all hoists.

(14) Normal-terminal stopping devices conforming to the requirements given under section 12-232-22(b) shall be provided for every electric or electrically controlled hoist.

(15) Motor-generator overspeed protection. Means shall be provided to cause the electric power to be removed automatically from the hoist driving-machine motor and brake should a motor-generator set, driven by a dc motor, overspeed.

(c) Voltages permitted in control and operating circuits.

(1) Voltages permitted in the hoistway or on the car. The maximum system or circuit potential permitted on any equipment in the hoistway or on the car shall not be more than 440 volts (nominal). Where the potential exceeds 120 volts, a grounding conductor shall be incorporated in the traveling cable or a separate grounding conductor shall be installed. A visual-type indicator shall be included in the grounding circuit so arranged as to continually indicate the continuity of the grounding conductor. The type and size of the grounding conductor and the grounding fastening means shall conform to the requirements of National Electrical Code, ANSI/NFPA 70.

(2) Voltages permitted in other locations. The nominal rated system of circuit potential for all circuits, in locations other than those specified in paragraph (1) above, shall not exceed 600 volts except for driving motors of motor-generator sets.

(d) Power-supply-line disconnecting means. A fused-disconnect switch or a circuit breaker shall be installed and connected into the power-supply line to each hoist motor or to the motor of the motor-generator set. Disconnect switches or circuit breakers shall be of the manually closed multipole type, and their location shall conform to the requirements of National Electrical Code, ANSI/NFPA 70. Disconnect means for hoists having a dc primary power supply and rheostatic control shall have the disconnect switch arranged so that its opening will directly open the driving-machine brake circuit. Where circuit breakers are used as a disconnecting means, they shall not be of the instantaneous type and shall not be opened automatically by a fire alarm system.

(e) Phase-reversal and failure protection. Hoists having polyphase ac power supply shall be provided with means to prevent the starting of the hoist motor if the phase rotation is in the wrong direction or there is a failure of any phase. This protection shall be considered provided in the case of generator-field control having ac motor-generator driving motors, provided a reversal of phase will not cause the hoist driving-machine motor to operate in the wrong direction. Controllers whose switches are operated by polyphase torque motors provide inherent protection against phase reversal or

failure.

(f) The installation of condensers, the operation or failure of which will cause an unsafe operation of the hoist, is prohibited. No permanent device shall be installed, except as provided in this chapter, which will make any required electrical protective device inoperative. See section 12-232-26(b).

(g) Release and application of driving-machine brakes. Driving-machine brakes shall not be electrically released until power has been applied to the driving-machine motor. All power feed lines to the brake shall be opened, and the brake shall apply automatically when the following conditions prevail:

(1) The operating device of a car-switch or continuous-pressure operation hoist is in the stop position;

(2) A floor stop device functions; and

(3) Any of the electrical protective devices function. Under conditions in paragraphs (1) and (2) above, the application of the brake may occur on or before the completion of the slowdown and leveling operations. The brake shall not be permanently connected across the armature or field of a dc hoist driving-machine motor.

(h) In the design and installation of the control and operating circuits, the following requirements shall be met:

(1) Springs shall not be used to actuate switches, contactors, or relays to break the circuit to stop the hoist;

(2) The completion or maintenance of an electric circuit shall not be used to interrupt the power to the hoist driving-machine motor or brake at the terminal landings, nor to stop the car when the emergency stop switch is opened or any of the electrical protective devices operate. Exception: These requirements do not apply to dynamic braking or to speed-control switches;

(3) The failure of any single magnetically operated switch, contactor, or relay to release in the intended manner, or the occurrence of a single accidental ground, shall not permit the car to start or run if any hoistway-door interlock is unlocked or if any hoistway-door or car-door or gate contact is not in the closed position; and

(4) Where generator-field control is used, means shall be provided to prevent the generator from building up and applying sufficient current to the hoist driving-machine motor to move the car when the hoist-motor control switches are in the "off" position. The means used shall not interfere with maintenance of an effective dynamic-braking circuit during stopping and standstill conditions.

(i) Absorption of regenerated power. Where a power source is used which, in itself, is incapable of absorbing the energy generated by an overhauling load, means of absorbing sufficient energy shall be provided on the load side of each hoist power-supply-line disconnecting means to prevent the hoist from attaining governor-tripping speed or a speed in excess of 125 per cent of rated speed, whichever is less. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-24 Hoisting and counterweight ropes, and rope connections. (a) Suspension means. Hoist cars shall be suspended by steel wire ropes attached to the car frame or passing around sheaves attached to the car frame specified in section 12-232-15. Exceptions are hoists with rack-and-pinion machines. Only steel wire ropes having the commercial classification "elevator wire rope," or specifications recommended by wire rope manufacturers for hoist use, shall be used for the suspension of hoist cars or for the suspension of counterweights.

(b) Wire-rope data.

(1) Wire-rope data on crosshead data plate. The crosshead data plate required by section 12-232-20(b) shall bear the following wire-rope data:
   (A) The number of ropes;
   (B) The diameter, in inches; and
   (C) The manufacturer's rated breaking strength per rope, in pounds.

(2) Wire-rope data on rope data tag. A metal data tag shall be securely attached to one of the wire-rope fastenings. This data tag shall bear the following wire-rope data:
   (A) The diameter, in inches;
   (B) The manufacturer's rated breaking strength per rope, in pounds;
   (C) The grade of material used;
   (D) The month and year the ropes were installed;
   (E) Whether rope is nonpreformed or preformed;
   (F) Construction classification;
   (G) Name of person or firm that installed ropes; and
   (H) Name of manufacturer of the rope.

(3) A new tag shall be installed at each rope renewal. The material and marking of the rope data tag shall conform to the requirements of section 12-232-20(d), except that the height of the letters and figures shall be not less than 1/16 inch (1.5 mm).

(c) Log at worksite office of user. A log shall be kept by the user of the hoist in the worksite office which shall indicate the following functions and the name of the person who performed them:

(1) The day, month, and year the ropes were installed, and whether they were new or used when installed; and

(2) The day, month, and year the ropes were refastened to permit increase in the height of the hoist.

(d) Factor of safety. The factors of safety of the suspension wire ropes shall be not less than shown in table 232-5. Figure 232-5 gives the minimum factors of safety for intermediate rope speeds. The factor of safety shall be based on the actual rope speed corresponding to the rated speed of the car. The factor of safety shall be calculated by the following formula:

$$f = \frac{S \times N}{W}$$

where

S = manufacturer's rated breaking strength of one rope
W = maximum static load imposed on all car ropes, with the car and its rated load at any position in the hoistway
N = number of runs of rope under load. In the case of multiple roping, the number of runs of rope (N) under load will be twice the number of ropes used, for 2:1 roping; 3 times the number of ropes used, for 3:1 roping, etc.

TABLE 232-5

Minimum Factors of Safety for Suspension Wire Ropes

Rope Speed (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

(e) Minimum number and diameter of hoisting ropes. The minimum number of hoisting ropes used shall be three for traction hoists and two for drum-type hoists. Where a car counterweight is used, the number of counterweight ropes used shall be not less than two. The term "diameter," where used in this section, shall refer to the nominal diameter as given by the rope manufacturer. The minimum diameter of hoisting and counterweight ropes shall be 1/2 inch (1.2 cm).

(f) Suspension-rope equalizers may be used.

(g) Car suspension ropes of winding-drum machines shall have the ends of the rope secured to the drum or drum flange by means of clamps or tapered sockets or by other means approved by the department.

(h) Spare rope turns on winding drums. Wire suspension ropes of drum-type machine shall have not less than three wraps of the rope on the drum when the car is resting on the fully compressed buffers.

(i) Suspension wire ropes shall not be lengthened or repaired by splicing.

(j) Wire-rope fastenings.

(1) Type of rope fastening. Hoisting and counterweight wire ropes shall be attached to cars and counterweight by means of zinc-coated or galvanized drop-forged fist grips (or equivalent) and wire-rope thimbles, or by approved special fastening devices. When fist grips are used, the minimum number, spacing, and tightening torque shall be in accordance with the instructions of the grip manufacturer. Grips shall be periodically checked and retightened to the recommended torque. When extra wire rope is carried on top of the frame of the hoisting platform, a drum and

clamp tie-down or equivalent-type anchor device, which will not damage or deform the wire rope, shall be used.

(2) Babbitted rope sockets shall be prohibited.

(k) Wire-rope inspection.

(1) Inspector. A representative of the user of the personnel hoist shall be appointed, and this representative shall keep written records of the rope condition on file at the worksite.

(2) Inspection periods shall be established for each hoist installation, with the frequency of inspection determined by the type of installation and operating conditions. A visual inspection shall be made daily. A complete inspection shall be made at least once each 30 days.

(3) Method of inspection. If ropes are dirty or overlubricated, a proper inspection may not be possible unless the dirt or excess lubricant is removed. Examination of traction-machine ropes and counterweight ropes of drum-type hoists should preferably start with the car located at the top of the hoistway and should be made from the top of the car, with the ropes examined on the counterweight side. The hoist ropes of overhead drum-type machines must be examined from the overhead machinery space. Where traction of drum machine is located below, the portions of the ropes leading from the driving-machine drum or sheave and from the counterweight to the overhead sheaves can be examined from the top of the car as it descends, except for a small portion which must be examined from the pit. The ropes should be marked with chalk to indicate location of unexamined sections which must be inspected from other locations such as the pit or overhead machinery space.

(4) Wire rope for personnel hoists shall not be used on more than one job.

(5) Sheaves, guards, guides, drums, flanges, and other surfaces contacted by wire rope during operation should be examined at the time of inspection. Any condition harmful to the rope should be corrected.

(l) Hoisting ropes with one or more of the following defects shall be removed or replaced immediately. If one wire rope of a set requires replacement, the entire set of ropes should be replaced.

(1) Severe corrosion.

(2) Broken wires:

(A) One or more valley breaks. A valley break is a wire break occurring in the valley between two adjacent strands; and

(B) Six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay. A rope lay is the length along the rope in which one strand makes a complete revolution around the type.

(3) End attachments. Development of broken wires in the vicinity of attachments. If this condition is localized in an operating rope and the section in question can be eliminated by making a new attachment, this may be done rather than replacing the entire rope.

(4) Abrasion. Abrasion, scrubbing, flattening, or peening causing loss of more than 1/3 of the original diameter of the outside wires.
(5) Kinking. Severe kinking, crushing, birdcaging, or other damage resulting in distortion of the rope structure.
(6) Heat. Evidence of any heat damage resulting from a torch or any caused by contact with electrical wires.
(7) Reduction of rope diameter. Reduction from nominal diameter of more than 3/64 inch (1.75 mm) for diameters up to and including 3/4 inch (1.9 cm), 1/16 inch (1.5 mm) for diameters 7/8 to 1-1/8 inches (2.2 cm to 2.8 cm), and 3/32 inch (2.2 mm) for diameters 1-1/4 to 1-1/2 inches (3.1 cm to 3.7 cm). Marked reduction in diameter indicates deterioration of the core.

(m) Governor ropes shall be replaced on the same basis as hoisting ropes. These ropes are lightly loaded and may show little or no wear. Inspectors should check for fatigued wires in strand valleys by bending over a small radius. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-25 <u>Inspection and tests of personnel hoists</u>. (a) Acceptance inspections and tests of new installations and alterations.

(1) Requirement for inspections and tests. In order to ensure the safe operation of new hoists and newly installed hoists, such devices shall, on their completion and before being placed in service, be subjected to an acceptance inspection and tests in the field to determine that all parts of the installation conform to the applicable requirements of these rules and that all safety equipment functions as required. A similar inspection and test shall be made following a major alteration of an existing installation.
(2) Persons authorized to make acceptance inspections and tests. Inspections shall be made by an inspector employed by the department. The following tests shall be performed by the person or firm installing or altering the equipment in the presence of an inspector employed by the department:
(A) Tests specified under subsections (b) and (c) below; and
(B) Any tests which require the following:
(i) Rendering of any safety devices or equipment temporarily inoperative; and
(ii) Removal or resetting of devices or equipment.

(b) Acceptance test schedule for car and counterweight safeties and governors.

(1) General requirements for safeties.
(A) Test load. Car safeties shall be tested with rated load in the car. In performing the test of car safeties, one-fourth of the rated load shall be distributed on each quarter of the platform symmetrically with relation to the center lines of the platform. Counterweight safeties, where

provided, shall be tested with no load in the car.

(B) The tripping speed of the governor shall be measured by means of a tachometer and, if necessary, adjusted to conform to the requirements given under section 12-232-19(b).

(C) Governors shall be sealed, either before or at the time of the safety test, as required by section 12-232-19(c). If any change is made in the governor setting during the field test in order to conform to the requirements given under section 12-232-20(b), governors previously sealed shall be resealed immediately following the test.

(D) Governor overspeed switch and car safety-mechanism switch. The operation of the governor overspeed switch and the car-safety-mechanism switch shall be checked for conformity with the requirements given under section 12-232-19(d).

(E) Level of car platform. After the safety has stopped the car, the level of the car platform shall be checked for conformity with section 12-232-18(h)(2).

(2) Tests of Type A safeties without governors operated only as a result of the breaking of slackening of the hoist ropes. The operation of this type of safety shall be tested by obtaining the necessary slack rope to cause it to function.

(3) Tests of Type B, C, and rack-and-pinion safeties.

(A) Tests required. Safeties shall be subjected to overspeed test, with the hoisting ropes attached, by gradually increasing the speed of the car until the governor causes application of the safety.
Exception: Safeties of hoists equipped with ac driving-machine motors, where the car with its rated load does not cause sufficient overspeed when the machine brake is released to trip the governor jaws, shall be tested by operating the car at its normal speed in the down direction and tripping the governor jaws manually. See paragraph (1)(B) above for test of governor-tripping speed.

(B) The overspeed switch on the governor shall be inoperative during the overspeed test. In order to ensure that the safety will retard the car with the minimum assistance from the hoist driving machine, and to minimize the development

of slack rope and fallback of the counterweight, the switch on the car operated by the car safety mechanism shall, for the duration of the test, be temporarily adjusted to open as close as possible to the position at which the car safety mechanism is in the fully applied position.

(C) Stopping distances for Type B, C, and rack-and-pinion safeties. The stopping distance shall conform to the requirements of section 12-232-18(b).

(D) Movement of governor rope to operate Type B and C safeties. The movement of the governor rope to operate the safety mechanism shall be tested for conformity with section 12-232-18(j)(1).

(E) The movement of car for rack-and-pinion safeties from the governor-tripping time to the full-stop time shall be determined in conformity with section 12-232-18(j)(2).

(c) Acceptance tests of car and counterweight buffers. No acceptance test shall be required for spring-type buffers. Oil buffers shall be tested in the field in accordance with Part X, Section 1000, Rule 1000.3, of American National Standard Safety Code for Elevators and Escalators, ANSI/ASME A17.1.

(d) Periodic inspection and tests of all installations.

(1) All existing installations, and all new installations after being placed in service, shall be subjected to periodic inspections and tests at regular intervals to determine that the equipment is in safe operating condition and has not been altered.

(2) Persons authorized to make periodic inspections and tests. Periodic inspections and tests, except for annual periodic tests required by paragraph (5) below and tests which are outlined in subsection (a)(2) above, shall be made by an elevator inspector in the employ of the department. The owner or an authorized agent shall have periodic tests that are required by paragraph (5) below and tests outlined in section 12-232-26(a)(2) performed by a person qualified to perform such service in the presence of an inspector in the employ of the department.

(3) Periodic inspections and tests required by paragraph (4) below shall be made at intervals not to exceed 3 months. Exception: Inspection and tests of car and counterweight safeties, governors, and oil buffers specified in paragraph (5) below.

(4) All parts of the equipment shall be inspected and, where necessary, tested to determine that they are in safe operating condition and that parts subject to wear such as ropes, bearings, gears, car safety and governor parts, buffers, etc., have not worn to such an extent as to affect the safe operation of the installation. Any such worn parts shall be adjusted or replaced.

(5) Car and counterweight safety governor and oil-buffer periodic inspections and tests. Safeties, governors, and oil buffers shall be inspected and tested for conformity with the requirements given under paragraphs (6) through

(9) below at intervals not to exceed three months unless an inspection made in conformity with paragraph (4) above indicates that the test should be performed at different intervals.

(6) Inspection of safety parts.

(A) All working parts of car and counter-weight safeties shall be inspected to determine that they are in satisfactory operating condition and that the distance between the guide-member-gripping faces of the safety parts is not less than the following:

(i) For new hoists having Type A, B, or C safeties, as specified in section 12-232-18(i); and

(ii) For existing hoists having steel guide safeties, not less than the thickness of the guide members plus 3/32 inch (2.2 mm).

(B) Type B safeties shall be operated by hand until the safety jaws contact the guide members, after which the inspection specified in subparagraphs (C) and (D) below shall be made.

(C) For Type B drum-operated safeties which require continual unwinding of the safety drum to fully apply the safety, check the number of turns remaining on the car safety drum. These must be sufficient to ensure proper operation of the safety on the maintenance test or should the safety operate on over-speed. Note that the requirements given under section 12-232-18(j) specify that three turns shall remain on the drum after application of the safety at over-speed with rated load in the car.

(D) For all Type B safeties, measure the movement of the governor rope necessary to bring the safety jaws into contact with the guide-member surfaces which measurement for new hoists shall not exceed the amount specified in section 12-232-18(j)(1). When resetting drum-operated safeties by means of the wrench in the car, sufficient tension shall be kept in the safety drum rope to prevent kinking of the rope and to ensure that it is wound evenly and uniformly in the drum grooves. The drum must be rewound until no slack remains in the safety rope between the drum and the car releasing carrier.

(7) Governors shall be inspected at intervals not to exceed three months and operated by hand to determine that all parts, including the rope-grip jaws, operate freely. All bearings, governor rope-grip jaws, and rubbing surfaces shall be checked to make sure they are not worn excessively and are free of paint. A test of the governor-tripping speed is not required unless the seal on the governor has been disturbed or the inspection indicates that for other reasons a retest is necessary. If a retest is performed, the governor shall be resealed after the test. In lieu of an inspection, an overspeed test may be performed to determine proper governor operation.

(8) Test of safeties. Safeties shall be subjected to a running test with no load in the car as follows:

(A) Governor-operated safeties. The safety shall be operated by tripping the governor by hand with the car operating at the slowest operating speed in the down direction. In this test, the safety shall bring the car to rest promptly. In the case of Type B and rack-and-pinion safeties, the stopping distance is not required to conform to section 12-232-18(b). In the case of Type A and Type C safeties employing rollers or dogs for application of the safety, the rollers or dogs are not required to operate their full travel. See paragraph (6)(E) above; and

(B) Type A safeties without governors operated only as a result of the breaking or slackening of the hoist ropes. The operation of this type of safety shall be tested by obtaining the necessary slack rope to cause it to function.

(9) Periodic tests of oil buffers shall be performed as specified in subsection (c) above.

(e) When the travel of the hoist is increased, the installation shall be reinspected, tested as per the requirements given under subsection (a) above; and approved by the department before it is again placed in normal service.

(f) Operation. Hoists shall be operated only by a competent authorized operator in the car or stationed adjacent to the driving machine subject to the following conditions:

(1) A regular attendant is stationed in the car;

(2) A constant-pressure-type switch shall be provided in the car, which must be held manually in the closed position by the attendant in the car in order to permit operation of the driving machine and which shall be opened automatically when released by the operator during normal or emergency stop operations; and

(3) A means of closed voice communication shall be provided between the car attendant and the operator stationed adjacent to the driving machine.

(g) Reports of inspections accidents and unsafe conditions, and repairs.

(1) A report of each inspection shall be made in conformity with the requirements of and on forms provided by the department.

(2) When an accident involving a personnel hoist in service results in personal injuries requiring the service of a physician or in any way impairs the strength or safe functioning of the hoist, the employer shall notify the director of the accident as soon as practicable but in no case later than twelve o,clock noon of the first day the department is open for business after the accident.

(3) When the accident occurs while the hoist is being installed, altered, adjusted, tested, or dismantled, the company performing the work shall be responsible for the required notification to the director of the accident.

(4) When the accident occurs, the personnel hoist involved in the accident shall not be placed in service but shall be preserved as found after the accident except to render aid to the injured and to mitigate property loss until inspected by an inspector employed by the department.

(5) A report of the unsafe condition and the corrective action taken shall be made by the employer to the department. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-26 Maintenance and repairs. (a) Lubrication. All parts of the machinery and equipment requiring lubrication shall be lubricated at regular intervals as recommended by the manufacturer, and a log maintained.

(b) No person shall at any time make any required safety device or electrical protective device inoperative, except where necessary during tests, inspections, and maintenance, such devices shall be restored to their normal operating condition in conformance with the applicable requirements of this chapter. See section 12-232-23(f).

(c) Repairs by replacement of parts shall be made with parts equivalent in material, strength and design with those replaced, and a permit and submission of plans and specifications for the repairs or replacements shall not be required.

(d) Repairs by welding of any part of a hoist upon which safe operation depends shall be done in compliance with 12-232-15(g)(3). Prior to commencing welded repairs that come within the scope of these rules, the department shall be notified and supplied with:

(1) Sufficient information so that it can be determined if the contemplated work is allowed by the code; and

(2) The name of the welder or the name of the contractor engaged to make the weldment, so that it can be determined that the process, procedure and the welder meet the requirements of the American Welding Society. Completed weldments shall be inspected by this department, tested as necessary by the inspector and found to be satisfactory before the hoist is placed into service. Welding that comes within the scope of these rules shall be considered a major alteration and a permit obtained as required by section 12-232-28(a)(3) unless the welding is done in connection with the installation or alteration of a hoist for which a permit has been issued. [Eff. 7/12/82; am and comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-27 Safety precautions for use of hoists. (a) Personnel hoists may be used for carrying materials provided the hoists are designed and installed for the type of loading to be used.

(b) Passengers and materials shall not be hoisted in the car at the same time. A sign indicating this fact shall be posted in each car used to hoist both people and materials. Exception: When material is of such size that it is completely in the custody and control of the passenger.

(c) A personnel hoist shall not be used to transport persons or the general public who are in no way connected with the construction, alteration or demolition of the building or structure

where the hoist is installed.

(d) The top of a personnel hoist car shall not be used to transport persons or material.

(e) A personnel hoist in service shall be maintained in a safe operating condition.

(f) A personnel hoist discovered to have a defect or a condition materially affecting its safe operation shall be taken out of service immediately by the employer and further operation thereof prevented until repairs have been made. [Eff. 7/12/82; comp 12/6/90] (Auth: HRS §397-4) (Imp: HRS §397-4)

§12-232-28 Permits. (a) Erection permit; submission of plans.

(1) No personnel hoist shall be erected or installed nor shall any major alteration be made to any personnel hoist unless a permit for the erection, installation or alteration is issued by the department.

(2) Written application for the permit shall be filed with the department and shall be accompanied by plans and specifications as may be required by the department.

(3) The department shall, before issuance of a permit for erection, installation or major alteration, charge and collect a fee for each permit in accordance with section 12-241-3. This fee shall provide for plan review, the acceptance inspection and the first operating permit.

(b) Operating permit.

(1) No personnel hoists shall be operated unless a currently valid permit for the operation has been issued by the department.

(2) An operating permit for any personnel hoist shall be issued only after the hoist has been inspected and found by an inspector to be in conformity with all applicable requirements of this chapter.

(3) An operating permit shall be valid for a period of 90 days after the date of its issuance unless sooner revoked. A permit may be renewed under conditions set forth in paragraph (2) above. A fee for the re-inspection and the renewal of the permit shall be charged and collected by the department.

(4) An operating permit shall be conspicuously posted in the personnel hoist car. [Eff. 7/12/82; am and comp 12/6/90; am 7/6/98] (Auth: HRS §397-4) (Imp: HRS §397-4)

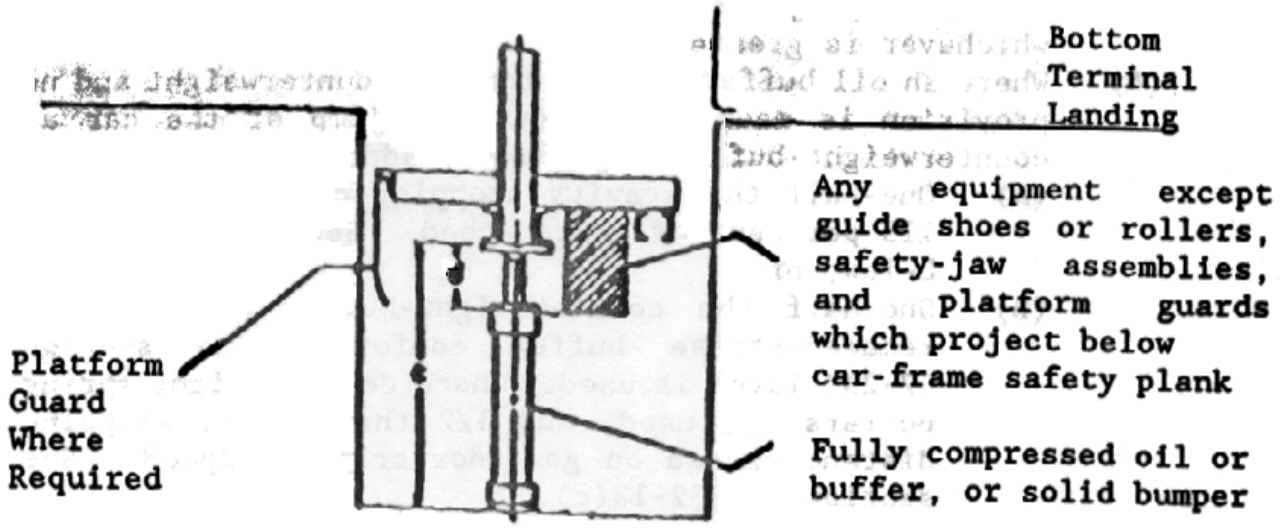


Figure 232-1

Bottom car clearance

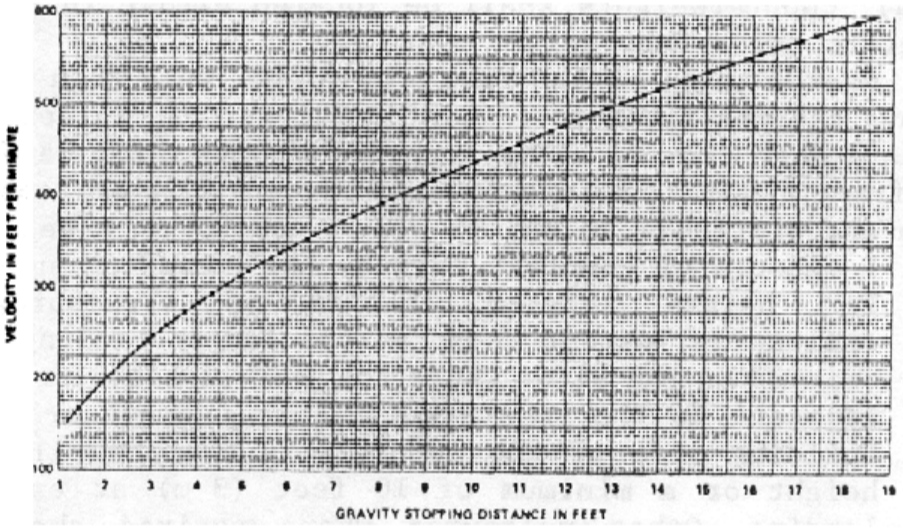

VELOCITY IN FEET PER MINUTE
600
500
400
300
200
100
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
GRAVITY STOPPING DISTANCE IN FEET

Figure 232-2

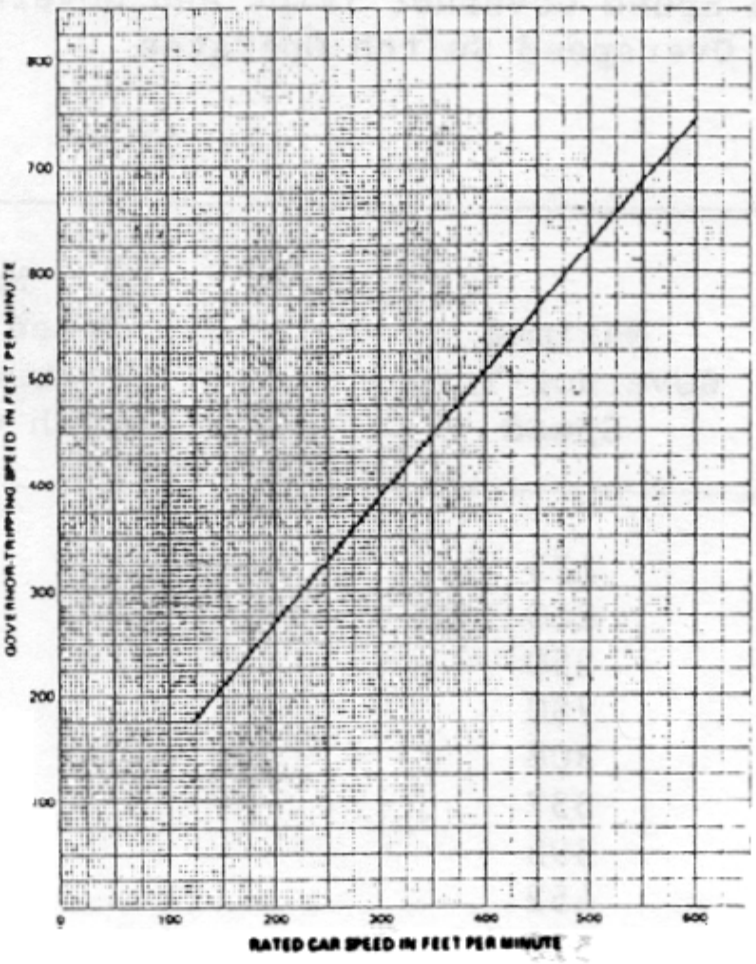


Figure 232-3
Maximum governor-tripping speeds

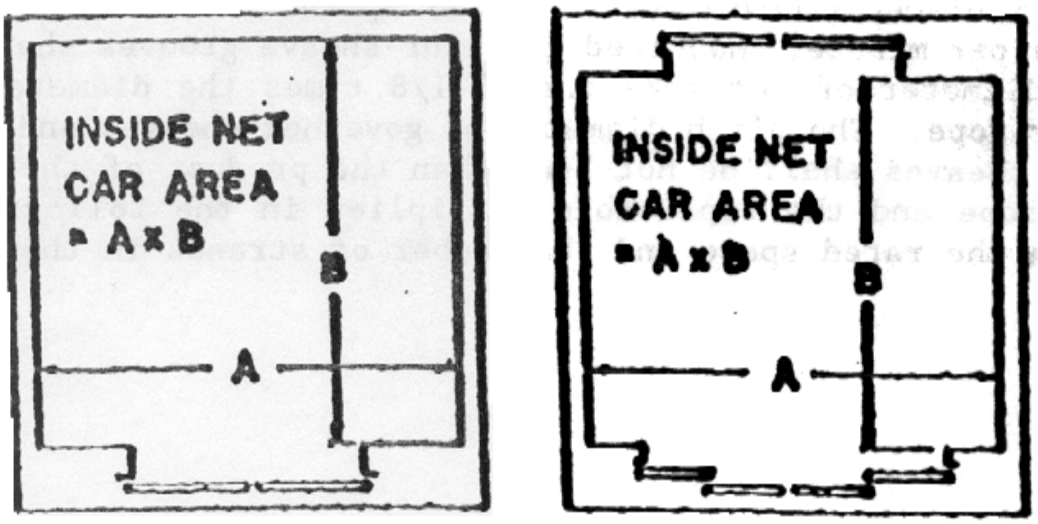
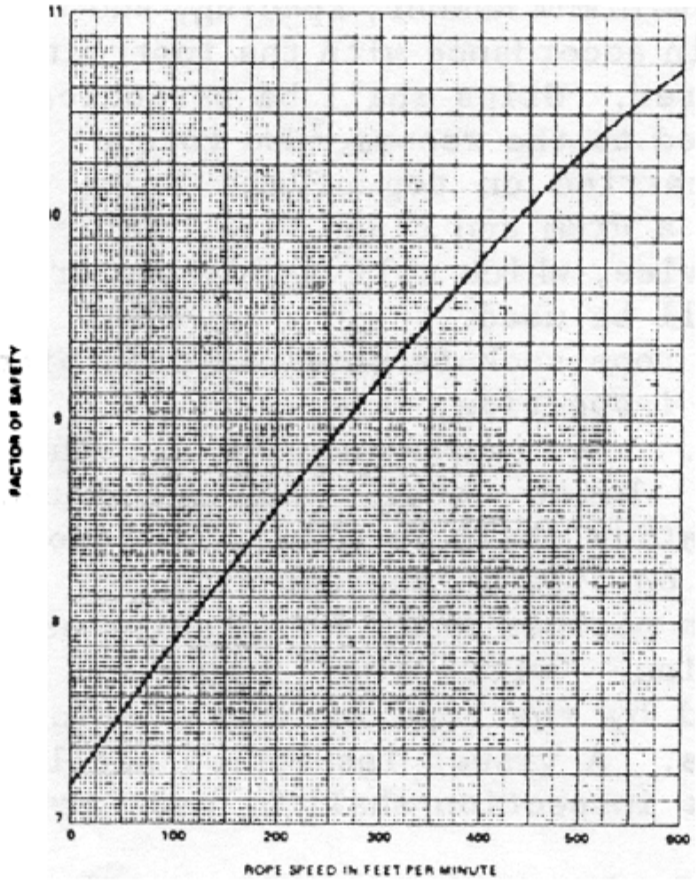


Figure 232-4
Inside Net Platform Areas for Personnel-Hoist Cars



Rope Speed In Feet Per Minute

Figure 232-5

Factors of Safety of Suspension Wire Ropes of Personnel Hoists