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The Commonwealth of Massachusetts

Department of Public Safety

1010 Commonwealth Avenue, Boston 15

March 9, 1950

To: Hon. Edward J. Cronin
Secretary of the Commonwealth
State House
Boston, Massachusetts

Subject: Elevator and Escalator Regulations - ELV-2.

1. In accordance with the provisions of General Laws, Chapter 143, Section 69, as amended, I am forwarding to you Elevator and Escalator Regulations, known as "ELV-2".

2. These rules and regulations are applicable to all new installations, as defined in ELV-2.

JFS:MG
Enc.

John F. Stokes
Commissioner

(Added, Sec No. 13.)
(Added, Sec No. 14.) Amended - (Additional Parts 8 and 9 added, Sec No. 4.)
(Amended - Part 10, added, Sec No. 5.)
(Amended, Sec No. 6.)
(Amended, Sec No. 8.)
(Amended, Sec No. 11.)

The Commonwealth of Massachusetts

DEPARTMENT OF PUBLIC SAFETY

BOARD OF ELEVATOR REGULATIONS

ELEVATOR AND ESCALATOR REGULATIONS

ELV-2

DEPARTMENT OF PUBLIC SAFETY
BOARD OF ELEVATOR REGULATIONS

In accordance with the provisions of G. L., C. 143, S. 69, as amended, the Board of Elevator Regulations amends existing regulations so far as they pertain to the construction of elevators, dumbwaiters, and moving stairways (escalators) hereafter installed, re-located or materially changed, by substituting therefor the following new regulations applicable to all new installations for which application for approval of plans or a permit for construction is filed on or after the effective date of these regulations, provided, however, that Part 6 of these regulations, dealing with the operation of elevators and the licensing of operators therefor, shall also apply to existing installations.

A new installation is any installation for which application for approval of plans or a permit for construction is filed on or after the effective date of these regulations; any installation which is re-located; any installation which is materially changed.

The following shall be considered material changes:

(a) If the speed of an existing elevator is increased.

(b) If the capacity of an existing elevator is increased.

(c) If the travel of an existing elevator is extended.

(d) If the machine room of an existing elevator is re-located.

(e) If the classification of an elevator is changed from freight to passenger.

NOTE: Any complete part of an existing installation which is replaced, such as machine, car, shaftway enclosure, gates, doors, door-locking devices, controllers, operating devices, load weighing devices, etc., shall be installed in accordance with the regulations for new installations; but such existing parts as remain in service need not be changed to conform with the regulations for new installations. Any change from DC (direct current) to AC (alternating current) or any change in voltage shall not be considered a material change, provided the speed or capacity of the installation is not increased.

PART 1 — DEFINITIONS

In these regulations the following terms shall have the meanings respectively assigned to them. They are not intended, however, as a complete glossary of terms used in connection with elevator installations.

Annunciator. Elevator Car: An elevator car annunciator is an electrical device in the car, which indicates the landings at which hall buttons have been pressed.

Buffer: A buffer is a device to absorb the impact of the car or counterweight at the extreme limits of travel.

Capacity: The capacity of an elevator is the load which the elevator is designed and equipped to adequately handle as determined by these regulations or by the inspector having jurisdiction.

Car, Elevator: An elevator car is the load-carrying unit, including its platform, car frame, and enclosure.

Car Door or Gate: A car door or gate is the door or gate attached to the elevator car which closes the opening regularly used for entrance and exit.

Car Door or Gate Electric Contact: A car door or gate electric contact is a device which opens the operating circuit, or an auxiliary circuit, when the car door or gate is open beyond the closed position and thus prevents operation of the elevator car by the operating devices.

Car Enclosure: The car enclosure or cab of an elevator is the enclosure consisting of walls and the top or cover built upon the platform.

Car Frame or Car Sling: A car frame or car sling is the supporting frame to which the car platform upper and lower sets of guide shoes and the hoisting ropes are attached.

Car Platform: The car platform is the structure which forms the floor of the car and which directly supports the load.

Clearance, Bottom Car: Bottom clearance of the ele-

vator car is the clear vertical distance between the underside of the car platform or between the underside of any equipment attached thereto, exclusive of the car frame channels, car safety blocks, guide shoes and any aprons or guards attached to the car sill, and the pit floor when the car rests on the fully compressed buffer.

Clearance, Top Car: Top clearance of the elevator car is the distance the car floor can travel above the level of the upper terminal landing without any part of the car or devices attached thereto coming in contact with the overhead structure.

Clearance, Top Counterweight: Top clearance of the elevator counterweight is 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 lower terminal landing.

Clearance, Bottom Counterweight: The bottom clearance of the counterweight is the vertical distance between the counterweight buffer and its striker plate when the car is level with the top terminal landing.

Contract Load: Contract load is the rated capacity in pounds specified in the contract for the purchase of the elevator and in the application for the permit.

Contract Speed: Contract speed is the speed in feet per minute, specified in the purchase contract or in the application for permit, to be attained by the elevator in the up direction with contract load in the car.

Control: The control of an elevator is a system of regulation by which the starting, stopping, direction of motion, acceleration, speed, and retardation of an elevator are governed.

Control, Generator-Field: Generator-field control is a system in which control is primarily accomplished by the use of an individual generator for each elevator, in which the voltage applied to the hoisting motor is adjusted by varying the strength and direction of the generator-field.

Control, Multi-Voltage: Multi-voltage control is a system in which control is accomplished primarily by impressing successively on the armature of the hoisting motor a number of substantially fixed voltages such as may be obtained from multi-commutator generators common to a group of elevators.

Control, Rheostatic: Rheostatic control is a system in which control is accomplished primarily by varying resistance or reactance in the armature or field circuit of the hoisting motor.

Control, Two-Speed Alternating Current: Two-speed, alternating current elevator control is a control for a two-speed induction elevator motor which is arranged to run at two different, practically constant speeds, by connecting the motor windings so as to obtain different numbers of poles.

Control, Variable Voltage: (Same as generator-field control).

Controller, Electric Elevator: An electric elevator controller is a device, or a group of devices, which serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

Dispatching Device, Automatic: An automatic dispatching device is a device whose principal function is to automatically operate a signal in the car to indicate when the car should leave the terminal.

Door Closer: A door closer is a device, operated by gravity or other means, which will automatically close a door when released by the operator or by suitable automatic means.

Door or Gate Device, Power-Operated: A power-operated door or gate device is a device or assemblage of devices, the purpose of which is to open or close the hoistway door or car door or gate by power other than by hand, gravity, springs, or the movement of the car.

Door Operator, Elevator Electric: An elevator electric door operator is an electric device for operating the hoistway or car doors, or both.

Dumbwaiter: A dumbwaiter is a hoisting and lowering mechanism equipped with a car which moves in guides in a substantially vertical direction the floor area of which does not exceed nine (9) square feet, whose total internal car height whether or not provided with fixed or removable shelves does not exceed four (4) feet; the capacity of which does not exceed 500 lbs. and which is used exclusively to transport material in a substantially vertical direction.

Dumbwaiter, Electric: An electric dumbwaiter is one in which the motion of the car is obtained through an electric motor directly applied to the dumbwaiter machinery.

Elevator: An elevator is a hoisting and lowering mechanism equipped with a car which moves in guides in a substantially vertical direction and which serves two or more floors of a building or structure, and shall include the enclosures, means and appurtenances required by these regulations. ENDLESS BELTS, CONVEYORS, CHAINS, BUCKETS, AND OTHER SIMILAR DEVICES USED FOR THE PURPOSE OF ELEVATING MATERIALS, AND ALSO TIERING, PILING OR FEEDING MACHINES GIVING SERVICE WITHIN ONE STORY, ARE NOT INCLUDED IN THE TERM "ELEVATOR".

Elevator, Automatic Push Button Electric: An electric automatic push button elevator is one that is started in response to the momentary actuation of operating devices at the landing, and/or of operating devices in the car identified with the landings, and/or in response to an automatic starting mechanism and wherein the car is stopped automatically at the landing.

Elevator, Auxiliary Power: An auxiliary power elevator is one having a source of mechanical power in common with other machinery.

Elevator, Builder's Hoist: A builder's hoist elevator is an elevator erected for temporary use, built in or adjoining a building under construction or alteration.

Elevator, Continuous Pressure: A continuous-pressure electric elevator is one operated by means of push buttons or switches at the landings with or without push buttons in the car which requires a button or switch to be held manually in contact to keep the car in motion.

Elevator, Double-Belted: A double-belted elevator is an auxiliary power elevator in which the direction of motion is changed without reversal of the prime mover.

Elevator, Electric: An electric elevator is one in which the motion of the car is obtained through an electric motor directly applied to the elevator machinery.

Elevator, Alternating Current: An alternating current elevator is an electric elevator equipped with an alternating current motor directly applied to the elevator machinery.

Elevator, Electro-Hydraulic: An electro-hydraulic elevator is one in which the lifting of the car is obtained by means of an electric motor driving a pump which pumps liquid directly into the cylinder.

Elevator, Freight: A freight elevator is an elevator used primarily for carrying freight.

Elevator, Gravity: A gravity elevator is an elevator in which gravity is the source of power.

Elevator, Hand: A hand elevator is an elevator driven by manual power.

Elevator, Hydraulic: A hydraulic elevator is an elevator in which the motion of the car is obtained from liquid under pressure.

Elevator, Passenger: A passenger elevator is an elevator that is used to carry persons other than the operator and persons necessary for loading and unloading.

Elevator, Platform: A platform elevator is an elevator the platform of which is directly supported at three or more points by suspension members which are relied upon to maintain the platform substantially level.

Elevator, Plunger: A plunger elevator is a hydraulic elevator having a ram or plunger directly attached to the under side of the car platform.

Elevator, Power: A power elevator is an elevator in which the motion of the car is obtained through the application of energy other than by hand or gravity.

Elevator, Private Residence: A private residence elevator is a power passenger elevator installed in a private residence, serving only a single family, and which has a rated load not in excess of seven hundred (700) pounds, the contract speed not in excess of fifty (50) feet per minute, a net inside platform area not in excess of twelve (12) square feet, and a rise not in excess of fifty (50) feet.

Elevator, Rope Geared Hydraulic: A rope geared hydraulic elevator is one in which the motion of the car is obtained by multiplying the travel of a piston or ram by a system of sheaves over which the hoisting ropes operate.

Elevator, Self-Service: A self-service elevator is one that is started by means of momentary pressure of push buttons at the landings, with or without push buttons in the car, and whose landing stops are automatic. An elevator shall not be deemed to be self-service if an operator has been permanently or regularly assigned to its operation.

Elevator, Sidewalk: A sidewalk elevator is an elevator the upper hatch opening of which is located either partially or wholly outside the building and which has no opening into the building at its upper terminal landing. (See Part 5).

Elevator, Signal Operation: See "SIGNAL OPERATION".

Elevator, Steam: A steam elevator is an elevator in which the motion of the car is obtained from a steam engine directly applied to the elevator machinery.

Emergency Release: An emergency release is a device the purpose of which is to make inoperative door or gate electric contacts or door interlocks in case of emergency.

Emergency Stop Switch: An emergency stop switch is a device in the car used to cut off the power from the elevator machine and brake independently of the position of the operating devices.

Escalator: A moving stairway.

Escalator, Electric: An electric escalator is one in which the motion is obtained through an electric motor directly applied to the escalator machinery.

Existing Installation: An existing installation is an elevator or moving stairway, for which a permit was issued for its erection, to increase its speed, to increase its capacity, to extend its travel, or to relocate its machine room, before the effective date of these regulations.

Hoistway: A hoistway is any opening or series of vertical openings in one or more floors of a building through which one elevator or dumbwaiter operates.

Hoistway Door or Gate: A hoistway door or gate is the hinged or sliding portion of the hoistway enclosure which closes the opening giving access to the elevator or dumbwaiter car at any landing.

Hoistway Door or Gate, Bi-Parting: A bi-parting door or gate is a vertical slide, horizontal slide, or swing door or gate consisting of two or more sections so arranged that the sections, or pairs of sections, open away from each other, and so interconnected that both sections operate simultaneously.

Hoistway Door or Gate, Full Automatic: A full automatic door or gate is a vertically-moving door or gate which is opened directly by the motion of the elevator car approaching any landing and closed by gravity as the car leaves any landing.

Hoistway Door or Gate, Manually Operated: A manually operated door or gate is a door or gate which is opened and closed by hand.

Hoistway Door or Gate Power-Operated: A power-operated door or gate is a door or gate which is opened or closed by power other than by hand, gravity, springs, or the movement of the car, and are further defined as follows:

Power-Closed Door or Gate: A power-closed door or gate is a door or gate which is manually opened and is closed by power other than by hand, gravity, springs, or the movement of the car.

Power-Opened, Self-Closing Door or Gate: A power-opened, self-closing door or gate is a door or gate which is opened by power other than by hand, gravity, springs, or the movement of the car, and is closed by energy stored during the opening operation.

Power-Operated Door or Gate, Automatically Opened: A power-operated door or gate, automatically opened, is a door or gate which is opened by power other than by hand, gravity, springs, or the movement of the car, the opening of the door being initiated by the arrival of the car at or near the landing. The closing of such door or gate may be under the control of the elevator operator or may be automatic.

Power-Operated Door or Gate, Manually Controlled: A power-operated door or gate, manually controlled, is a door or gate which is opened and closed by power other than by hand, gravity, springs, or the movement of the car, the door movement in each direction being controlled by the elevator operator.

Self-Closing Door or Gate: A self-closing door or gate is a door or gate which is opened manually and closes when released.

Semi-Automatic Door or Gate: A semi-automatic door or gate is a door or gate which is opened manually and which closes automatically as the car leaves the landing.

Hoistway Door or Gate Electric Contact: A hoistway door or gate electric contact is a device the purpose of whiich is to open the operating circuit, or an auxiliary circuit, unless the hoistway door or gate at which the car is standing is in the closed position, and thus prevent operation of the elevator by the operating devices in a direction to move the car away from the landing.

Door Unit System is a contact system which meets the requirements of the contact definition above, but does not require all the hoistway doors to be closed. **Hoistway Unit System** is a contact system which meets the requirements of the contact definition above, and also requires that all hoistway doors are closed.

Hoistway or Shaftway Enclosure: A hoistway or shaftway enclosure is any structure which separates the hoistway or shaftway, either wholly or in part, from the floors or landings through which the hoistway or shaftway extends.

Hoistway Door Interlock: A hoistway door interlock is a device, the purpose of which is:

First: To prevent the operation of the elevator machine by the operating devices in a direction to move the car away from a landing unless the hoistway door at that landing at which the car is stopping or is at rest is locked in the closed position.

Second: To prevent the opening of the hoistway door from the landing side; unless the car is at rest within the landing zone, or is coasting through the landing zone with its operating device in the stop position.

Door Unit System is an interlocking system which meets the requirements of the interlock definition above, but does not require all the hoistway doors to be locked in the closed position.

Hoistway Unit System is an interlock system which, in addition to fulfilling the requirements given under the definition of interlock, will also prevent the operation of the car by the operating devices unless all hoistway doors are locked in the closed position.

Inching Device: An inching device is a set of "up" and "down" continuous-pressure buttons located on the car arranged to permit the manual operation of the car when within the inching zone toward the landing level where the landing doors, or gates, or the car doors or gates, are not in the locked or closed position.

Inching Zone: A car is considered within the meaning of these regulations as being within the inching zone when the car is eight inches (8″) below any landing, or eight inches (8″) above any landing.

Landing, Elevator: An elevator landing is that portion of a floor, balcony, or platform used to receive and discharge passengers or freight.

Landing Zone: A car is considered, within the meaning of these regulations, as being within the landing zone when the car floor is not more than eighteen inches (18″) above or below the landing.

Leveling Device: A car-leveling device is any mechanism or control which will automatically move the car within a limited zone toward, and stop the car at the landing.

Machine, Elevator: An elevator machine is the machinery and its equipment used in raising and lowering the elevator car or platform, and are further defined as follows:

Machine, Chain Driven: A chain driven elevator machine is an elevator machine connected to a reversible motor, engine, or turbine by a chain.

Machine, Direct-Drive: A direct-drive machine is one in which the driving motor is connected directly to the driving sheave or drum with or without intermediate mechanism or gears.

Machine, Single-Belted: A single-belted elevator machine is an elevator machine connected to a reversible motor, engine, or turbine by a belt.

Machine, Double-Belted: A double-belted elevator machine is an elevator machine connected to a nonreversible prime mover by two belts through which the direction of motion is changed.

Machine, Spur-Geared: A spur-geared machine is one in which power is transmitted to the driving sheaves or drum through spur gearing.

Machine Traction: A traction machine is an elevator machine in which the motion of the car is obtained through friction between the hoisting ropes and the traction sheave.

Geared-Traction: A geared-traction machine is a traction machine which employs gearing between the electric motor and the traction sheave.

Gearless-Traction: A gearless-traction machine is a traction machine which has the traction sheave and the brake drum mounted directly on the electric motor shaft.

Machine, Winding Drum: A winding-drum machine

is an elevator machine in which the ropes are fastened to and wind on a drum.

Machine, Worm-Geared: A worm-geared machine is one in which the power is transmitted to the driving sheaves or drum through worm gearing.

Material Change: The following shall be considered material changes: (a), if the speed of an existing elevator is increased; (b), if the capacity of an existing elevator is increased; (c), if the travel of an existing elevator is extended; (d), if the machine room of an existing elevator is re-located; and (e), if the classification of an elevator is changed from freight to passenger.

Moving Stairway: A moving stairway is a moving inclined continuous stairway or runway used for raising or lowering persons.

New Installation: A new installation is any installation for which application for approval of plans or a permit for construction is filed on or after the effective date of these regulations; any installation which is re-located; any installation which is materially changed.

Non-Stop Switch, Elevator: A non-stop switch is a switch which when thrown will prevent the elevator from making hall stops and will automatically transfer these hall stop signals to the next car following, or, where no other car is provided, hold the floor stop calls registered until the elevator answers them.

Oil Buffer Stroke: The stroke of an oil buffer is the oil displacing movement of the buffer plunger or piston and does not include the travel of the buffer plunger accelerating device.

Operating Devices: The operating device is the car switch push button, or other device employed to enable the operator to actuate the controller.

Operation: Operation is the method of actuating the controller by the operating devices.

Operation, Automatic: Operation wherein the starting of the elevator is effected in response to the momentary actuation of the operating devices at the landing, and/or of operating devices in the car identified with the landings, and/or in response to an automatic starting mechanism, and wherein the car is stopped automatically at the landings.

Non-Selective Collective Automatic Operation: Non-selective collective automatic operation is automatic operation by means of one button in the car for each landing level served and one button at each landing, wherein all stops registered by the momentary pressure of landing or car buttons are made irrespective of the number of buttons pressed or of the sequence in which the buttons are pressed. With this type of operation, the car stops at all landings for which buttons have been pressed, making the stops in the order in which the landings are reached after the buttons have been pressed but irrespective of its direction of travel.

Selective Collective Automatic Operation: Selective collective automatic operation is automatic operation by means of one button in the car for each landing level served and by "up" and "down" buttons at the landings, wherein all stops registered by the momentary pressure of the car buttons are made as defined under non-selective collective automatic operation, but wherein the stops registered by the momentary pressure of the landing buttons are made in the order in which the landings are reached in each direction of travel after the buttons have been pressed. With this type of operation, all "up" landing calls are answered when the car is traveling in the "up" direction and all "down" landing calls are answered when the car is traveling in the "down" direction, except in the case of the uppermost or lowermost calls, which are answered as soon as they are reached, irrespective of the direction of travel of the car.

Single Automatic Operation: Single automatic operation is automatic operation by means of one button in the car for each landing level served and one button on each landing, so arranged that if any car or landing button has been pressed the pressure of any other car or landing operating button will have no effect

on the operation of the car until the response to the first button has been completed.

Car-Switch Operation: Car-switch operation is operation wherein the starting, direction of motion, and the stopping of the car are directly and solely under the control of the operator by means of a self-centering switch or by constant pressure buttons in the car.

Car-Switch Automatic Floor-Stop Operation: Car-switch automatic floor-stop operation is operation in which the stop is initiated by the operator from within the car with a definite reference to the landing at which it is desired to stop, after which the slowing down and stopping of the elevator is automatically effected.

Continuous Pressure Operation: Continuous pressure operation is operation by means of push buttons or switches at the landings with or without buttons in the car; any one of which may be used to control a movement of the car so long as the button or switch is manually held in the operating position.

Dual Operation: Dual operation is a system of operation whereby the controller of an automatic operation elevator is arranged so that, on the throwing of a transfer switch the starting of the car is solely under the control of an operator in the car. Landing stops may be either automatic or under the control of the operator.

Pre-Register Operation: Pre-register operation is operation in which signals to stop are registered in advance by buttons in the car and at the landings. At the proper point in the car travel the operator in the car is notified by a signal, visual, audible, or otherwise, to initiate the stop, after which the landing stop is automatic.

Signal Operation: Signal operation is operation by means of single buttons or switches, or both, in the car, and up or down direction buttons, or both, at the landings, by which pre-determined landing stops may be set up or registered for an elevator or for a group of elevators. The stops set up by the momentary pres-

sure of the car buttons are made automatically in succession as the car reaches those landings, irrespective of its direction of travel or the sequence in which the buttons are pressed. The stops set up by the momentary pressure of the up and down buttons at the landing are made automatically by the first available car in the group approaching the landing in the corresponding direction, irrespective of the sequence in which the buttons are pressed. With this type of operation, the car can be started only by means of a starting switch or button in the car.

Overhead Structure: The overhead structure is all the structure and platforms which support the elevator equipment at the top of the hoistway.

Overtravel, Bottom: Bottom overtravel of the elevator car is the distance the car floor can travel below the level of the lower terminal landing until the weight of the fully loaded car rests on the buffers, and includes the resulting buffer compression. Bottom overtravel of the counterweight is the distance the counterweight can travel below its position when the car platform is level with the upper terminal landing until the full weight of the counterweight rests on the buffers, and includes the resulting buffer compression.

Overtravel, Top: Top overtravel of the elevator car is the distance the car floor can travel above the level of the upper terminal landing until the counterweight buffer is fully compressed.

Panelboard: A single panel or a group of panel units designed for assembly in the form of a single panel; including buses, and with or without switches and/or automatic overcurrent protective devices for the control of light, heat or power circuits of small individual as well as aggregate capacity; designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front. (See "Switchboard").

Position Indicator: A position indicator is a device which indicates the position of the elevator car in the hoistway. It is called a hall position indicator when placed in the hall or a car position indicator when placed in the car.

Potential Switch, Elevator: An elevator potential switch is a magnetic-type switch which disconnects the power from the elevator apparatus when the supply voltage fails or decreases below a definite value and which is usually opened by various electrical safety devices.

Runby, Top: The top runby of the elevator car is the distance the car floor can travel above the level of the

upper terminal landing until the counterweight strikes the counterweight buffer.

Safety, Car or Counterweight: A car or counterweight safety is a mechanical device attached to the car or counterweight frame to stop and hold the car or counterweight in case of pre-determined overspeed, free fall, or through slackening of the ropes.

Safety Governor: A safety governor is a device which together with the governor safety ropes is designed to set the car or counterweight safeties at a pre-determined rate of overspeed.

Safety Plank: A safety plank is the lower structural member of the car frame which supports the car platform and includes the car safety, its actuating mechanism and the lower set of guide shoes.

Shaftway: A shaftway is any opening or series of vertical openings in one or more floors of a building through which one or more than one elevator or dumbwaiter operates.

Shaftway or Hoistway Enclosure: A shaftway or hoistway enclosure is any structure which separates the shaftway or hoistway, either wholly or in part, from the floors or landings through which the shaftway or hoistway extends.

Shutdown Device, Elevator Automatic: An elevator automatic shutdown device is one that automatically disconnects the elevator apparatus, usually the motor-generator set, after the elevator has remained stopped for a definite time interval, which time interval may be adjustable.

Signal Button, Elevator Hall: An elevator hall signal button is a push button placed in the elevator hallways, by momentary pressure of which a stop signal is registered in the car.

Signal Device, Elevator Car Flash: An elevator car flash signal device is one providing a signal light in the car, which is illuminated when approaching the landings at which hall buttons have been pressed.

Signal System, Elevator Separate: An elevator separate signal system is one providing push buttons in the hallways, which, when momentarily pressed by a person

desiring elevator service, indicate in the car where the operator is to stop, by illuminating a flash signal or operating an annunciator.

Signal Transfer Device, Elevator Automatic: An elevator automatic signal transfer device is one used with manually operated elevators, by means of which the signal is automatically transferred to the next car following, in case a car passes a set signal without making a stop.

Signal Transfer Switch: A signal transfer switch is a switch in the car which may be thrown by the operator when the car is filled or when, for some other reason, it is desirable to pass a signal, and which thereby transfers the signal to the next car approaching in the same direction.

Slack-Rope Switch, Elevator: An elevator slack-rope switch is a device for automatically cutting off the power in case the hoisting ropes become slack.

Special Retarding Device or Speed Control: A special retarding device or speed control is a slow-down device so arranged that when the elevator does not slow down to a predetermined speed when approaching a terminal landing, an emergency retarding force is applied.

Starter's Panel, Elevator: An elevator starter's panel is an assembly of devices by means of which the starter is kept informed of the condition of the elevator service. This panel is generally located in the elevator hallway on the main entrance level.

Stroke of Oil Buffer: See "OIL BUFFER STROKE."

Switchboard: A large single panel, frame, or assembly of panels, on which are mounted, on the face or back or both, switches, overcurrent and other protective devices, buses and usually instruments. Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets. (See "Panelboard")

Terminal Stopping Device, Final: A final terminal stopping device is an automatic device for stopping the car and counterweight from contract speed, within the top clearance and bottom overtravel, independently of the operation of the normal terminal stopping device and the operating device.

Terminal Stopping Device, Normal: A normal terminal stopping device is an automatic device for stopping the elevator car at or near the terminal landings, independently of the operation of the operating device

and the final terminal stopping devices.

Travel: The travel, or rise, of an elevator or dumbwaiter is the vertical distance between the bottom terminal landing and the top terminal landing.

Traveling Cable: An electric traveling cable is a cable made up of electric conductors, which provides electrical connection between the car and stationary apparatus.

Undercounter Dumbwaiter: One which has the top terminal landing located beneath a counter and which serves only this landing and the bottom terminal landing.

Waiting Passenger Indicator: A waiting passenger indicator is an indicator which shows, for a single elevator or a group of elevators, where and for which direction hall buttons have been pressed, and also indicates when these calls have been answered. This indicator is usually located at the main lobby floor where it may be seen by the starter.

PART 2.-- POWER PASSENGER AND FREIGHT ELEVATORS

10.00 SHAFTWAY ENCLOSURES

11.00 General

11.01 The shaftways of all elevators shall be enclosed throughout their height.

11.02 Where the elevator shaftway penetrates any fully enclosed solid floor above the bottom landing, the walls shall be of not less than two hour fire resistive rating, and in addition any portion of the walls exposed to automotive traffic shall be of solid masonry not less than 8" in thickness to a height of not less than four feet six inches (4' 6") above finished floor.

11.03 Where the elevator either serves only open construction floors or serves only open balcony floors within one story, the wall shall be of non-combustible materials of either solid construction or open metal construction which will reject a 2" ball, provided such open construction fronts or panels are not less than 2" from any moving equipment within the enclosure. Where less than 2" from moving equipment, open construction shall reject a 1/2" ball.

11.04 Shaftway windows shall be located only in exterior walls of the building, or in hoistway walls above the roof.

11.05 Not more than four elevators shall be installed in the same shaftway.

11.06 Dividing wall partitions which are located within an elevator shaftway shall be constructed with solid walls of not less than three-quarter hour fire resistive construction.

11.07 Where a hoistway extends into the top story of a building, fire-resistive hoistway or machinery enclosures, where required, shall be carried to the underside of the roof if the roof is of fire-resistive construction, and at least three feet (3') above the top surface of the roof if the roof is of nonfire-resistive construction.

11.08 Where shaftway enclosures are not required to continue through the roof, the top of the shaftway shall be of fire resistive construction equivalent to that required for the walls.

12.00 Machine rooms, sheave rooms and secondary levels.

12.01 Machine rooms shall be located above, below, or adjacent to any side of the shaftway.

12.02 Machine rooms located above any shaftway shall be provided with a flooring which is either above or level with the top of the machine supporting beams.

(a) Machinery spaces located above any shaftway and containing hoisting or counterweight sheaves directly over the car shall be provided with a flooring located either below the sheaves or level with the top of the sheave supporting beams. Machinery spaces located above any shaftway and containing secondary and deflecting sheaves shall be provided with a flooring if the space also contains other elevator equipment in addition to the sheaves. Where no flooring is provided beneath secondary and deflecting sheaves requiring frequent replenishment of the sheave bearing lubricant means shall be provided for lubricating the sheave bearing from the machine room.

(b) Machine room floors shall be designed to support a uniformly distributed load of not less than fifty pounds per square foot.

(c) Sheave room or secondary level floors shall be designed to support a uniformly distributed load of not less than thirty pounds per square foot.

(d) Floors shall be either of concrete construction or of open metal construction which will reject a ¾" ball.

(e) Where holes in flooring for sheaves or groups of ropes are unprotected, they shall be provided with curbing guards not less than 4" high.

(f) Machine room, sheave room and secondary level flooring shall fill the entire top of the hoistway where the cross-sectional area is 150 square feet or less. Where the cross-sectional area is greater than 150 square feet, the flooring shall either fill the entire top of the hoistway or shall extend not less than 2' beyond the general contour of the sheaves, machines, and controllers, and shall also extend to the entrance

of the room. Where this flooring does not entirely cover the top of the shaftway, all open or exposed sides of the platform shall be provided with a screened railing which is not less than 42" high and a toeguard which is not less than 4" high.

(g) Where a section of bar type or other metal cover is part of a machine room floor, it shall conform to the following requirements:

The section shall be installed in a steel frame set flush with the top of the machine room floor.

The cover shall be hinged to the steel frame and shall be equippedwith a lock and key which will lock the cover in the closed position. Such cover or grating, shall not be made removable.

Exception: 1. Floors are not required above the hoistway of elevators where the machine is located below or at the side of the hoistway and the overhead sheaves are mounted in frames at the sides of the hoistway, provided that:

There is no other equipment, such as selectors, signal machines, etc., exclusive of governors on the same level, and the sheaves are equipped with ball or roller bearings packed in lubricant; or, if they have bearings requiring frequent lubrication, means are provided to lubricate the bearings from the top of the car or the machine room.

12.03 Machine room, sheave room, and secondary level enclosures shall be constructed as follows:

(a) Where solid construction shaftways are required by these regulations, the walls shall be of not less than two hour fire resistive construction other than for doors, windows, louvres, or ventilators.

(b) Where open construction shaftways are permitted by these regulations, the walls shall be of non-combustible materials which shall be either solid construction walls, or open metal construction which will reject a 2" ball, and shall be not less than six feet (6') high.

(c) Where the machine room is located within the building and where solid construction shaftways are required by these regulations, the ceiling of each machine room shall be of not less than two hour fire resistive construction.

(d) Where an open construction hoistway is permitted, the machine room ceiling may be omitted.

12.04 Machine room walls shall be located not less than 2' from the front and not less than 2' from one side of the hoisting machine.

12.05 In the space provided for elevator machinery, the head room above the floor or platform shall be not less than the following:

(a) For elevator hoisting machines - 7' -0".

(b) For secondary sheave spaces housing machinery in addition to the sheaves - 4' -6".

(c) For secondary sheave spaces housing no machinery in addition to the sheaves, or for spaces housing other sheaves vertically over the car - 3' -6".

Machine and supporting beams may encroach on this headroom in the secondary sheave space provided there is a clearance of not less than 2' -6"

between the under side of such beams and the top of the secondary sheave level slab or grating.

(d) Means of access for the inspection, as necessary, of speed governors shall be provided from outside the hoistway, the clear opening to be not less than thirty inches (30") by thirty inches (30").

(e) When the speed governor is not accessible from outside the hoistway, a flooring or grating shall be provided.

(f) The access opening shall be provided with a self-closing door equipped with a spring lock that can be opened by hand from the inside of the hoistway. Where solid construction is required doors shall have a fire-resistive construction of not less than 1 1/2 hours. Where open construction is permitted doors shall be constructed of noncombustible material.

12.06 Exposed gears, sprockets, tape and rope sheaves, or ropes and tapes passing through the secondary levels shall be equipped with guards.

12.07 Each machine room, sheave room, or secondary level shall be electrically illuminated with lighting of not less than one foot candle at the floor level, and each such lighting circuit shall be provided with an enclosed type switch located within the room at the lock jamb of the entrance door.

12.08 All elevator machinery spaces shall be provided with ventilation to secure safe operation.

12.09 Machine rooms shall be provided with self-closing doors equipped with spring-locks that can be opened by hand from the inside of the machine room and only by key from the outside of the machine room. Where solid construction is required, doors shall have a fire resistive construction of not less than 1 1/2 hours. Where open construction is permitted, doors shall be constructed of non-combustible material.

12.10 Where the entrance to machine rooms and overhead machinery spaces is more than five feet above the adjacent floor or roof surface, and where entrance to secondary sheave levels is through openings in machine room floors and the difference in floor levels is more than 5 feet, access shall be provided by means of a metal ladder or stairway having an angle not exceeding 60° from the horizontal.

(a) Where the difference in level is over 2 feet and not over 5 feet, ladders may be vertical. Where the difference in level is 2 feet or less, no ladders or stairs are required.

(b) Inclined ladders or stairways shall be fitted with a metal handrail above all outside stringers. Vertical ladders shall be fitted with hand grips at the top.

(c) When the entrance door opens outward and is more than three feet above the adjoining roof, a metal or masonry platform shall be provided not more than eight (8) inches below the door sill.

(d) The platform shall be not less than two feet wide and shall project not less than two feet beyond the lockjamb of the door.

(e) A guard rail shall be provided at the edges of this platform. This guard rail shall be not less than forty-two (42) inches high.

12.11 Elevator machine rooms shall not be used as public thoroughfares.

12.12 All overhead machinery and sheaves shall be supported on steel beams. Controllers, motor generator sets and other auxiliary equipment may be mounted on the machine room or secondary level floor provided the floor is designed to support the imposed static load. Governors may be mounted on machine room or secondary level floors if the floor is designed to withstand the impact load resulting from the application of the car safety device. Supports for machinery and sheave beams shall be of strength to support the imposed loads and may be building walls or frames.

12.13 Loads on overhead beams and their supports shall be computed as follows:

(a) The total load on overhead beams shall be assumed as equal to the weight of all apparatus resting on the beams plus twice the maximum load suspended from the beams.

(b) The load resting on the beams shall include the complete weights of machine, sheaves, controllers, etc. The load suspended from the beams shall include the sum of the tensions of all ropes suspended from the beams.

12.14 No elevator machinery, other than the deflector or secondary sheaves or signal devices, shall be fastened to the overhead supporting beams by means of a tension connection.

12.15 Where winding-drum machines are used, a permanent beam or bar shall be provided at the top of the counterweight guides and beneath the counterweight rope sheaves to prevent the counterweights from being drawn into the sheaves. It shall be of such strength that the ropes will be pulled out of the sockets before there is failure of the beam. The bar or beam shall be located in line with the center of mass of the counterweight, or if more than one stop is used, they shall be located sym-

metrically with respect to the counterweight.

12.16 The required factor of safety for all steel overhead beams and their supports, based upon both the average ultimate strength of the material and the loads, shall be not less than five (5).

12.17 The allowable deflections of overhead beams and their supports shall be in accordance with the following:

(a) For overhead machine beams of all a.c. installations, and for d.c. installations where the car speed is over 150 f.p.m., the deflection under static load shall not exceed 1/2000 of the span.

(b) For overhead machine beams of d.c. installations, where the car speed is 150 f.p.m. or less, the deflection under static load shall not exceed 1/1666 of the span.

(c) For all overhead sheave beams the deflection under static load shall not exceed 1/1333 of the span.

(d) For overhead beams supporting the machine beams, the deflection under static load shall not exceed 1/1666 of the span.

13.00 VENTING OF HOISTWAYS

13.01 Hoistways of elevators serving more than three stories shall be provided with means for venting smoke and hot gases to the outer air in case of fire.

Exception: Hoistways not extending into the top story of a building, other than hotels, apartment houses, hospitals, and similar buildings with overnight sleeping quarters, where the hoistways are equipped with approved automatic sprinklers connected to the building water-supply system or to an approved automatic sprinkler system. (In case any question arises as to what is the best practice, work done in accordance with the requirements of NBFU Standards No. 13, entitled "Sprinkler Systems", dated June, 1953, will be considered as compliance.)

13.02 Location of Vents. Vents shall be located:

(a) In the side of the hoistway enclosure directly below the floor or floors at the top of the hoistway, and shall open directly to the outer air or through

incombustible ducts to the outer air; or,

(b) In the wall or roof of the penthouse or overhead machinery space above the roof, provided that openings of at least equivalent area are provided in the floor or floors at the top of the hoistway.

13.03 Area of Vents

The area of the vents shall be not less than three and one-half ($3\frac{1}{2}$) per cent of the area of the hoistway nor less than three (3) square feet for each elevator car, whichever is greater. Of the required vent area, not less than one-third (1/3) shall be of the permanently open type.

Exceptions: Where mechanical ventilation providing equivalent venting of the hoistway is provided in the overhead elevator machine room (see Rule 12.08), required vent area may be reduced subject to the following:

(a) The building is not a hotel, apartment house, hospital, or similar building with overnight sleeping quarters;

(b) The machine room is so located that it has no outside exposure;

(c) The hoistway does not extend to the top story of the building;

(d) The machine room exhaust fan is automatically reactivated by thermostatic means.

13.04 Closed Vents.

Closed portions of the required vent area shall consist of windows, skylights, or duct openings glazed with plain glass not more than one-eighth (1/8) inch thick.

13.05 Window and Skylight Frames and Sash..

Window and skylight frames and sash shall be of metal.

13.06 Skylight Guards.

A guard, securely anchored to the supporting structure, consisting of a wire-mesh screen of at least #13 steel wire gauge with openings which will reject a ball one (1) inch in diameter, or an expanded metal screen of equivalent strength and open area, shall be installed above every elevator skylight. A similar screen of at least #18 steel wire gauge, or of expanded metal of equivalent strength and open area, shall be installed below every elevator skylight.

13.07 All windows and window frames in fire-resistive hoistway enclosures shall be fire windows conforming to local laws and ordinances.

13.08 Exterior windows in the hoistway less than one hundred (100') above the ground or less than thirty feet (30') above an adjacent roof shall be guarded on the outside by one of the following methods:

(a) By vertical bars not less than 5/8" in diameter, or equivalent, spaced not less than 10" on centers, and not more than 10" between the window jamb and the center of the nearest bar.

(b) By metal sash having solid-section steel muntins of not less than 1/8" thickness, spaced not more than 8" apart.

14.00 Clearance and Pits

14.01 Horizontal.

(a) The clearance between a hoistway enclosure and a loading side of the car platform opposite a car opening shall not be more than the following:

Seven (7) inches where Pass Type Vertical biparting counter-balanced doors are installed wholly within the hoistway.

Five (5) inches for all others.

(b) The clearance between the sill of the car and the threshold of the landing shall be not less than three-fourths of an inch (¾″) nor more than one and one-half inches (1½″).

(c) There shall be a clearance of not less than three-fourths of an inch (¾″) between cars and the shaftway enclosures and a clearance of not less than one inch (1″) between cars and their counterweights.

(d) There shall be a clearance between elevator counterweights and the shaftways of not less than three-fourths of an inch (¾″).

(e) If two or more cars are operated in adjacent hoistways, the clearance between cars shall be not less than two inches (2″).

(f) All recesses or offsets or windows in shaftways which are opposite a car opening shall be protected by substantial curtain walls, grating or vertical bars of the fixed type. They shall be firmly secured set on a flush line with the general surface of the shaftway. The distance between the vertical members shall not exceed four inches (4″).

14.02 Vertical bottom clearances.

(a) A pit shall be provided at the bottom of every power elevator hoistway. The pit shall be of sufficient depth to contain the buffers, compensating rope sheaves (if any) and any other equipment necessary for the safe and satisfactory operation of the elevator and to provide the following minimum vertical clearances between the car and counterweight and their buffers when the car is at the bottom and top landing respectively:

Not less than 6″ where oil buffers are used or where spring buffers are used with "generator field control."

Not less than 12″ where spring buffers are used with "rheostatic control" for contract speeds of 100 f.p.m. or less.

Not less than 18″ where spring buffers are used with "rheostatic control" for car speeds of from 101 to 200 f.p.m.

(b) The floor of the pit shall be of concrete and approximately level. Where structural conditions make it essential, trenches or depressions may be provided for the installation of buffers and compensating sheaves located in the pit.

side of the car platform or between the underside of any equipment attached thereto, exclusive of the car frame channels, car safety blocks, guide shoes and any aprons or guards attached to the car sill, and the pit floor when the car rests on the fully compressed buffer shall be not less than 2 feet (2′). In measuring this clearance, the depth of any trenches or depressions in the pit floor shall not be included.

14.03 Vertical — Top Clearances.

(a) The top clearances for power passenger and freight elevators shall be as follows:

Car Clearance—When the car is at its top landing, the clear distance between the top of the crosshead of the car and the corresponding point of any obstruction or equipment in the hoistway vertically above it, shall be not less than the sum of the following four items:

The clearance between the counterweight buffer and its striker block.

The stroke of the counterweight buffer used.

Two feet.

One-half the distance required to stop the car from 115% of contract speed with a retardation of 32.2 feet per second per second. This item may be omitted if provision is made to eliminate the jump of the car at counterweight buffer engagement.

When any equipment on the car projects more than two (2) feet above the car cross-head, the minimum overhead car clearances required shall be increased by the amount which this projection exceeds two (2) feet.

Counterweight Clearance—When the car floor is level with the bottom landing, the clear distance between the top of the counterweight assembly and the corresponding point of any obstruction or equipment in the hoistway vertically above it shall be not less than the sum of the following items:

The clearance between the top of the car buffer and its striker block.

The stroke of the car buffer used.

Six (6) inches where oil buffers are used, and twelve (12) inches where spring buffers are used.

One-half the distance required to stop the car from one hundred and fifteen (115) per cent of contract speed with a retardation of thirty-two and two-tenths (32.2) feet per second per second. This item may be omitted if provision is made to eliminate the jump of the counter-weight at car-buffer engagements.

Where the car precompresses the buffer, the total stroke of the buffer minus the precompression shall be added in lieu of items 1 and 2 above.

14.04 Safe and convenient access shall be provided to all pits, and shall conform to the following:

1. Access may be by means of the lowest hoistway door or by means of a separate pit access door.

2. Access to pits extending more than four (4) feet below the sill of the pit access door shall be provided by means of fixed vertical ladders of incombustible material, located within reach of the access door. The ladder shall extend not less than thirty (30) inches above the sill of the access door, or hand-grips shall be provided to the same height.

3. Pits shall be accessible only to authorized persons.

Where a separate pit access door is provided, it shall be self-closing and provided with a spring-type lock arranged to permit the door to be opened from inside the pit without a key. Such doors shall be kept locked.

14.05 Illumination of Pits. A permanent lighting fixture shall be provided in all pits, which shall provide an illumination of not less than five (5) foot candles at the pit floor. A light switch shall be provided and shall be so located as to be accessible from the pit access door.

15.00 Hoistway Guards

15.01 Counterweight runways of power elevators located in the elevator hoistway shall be enclosed from a point twelve (12) inches above the floor of the pit to a point at least seven (7) feet above the floor of its own pit and any other pit adjacent to such counterweight runway, other than where compensating chains or ropes which practically compensate for the weight of the hoisting ropes are attached to the counterweight. In this case, counterweight enclosures shall not be required on the side facing the elevator.

15.02 Adjoining Hoistways

(a) Where two or more hoistways are located in the same shaftway and where the pit floors of adjacent elevators are located at different levels exceeding two feet, a hoistway guard extending from the floor of each higher pit to a height of not less than seven feet above the floor of such higher pit shall be provided to separate all hoistways adjoining each other. Where the difference in level is 2 feet or less, a metal railing 36" high may be installed in lieu of the guard.

15.03 Landing Sill Guards

(a) Under the following conditions, all elevator landing sills shall be guarded on the underside with smooth metal guard plates of not less than No. 14 U. S. Gage (0.078125 in.) extending the full width

of the car entrance, securely fastened in place as follows:

(b) Where a car levelling or inching device is provided and the hoistway edge of the sill is either flush with or projects into the hoistway, the guard shall have a straight vertical face extending below the sill not less than the depth of the levelling or inching zone plus 3 inches, provided that where the sill projects inward from the general line of the hoistway the bottom of the guard shall also be bevelled at an angle of not less than 75° with the horizontal or the guard shall be extended from the hoistway edge of the landing sill to the soffit of the hoistway landing door next below.

(c) Where no car levelling or inching device is provided and the sill projects inward from the general line of the hoistway, the guard shall either be bevelled at an angle of not less than 75° with the horizontal or it may have a straight vertical face extending from the hoistway edge of the landing sill to the soffit of the hoistway landing door next below.

(d) Where vertical bi-parting counterbalanced landing doors are provided, the landing sill guards may be omitted provided that, where the trucking sills of such doors project inward from the hoistway face of the door, the lower edge of the trucking sill is equipped with a guard having an angle of not less than 60° with the horizontal.

15.04 Soffits of other projections.
(a) The soffits of all other projections other than door interlocks or contacts, door operating devices, and indicator and signal devices which extend into the hoistway and which are opposite a car entrance, shall be guarded on the underside with smooth metal guard plates of not less than No. 14 U. S. Gage (0.078125 in.) having an angle of not less than seventy-five degrees (75°) with the horizontal.

15.05 Hoistway Guard shall be building walls, solid

or latticed partitions, grille work, metal gratings or expanded metal with smooth edges, as follows:

(a) Where wire grille work is used, the wire shall be not less than No. 13 Steel Wire Gage (0.0915 in. diam.) and the mesh shall be not more than two inches (2″).

(b) Where expanded metal is used, its thickness shall be not less than No. 13 U. S. Gage (0.094 in.).

(c) The spacing between bars shall be not more than two inches (2″), other than where used as "furring" material, in which case the spacing between bars or slats shall be not more than four inches (4″).

(d) Where sheet metal is used it shall be not less than No. 14 U. S. Gage.

(e) Where building walls are used, they shall be of not less than two (2) hour fire-resistive construction.

15.06 Rope Enclosures.

(a) Where ropes pass through floors on the outside of the shaftway, they shall be enclosed completely from floor to ceiling at all floors with solid enclosures of not less than two (2) hour fire-resistive construction.

16.00 Thoroughfares

16.01 If a shaftway does not extend to the lowest floor of a building, and the space under the bottom of the shaftway is used for any purpose, the following conditions shall exist:

(a) Buffers shall be provided.

(b) The cars and counterweight shall be provided with safety devices.

(c) There shall be a structure under the shaftway sufficiently strong to withstand without failure the impact of the car with contract load or the impact of the counterweight when either is descending at contract speed or at governor-tripping speed where a governor-operated safety is used.

17.00 Pipes and Wiring

17.01 No pipes, ducts, vessels, electrical conduits or

cables shall be located within an elevator shaftway or hoistway or its pit other than those used to furnish or control power, light, heat, sprinklers, communications or signals for the elevator or hoistway, or for low voltage fire detection systems for the hoistway.

17.02 The fixed electrical conductors installed in elevator or counterweight hoistway, machine room and pit shall be encased in rigid metal conduits or electrical metallic tubing. Flexible conduits or armored cables may be used between fixed conductors and limit switches, interlocks, push buttons and similar devices.

17.03 The traveling electrical conductors connecting the car to the fixed wiring in the hoistway shall have a flame retardant and moisture resistant outer cover.

17.04 Pipes, conduits and armored cables shall be securely fastened to the hoistway construction.

17.05 Pressure in steam pipes shall not exceed fifteen (15) pounds above atmospheric pressure.

17.06 No pipes, ducts or vessels conveying gases or liquids shall be discharged or vented into the hoistway or shaftway.

17.07 No part of any electric circuit having a rated system or circuit voltage in excess of two hundred and fifty (250) volts shall be used either for any operating circuit or for any control circuit or any equipment which is located in the hoistway, on the car, on the landing doors, or at the landing openings. Circuits of rated system in excess of two hundred and fifty (250) volts may be used in machine rooms for the operation of motors and for generators, provided that wiring subject to such higher voltage is thoroughly insulated from all other wiring.

17.08 All live parts of electrical apparatus in elevator hoistways shall be suitably enclosed to protect against accidental contact. Metal coverings shall be permanently grounded. All wiring for electricity shall be done in accordance with the best practice. In case any question arises as to what is the best practice, work done according to the requirements of the National Board of Fire Underwriters shall be considered as so done.

17.09 Switchboards, panelboards, and contact supports shall be of moisture-resistant and noncombustible material.

20.00 SHAFTWAY DOORS

21.00 General

21.01 All landing openings in power elevator fire-resistive shaftways shall be provided with doors, panels or fronts of not less than one and one-half (1½) hour fire-resistive construction. Where fire-resistive shaftway enclosures are not required, doors may be of open metal construction which will reject a ball two (2) inches in diameter.

21.02 All landing opening doors shall provide a clear passage of not less than six and one-half (6½) feet in height.

21.03 All shaftway doors shall be provided with interlocks.

21.04 No hardware, other than as required for interlocking, indicators, door operators, and signal devices, shall extend into the hoistway beyond the line of any landing threshold.

21.05 No emergency release system which permits the operation of the car by the operating devices when the hoistway doors are open shall be provided other than at the top landing only, where a continuous pressure key operated five pin lock type tumbler switch may be installed in the door jamb. This key shall cut out all corridor operating devices and shall permit operation only when all landing doors except the top landing door are closed and locked, and shall permit operation of the car only in a zone extending below the top landing for a distance not exceeding the height of the car cab enclosure. This key shall not be master-keyed and shall be available only to licensed elevator mechanics and inspectors.

21.06 No keys or devices shall be permitted which will unlock any landing door when the car is not within the landing zone.

21.07 Hoistway doors for passenger elevators shall be so arranged that it is not necessary to reach back of any panel, jamb, or sash to operate them.

21.08 Hangers for power-operated hoistway doors

shall be designed to withstand a downward thrust of five times the weight of the door and an upward thrust of four times the weight of the door.

21.09 Means shall be provided to prevent hangers for all sliding hoistway doors from jumping the tracks. Stops shall be either provided to prevent the hanger carriage from leaving the ends of the track or suitable stops shall be provided on the door.

21.10 Manually operated or self-closing hoistway doors of the sliding type for elevators with automatic or continuous-pressure operation shall be provided with either one or more vision panels, or a hall position indicator or a hall lantern. All swing-type hoistway doors shall be provided with vision panels. Vision panels may be provided for any type of hoistway door irrespective of the type of operation of the elevator. Where required or used, vision panels shall conform to the following requirements:

(a) The area of any single panel shall not be less than twenty-five square inches (25), and the total area of one or more panels in any hoistway door shall be not more than eighty (80) square inches.

(b) Each clear panel opening shall reject a ball six (6) inches in diameter.

(c) Panels shall be of clear wired glass.

(d) The center of the vision panel for horizontal, slide and swing type doors shall be not less than fifty-four (54) inches nor more than sixty-six (66) inches above the elevator landing. For vertical biparting counter-balanced doors, it shall be located to comply with the dimensions specified insofar as the conditions will permit.

(e) If used for power-operated hoistway doors, the wired-glass panel shall be substantially flush with the surface of the landing side of the door.

21.11 Door counterweights shall run in metal guides in such a manner that they cannot become dislodged or shall be boxed in. The bottoms of the guides or boxes shall be so constructed as to retain the counterweight if the counterweight rope breaks.

21.12 Power opened hoistway doors shall be equipped

with interlocks, operating mechanisms and control systems which are arranged to prevent the opening of all doors in the hoistway other than the door or doors which are located as follows:

(a) At that landing where the car is at rest.

(b) At that landing when the car is coasting through the landing zone with its operating device in the stop position.

(c) At that landing where the car is being moved by the car leveling devices within the landing zone.

21.13 Shaftway doors shall be arranged so that they may be opened by hand from the hoistway side unless locked "out of service". Neither the door at the main floor nor the door at the bottom landing shall be locked "out of service" when the elevator is "in service".

21.14 Where an elevator is installed in a single blind hoistway, there shall be installed in the blind portion of the hoistway an emergency door at every third (3rd) floor, but not more than forty-two (42) feet apart, conforming to the following:

1. It shall be at least thirty inches (30") wide and six feet six inches (6'6") high.

2. It shall be easily accessible and free from fixed obstructions.

3. It may be either horizontally sliding, or swinging, or vertical sliding, irrespective of the type door at the other landings.

4. If of the horizontally sliding or swinging type, it shall where the elevator has automatic operation, conform to the following:

(a) Be provided with door closers arranged to close an open door automatically if the car for any reason leaves the landing zone.

Exceptions: (1) Center opening horizontally swinging doors.

(2) The swinging portion of combination horizontally sliding and swinging type doors.

5. It shall be provided with hoistway door interlocks conforming to ELV-2, Part 2, Section 24.00.

6. Means shall not be provided or used to unlock hoistway doors from the landing side when the car is not within the landing zone.

22.00 Landing Doors for Power Passenger Elevators

22.01 No automatic fire door shall lock any landing opening in the hoistway enclosure of any passenger elevator or lock any exit leading from any hoistway landing door to the outside of the building.

22.02 Landing openings in passenger elevator shaftway enclosures shall be protected by horizontal sliding doors, combinating sliding and swinging doors, or by swinging doors.

22.03 The distance between the hoistway side of the landing door opposite the car opening and the hoistway edge of the landing threshold on elevators which can be operated only from the car shall be not more than four (4) inches. For automatic-operation elevators, the distance between the hoistway side of the hoistway door opposite the car opening and the hoistway edge of the landing threshold, shall be not more than the following:

(a) For swinging doors, one-half (1/2) inch.

(b) For sliding doors, two and one-quarter ($2\frac{1}{4}$) inches.

In no case shall the hoistway face of the hoistway door project into the hoistway beyond the edge of the landing sill. When the hoistway door consists of two or more sections, the distance specified in this paragraph

shall be measured from the section of the door nearest to the edge of the hoistway landing sill.

22.04 Hydraulic elevators shall be equipped with an anti-creep device which will bring the car back to the landing and shall conform to the requirements of Rule 15.03 and the following:

(a) It shall maintain the car within three (3) inches of the landing from any point within the interlock zone.

(b) For electro-hydraulic elevators, it shall be required to operate the car only in the up direction.

(c) For maintained pressure hydraulic elevators, it shall be required to operate the car in both directions.

(d) The car may be operated by car-levelling or inching devices conforming to Rule 31.09.

23.00 Landing Doors for Power Freight Elevators

23.01 Each landing opening in a freight elevator shaftway shall be equipped with a door set within four (4) inches of the face of the landing threshold.

Bi-parting counterbalanced doors shall have the lower edge of the upper door section provided with a fire-resistive, non-shearing, non-crushing member to provide a spacing of not less than three-quarters inch (3/4") between the rigid members of the door sections when closed.

Any rigid astragal, locking or latching device overlapping the meeting edge is prohibited.

23.02 Landing doors may be horizontally or vertically sliding, counter-balanced vertically sliding, combination sliding and swinging or swinging type.

23.03 If vertical bi-parting counter-balanced doors are power-operated, the landing door shall not start to close until after the car gate is within twelve (12) inches of full closure, and, on opening, the car gate shall not start to open until the landing door is within twelve (12) inches of its full open position.

23.04 Pull Straps on Manually-Operated Vertically-Sliding Bi-Parting Counterbalanced Hoistway Doors

Manually-operated vertically sliding bi-parting counterbalanced hoistway doors of elevators which can be operated from the landings shall be provided with pull straps on the inside and outside of the door and shall be located at the lower edge of the upper door section.

The length of the straps shall conform to the following:

1. The bottom of the straps shall be not more than six feet (6') above the floor when the door is in the fully-opened position.

2. The length of the straps shall not be extended by means of ropes or other materials.

3. The length of pull straps where provided on such doors of elevators which can be operated from the car only shall conform to the requirements specified.

23.05 Single or multisection vertically-sliding doors and vertically-sliding bi-parting counterbalanced doors shall be so counterbalanced that they will not open by gravity. Fastenings shall be provided to prevent the detachment or dislodgment of the counterbalancing weights of doors. Suspension means and their connections for vertically-sliding bi-parting doors and for counterweights of vertically-sliding counterweighted doors shall have a safety factor of not less than five (5).

24.00 Shaftway Door Interlocks

24.01 Interlocks shall be arranged to prevent the operation of the elevator machine by the operating devices in a direction to move the car away from the landing unless all hoistway doors are both closed and locked in the closed position; and the interlock shall not be required to prevent the movement of the car by inching or levelling devices with the shaftway door open.

24.02 The interlock shall prevent the opening of the shaftway door from the landing side unless the car either is at rest within the landing zone or coasting through the landing zone with its operating devices in the stop position.

24.03 For automatic operation or continuous-pressure operation, the hoistway door shall not be considered in the closed position until the door is within three-eighths (3/8ths) inch of the nearest face of the door jamb; or, in the case of bi-parting doors, either three eighths (3/8ths) inch of contact with each other when horizontal sliding doors are used.

24.04 For power elevators where the hoistway door is not equipped with a door closer, the door shall be considered in the closed position only when the door is within three-eighths (⅜ths) inch of the nearest face of the door jamb; or, in the case of bi-parting doors, either three-eighths (⅜ths) inch of contact with each other when horizontal sliding doors are used; or two (2) inches of contact with each other when vertical sliding doors are used, and the upper sections of the vertical sliding bi-parting doors are equipped with astragals which close the opening between the door section when the interlock circuit is closed.

24.05 Where the hoistway door of an elevator requiring the presence of an operator in the car is equipped with a door closer, the door shall be considered to be in the closed position and the car may be started when the door is within four (4) inches of the nearest face of the jamb; or, in the case of a bi-parting door, when the sections are within four (4) inches of contact of each other, if at this position and any other up to the closed position the door cannot be opened from the landing side more than four (4) inches from the jamb, or the sections more than four (4) inches from each other in the case of a bi-parting door.

24.06 All interlocks for all shaftway doors shall be so designed that the door is locked in the closed position (as defined in paragraphs 24.03, 24.04, and 24.05 immediately preceding) before the car can be operated by the operating devices. Devices employing locks and contacts of a type in which the interlocking contact is made when the door is closed and the locking of the door takes place subsequently, are not interlocks and are not permitted where interlocks are required under these regulations.

24.07 Interlock contacts shall open the operating circuit and shall be positively opened by the locking member. They shall be maintained in the open position

by the action of gravity or a restrained compression spring or both, or by means of a positive linkage. The interlock shall hold the door in the locked position by means of gravity or a restrained spring or by both.

24.08 Each type and make of door interlock shall be tested and approved on the basis of tests conforming to the best engineering practice made by or under the supervision of a competent designated laboratory. Minor changes in design may be made without re-testing, subject to the approval of either the enforcing authority or the testing laboratory. In case any question arises as to what is the best engineering practice, tests conforming to the American Standard Safety Code for Elevators (No. A17) shall be considered as conforming thereto.

24.09 Approved interlocks shall be suitably and plainly marked for identification, the marking to be permanent and so placed as to be readily visible when the interlock is mounted in position. Only one identification marking is required, which shall include the following:

(a) Manufacturer's name or trademark;
(b) Type of style letter or number;
(c) Rated voltage.

24.10 The car cam used to actuate any particular interlock shall exert a force at least double the average force, and shall have a movement at least one-half (1/2) inch in excess of the average movement, as given in the test certificate for that interlock.

24.11 On all vertical bi-parting doors, means shall be provided to prevent the closing of the interlock circuit by hand when the doors are in the open position.

24.12 No electrically released, gravity or spring applied rope gripper or rope-lock shall be used as a component device in any interlock system.

24.13 Where required, interlocks, or combination mechanical locks and electric contacts, or electric contacts, and the wiring, shall be so located that they are not accessible from the landing side when the hoistway doors are closed.

25.00 Landings for Power Passenger and Freight Elevators

25.01 The landing threshold shall be constructed and maintained so that persons will not readily slip thereon.

25.02 If there is a railroad track upon any elevator

landing, the tops of the rails shall be flush with the floor for a distance of six feet (6′) from the threshold.

25.03 When the car of a power elevator is "in service" at the landing, the landing edges of the threshold and car platform shall be plainly visible. The illumination on the landing threshold shall be not less than one foot (1′) candle.

30.00 CARS

31.00 Car Construction

31.01 Car suspension frames and platform frames of passenger and freight elevators, and platform stringers of freight elevators shall be constructed of steel meeting not less than the requirements of specification A7 of the ASTM.

31.02 The stresses of rolled steel sections or annealed cast steel used in the construction of car frames and platforms based on the static load imposed on them, including the weight of the unloaded car and the maximum rated carrying capacity, shall not exceed the values given in Table (I) for passenger cars and Table (II) for freight cars.

TABLE I. ALLOWABLE STRESSES FOR PASSENGER CAR-FRAME AND PLATFORM MEMBERS

Loading	*Maximum Allowable Stress (lb. per sq. in.)*	*Basis*
Tension	10,000	Net area
Bending	10,000	Gross section
Shear on Shop Rivets	8,000	Net area
Bearing on Shop Rivets	16,000	Net area
Shear on bolts in clearance holes	7,000	Gross section
Bearing on bolts in clearance holes	14,000	Gross section
Bolts or threaded portions of rods in tension	6,000	Net area
Compression	11,700—49L/R	Gross area

L = effective free length of member in inches

R = least radius of gyration in inches

TABLE II.....ALLOWABLE STRESSES FOR FREIGHT CAR-FRAME AND PLATFORM MEMBERS

Loading	*Maximum Allowable Stress (lb. per sq. in.)*	*Basis*
Tension	12,000	Net area
Bending of car frame member and platform framing at entrance	12,000	Gross section
Bending of platform stringers	15,000	Gross section
Shear on shop rivets	9,500	Net area
Bearing on shop rivets	19,000	Net area
Shear on bolts in clearance holes	8,000	Gross section
Bearing on bolts in clearance holes	16,000	Gross section
Bolts or threaded portions of rods in tension	8,000	Net area
Compression	14,000 59 L/R	Gross area

L = effective free length of member in inches
R = least radius of gyration in inches

The stresses tabulated above are based on steels having an ultimate strength from 55,000 to 65,000 lbs. per sq. inch for rolled sections or cast steel and 46,000 to 56,000 lbs. per sq. inch for rivets. For steels of greater ultimate strength, the allowable stresses may be increased proportionately.

31.03 No cast iron shall be used in the construction of any member of the car frame or platform subject to tension or bending. Cast iron may be used for compensating cable anchorages, releasing carriers and guide-shoe stands.

31.04 The deflection of crosshead and safety plank shall not exceed one-eighth inch (⅛″) in each ten feet (10′) of span under static conditions with contract load substantially uniformly distributed over the car platform.

31.05 The slenderness ratio L/R for members not normally subject to compression shall not exceed 250; for members normally subject to compression this ratio shall not exceed 120. Loading resulting from buffer and safety operation shall not be considered normal loading.

31.06 No glass shall be used in elevator cars except to cover certificates, lighting fixtures, vision panels, and appliances necessary for the operation of the car.

31.07 There shall be no obstructions or projections in the car floor.

31.08 Where platform floors are constructed of wood or other combustible materials they shall be covered on the underside with sheet metal of not less than No. 27 U. S. Gage thickness.

31.09 Elevators provided with car levelling or inching devices shall have their platforms provided with a metal guard not less than No. 16 U. S. Gage in thickness. This guard shall extend horizontally the full width of the car entrance and vertically below the car floor for not less than the depth of the levelling or inching zone plus three (3) inches. The lower edge of the guard shall be beveled at an angle of not less than seventy (70) degrees with the horizontal.

31.10 The requirements for loading classifications will be found in Appendix A. Satisfaction as to compliance will be evidenced by the manufacturer's certificate.

32.00 Car Enclosures

32.01 General

(a) Each power passenger or freight elevator car shall be fully enclosed on top and at all sides other than above the top of a power freight elevator car gate.

(b) The car enclosure shall be secured to the car platform and sling in such a manner that it cannot work loose or become displaced in ordinary service.

(c) No part of a car enclosure shall deflect either so as to reduce the minimum clearances specified in Section 14.00 or more than one (1) inch when subjected to any single horizontally applied force of seventy-five (75) pounds.

(d) Means for ventilating shall be provided for all cars with solid enclosures and solid doors.

(e) No elevator shall have more than two entrances.

(f) No elevator shall have more than one compartment.

32.02 Power Passenger Elevator Car Enclosures, Sides and Top.

(a) Power passenger elevator car enclosures shall be either of metal, fire-retardant wood or equally fire-retardant materials provided that untreated wood

or materials of equivalent combustible characteristics may be used if covered with sheet metal not less than No. 27 U. S. Gage (0.0172 inch) or equivalent approved non-combustible material applied directly to all exterior surfaces of the enclosure. Thin finishes or linings of materials not more than one-twentieth (1/20th) inch in thickness, having no greater fire hazard than paper and securely bonded to non-combustible panels, shall be permitted on the interior of the car.

(b) Openings in an enclosure, other than as required for entrance, vision panels, emergency exit, and ventilation, are prohibited.

(c) Ventilating openings less than seven (7) feet above the car platform shall reject a ball two (2) inches in diameter.

(d) No cast iron shall be used for car tops.

32.03 Power Passenger Elevator Car Emergency Exits

(a) Each power passenger elevator car shall be provided with an emergency exit in the top of the car.

(b) In addition to the top emergency exit, whenever there is an adjacent elevator which is not more than two feet six inches (2'6") away and without intervening hoistway partitions, counterweights, or similar obstruction, a side emergency exit shall be provided in each car to permit emergency passage to each adjacent car.

(c) Top emergency exit panels shall:

be not less than four hundred (400) sq. inches in area;

measure not less than sixteen inches (16") on any one side;

be held in place by thumb screws arranged so that the exit covers may be opened from both the inside and the topside of the car;

be arranged to open outwardly;

be arranged so that no equipment mounted above the car top interferes with proper access to the emergency exit.

(d) Side emergency exit panels shall:

be of the hinged type,

open only into the car,

be not less than sixteen inches (16″) in width,

be extended from the floor or base moulding up to the soffit moulding and in no case less than five feet (5′) in height,

be located where passage of persons is not obstructed by car frame members or by fixed hoistway equipment,

be provided with a lock arranged so that the door may be opened from the inside of the car by means of a removable key and from the outside of the car by means of a non-removable handle. Keys shall be located as follows:

for automatic operation elevators in a receptacle with a transparent breakable cover suitably marked and located at the landing of each elevator or group of elevators that is nearest the main entrance to the building; for elevators having other types of operation, in the car.

be provided with an electric contact which shall prevent the operation of the car by the operating devices when the panel is open on all automatic-operation or continuous pressure operation elevators which may be operated from both the car and the landings.

32.04 Power Passenger Elevator Car Doors.

(a) Cars of passenger elevators which can be operated from the car only and cars of automatic operation passenger elevators shall be provided with a horizontal door or horizontal gate at each entrance as follows:

Elevators installed in new hoistways shall be provided with horizontal car doors.

Elevators installed in existing hoistways where space conditions do not permit the installation of car doors may be provided with horizontal gates.

(b) The car door or gate when closed shall guard the full opening, and each door or gate shall be

provided with a car door or gate electric contact. Car gates where permitted shall be of a design which will reject a ball three (3) inches in diameter and shall be so guided top and bottom and of such strength as not to deflect past the line of the car sill when subjected to a force of one hundred (100) pounds applied horizontally at any point. Collapsible type power gates shall not be power opened for a space in excess of nine (9) inches from full closure.

(c) Car doors for passenger elevators, employing a type of operation which does not require the presence of an operator in the car and which are closed by power other than by hand, shall be driven by a mechanism so designed and set that the force necessary to prevent the closing of the door shall not exceed thirty (30) lbs. The kinetic energy of the door plus all parts connected rigidly thereto, computed for the average closing speed, shall not exceed five (5) foot-pounds. Where the same mechanism also closes the hoistway door, the total kinetic energy shall not exceed seven (7) foot-pounds.

(d) Automatic-operation passenger elevators in multiple dwellings (apartment houses) and hospitals, equipped with horizontal sliding type landing and car doors, closed by power other than by hand, shall have the car doors equipped with a safety edge, or equivalent device, arranged to re-open the car and landing doors if the closing of the car doors is obstructed.

(e) For automatic-operation passenger elevators having power closed or automatically released, self-closing car doors and manually closed or self-closing hoistway doors, the closing of the car door shall be delayed until the hoistway door is in the closed position.

(f) Each car door for power passenger elevators may be provided with wired glass panels not to exceed a width of six (6) inches and a height of twenty-four (24) inches.

(g) Sliding car doors shall operate in guides.

(h) Hangers for power-operated car doors shall be designed to withstand a downward thrust of five (5) times, and an upward thrust of four (4) times, the weight of the door.

(i) Each car door or gate shall be provided with a car door or gate electric contact.

32.05 Power Freight Elevator Car Enclosure Sides and Top.

(a) Freight elevator car sides shall be of solid metal construction to a height of not less than six (6) feet above the car platform. Above six (6) feet, car sides other than that section opposite a counterweight shall be extended to the car top or crosshead and shall be of solid metal construction or of perforated metal or of wire mesh not less than No. 13 Steel Wire Gage construction which will reject a ball one and one-half (1½) inches in diameter. The section of the car enclosure opposite a counterweight shall be extended to the car top or crosshead and shall be of solid metal construction.

(b) Each freight elevator car top shall be of solid construction, or open metal construction which will

reject a ball one and one half (1½) inches in diameter, capable of sustaining a load of three hundred (300) pounds on any square area of two (2) feet on each side or one hundred and fifty (150) pounds applied on any spot.

(c) Where sheet metal is used, it shall be equal in strength and stiffness to not less than No. 14 U. S. gage sheet metal (0.078 inch).

(d) The front section of each freight elevator car top shall be hinged along a line not less than eighteen (18) inches from the front of the car or an emergency top exit shall be provided.

32.06. Power Freight Elevator Car Doors or Gates.
(a) A car door or gate shall be provided at each entrance to power elevator freight cars.

(b) Each door or gate shall be provided with a car-door or gate electric contact, or with an interlock.
(c) Car gates for freight elevators when closed shall guard the full width of the opening, and they shall be not less than six (6) feet high.

(d) If vertical bi-parting counterbalanced doors are power operated, the landing door shall not start to close until after the car gate is within twelve (12) inches of full closure, and, on opening, the car gate shall not start to open until the landing door is within twelve (12) inches of its full open position.

(e) Collapsible gates when fully expanded shall reject a ball four and one-half (4½) inches in diameter. Vertical lifting type car gates shall be of a design to reject a ball two inches (2″) in diameter.

A gate made in two or more parts which slide or telescope by each other in the same direction may be used if the gate is solid or if the openings are three-eighths inches (3/8") square or smaller, and if the edges of adjacent parts of the gate always lap so that the danger of injury due to shear is eliminated.

(f) A weight used to close automatically or counterbalance a car door or gate shall run in metal guides from which it cannot become dislodged, or it shall be boxed in. The bottoms of the guides and boxes shall be so constructed as to retain the weight if the suspension member breaks.

(g) Sliding car doors for power freight elevators may be solid, may be provided with open grille or

bars which shall reject a ball two (2) inches in diameter, and may be provided with glass vision panels. Grilles or bars may extend the full height of the door panel.

(h) Sliding car doors or gates shall operate in guides.

(i) Hangers for power operated car doors shall be designed to withstand a downward thrust of five (5) times, and an upward thrust of four (4) times, the weight of the door.

32.07 Location of Power Passenger and Power Freight Car Doors and Gates.

Doors or gates for automatic or continuous-pressure operation elevators shall be so located that the distance from the face of the car door or gate to the face of the hoistway door shall be not more than the following:

(a) Where a swinging-type hoistway door and a car gate are used - four inches (4").

(b) Where a swinging-type hoistway door and a car door are used - five and one-half inches (5 1/2").

(c) Where a sliding-type hoistway door and a car gate or door are used - five and one-half inches (5 1/2").

The distance specified shall be measured as follows:

(a) Where multi-section car and hoistway sliding doors are used, or where one of these doors is multi-section and the other is single-section, between the section of the two doors nearest to each other.

(b) Where a multi-section car door and a swinging-type hoistway door are used, between the hoistway door and the section of the car door farthest from it.

(c) Where a car gate is used, between the car gate and that section of the hoistway door nearest to the car gate.

Rule 32.08. Power Elevator Car Door or Gate Electric Contact.

(a) The electric contact of the car door or gate, other than when the car is being operated by inching or levelling devices, shall prevent the operation of the car by the operating devices unless the door or gate is in the closed position.

(b) Horizontal sliding type doors or gates shall be considered in the closed position when the clear open space between the edge of a door or gate and the nearest face of the jamb does not exceed two (2) inches. Where the car gate is the vertical slide type, the gate shall be considered in the closed position when the lower horizontal member of the gate is not more than three (3) inches above the car sill. Where the car door or gate of an elevator that can be operated from the car only is provided with a door closer, the electric contact on the car door or gate may permit the starting of the car when the clear open space does not exceed four (4) inches.

(c) The car door or gate contact shall be located so that it is not normally accessible to a person standing on the car platform.

(d) Car door or gate contacts shall open the operating circuit and shall be positively opened by a lever or other device attached to and operated by the door or gate. Contacts shall be maintained in the open position by gravity or a restrained spring or both, or by means of a positive linkage.

(e) Each type and make of contact shall be tested

and approved on the basis of tests conforming to the best engineering practice made by or under the supervision of a competent designated laboratory. Minor changes in design may be made without re-testing, subject to the approval of either the enforcing authority or the testing laboratory. In case any question arises as to what is the best engineering practice, tests conforming to the American Standards Safety Code for Elevators (No. A17) shall be considered as conforming thereto. Such contacts shall be suitably marked for identification.

33.00 Capacity and Loading

33.01 Contract Load of Passenger Elevators.

(a) For passenger elevators having platform areas not exceeding fifty square feet (50 sq. ft.) the contract load shall be not less than determined by the following formula:

$$L = .667A^2 + 66.7A$$

(b) For platform areas exceeding fifty square feet (50 sq. ft.), the contract load shall be not less than:

$$L = .0467A^2 + 125A - 1367$$

where L = Contract load in pounds
and A = net inside area of car in square feet.

(c) Table below shows the maximum net inside car areas for various contract loads:

Duty Load	Net Car Area	Duty Load	Net Car Area
500	7.00	4500	46.2
600	8.3	5000	50.
700	9.6	6000	57.7
1000	13.25	7000	65.3
1200	15.6	8000	72.9
1500	18.9	9000	80.5
1800	22.1	10000	88.0
2000	24.2	12000	103.0
2500	29.1	15000	125.1
3000	33.7	18000	146.9
3500	38.0	20000	161.2
4000	42.2	25000	196.5

33.02 Capacity Plate and Signs for Passenger and Freight Elevators.

(a) In each passenger elevator car, a metal plate

shall be provided which shall be fastened in a conspicuous place and shall bear the following information in not less than one-quarter (1/4) inch letters or figures stamped in, etched, or raised on the surface of the plate:

CAPACITY (X) POUNDS

The contract load of the elevator in pounds shall be inserted in space (X) above.

(b) In each freight elevator car, the capacity shall be indicated in a conspicuous place in letters and figures not less than one (1) inch high, by the word "CAPACITY", followed by figures giving the contract load in pounds.

(c) Upon the crosshead of each power elevator car, a metal plate shall be placed, bearing the following information:

The weight of the complete car, including the safeties;
The contract car speed in feet per minute at which the elevator is designed to travel;
The number, diameter in inches, and the rated ultimate strength in pounds of wire ropes.

(d) In every freight elevator a sign shall be posted with one of the following markings:

(1) THIS ELEVATOR DESIGNED FOR GENERAL FREIGHT LOADING.
(2) THIS ELEVATOR DESIGNED FOR MOTOR VEHICLE LOADING.
(3) THIS ELEVATOR DESIGNED FOR INDUSTRIAL TRUCK LOADING.

Sign plates shall be of metal and letters shall be not less than one-half (1/2) inch and stamped in, etched, or raised on the surface of the plate.

33.03 Minimum Load for Freight Elevators

(a) Minimum Load Permitted.

The minimum load for freight elevators in pounds shall be based on the weight and class of the load to be handled, but shall in no case be less than the minimum specified in Rule 33.03 (b) for each class of loading based on the inside net platform area.

(b) Classes of Loading.

Freight elevators shall be designed for one of the following classes of loading:

1. Class A - General Freight Loading.

Where the load is distributed, the weight of any single piece of freight or of any single hand truck

and its load is not more than one-quarter (1/4) the rated load of the elevator, and the load is handled on and off the car platform manually or by means of hand trucks.

For this class of loading, the rated load shall be based on not less than fifty (50) pounds per square foot of inside net platform area.

2. Class B - Motor Vehicle Loading.

Where the elevator is used solely to carry automobile trucks or passenger automobiles up to the rated capacity of the elevator.

For this class of loading, the rated load shall be based on not less than thirty (30) pounds per square foot of inside net platform area.

3. Class C - Industrial Truck Loading.

Where the load is carried in transit by, or is handled on and off the car platform by means of industrial power trucks or by hand trucks having a loaded weight more than one-quarter (1/4) the rated load of the elevator.

For this class of loading the following requirements shall apply:

a. The rated load shall be based on not less than fifty (50) pounds per square foot of inside net platform area.
b. The weight of the loaded industrial truck shall not exceed the rated load of the elevator.
c. The weight of the industrial truck plus any other material carried on the elevator shall not exceed the rated load when the industrial truck is also carried.
d. During loading and unloading, the load on the elevator shall in no case exceed one hundred and fifty (150) per cent of the rated load, and where this load exceeds the rated load, the capacity of the brake and the traction relation shall be adequate to safely sustain at least one hundred and fifty (150) per cent of the rated load.

NOTE: When the entire rated load is placed on the elevator by the industrial truck in increments, the load imposed on the car platform while the last increment is being loaded or the first increment unloaded will exceed the rated load by the weight of the empty industrial truck.

33.04 Employees and Emergency Loading of Freight Elevators

(a) It shall be allowable at stated hours to carry employees, but not the general public, on a freight elevator, provided that the freight elevator conforms to the load-carrying requirements for passenger elevators (Sec. 33.00 ELV-2) and a special permit is granted by the enforcing authority subject to the following:

Car-switch operated elevators and continuous-pressure operated elevators shall be in charge of a licensed operator when used to carry employees at stated hours.

Stated hours shall be determined by the enforcing authority.

(b) It shall be allowable to carry passengers on a freight elevator under emergency conditions, equal in number to the contract load divided by one hundred and fifty (150).

33.05 Safe Lift Devices

(a) When power freight elevators are used for carrying safes or other one-piece loads greater than the contract load of the elevator, and when power passenger elevators are used for carrying concentrated loads greater than seventy-five (75) per cent of the contract load of the elevator, the requirements of (b) to (i), inclusive, of this section shall be complied with:

(b) A locking device shall be provided which will hold the car at any landing independently of the

hoisting ropes while the safe or other object is being loaded or unloaded.

(c) The locking device shall be so designed that it cannot be unlocked unless the entire weight of the car and load is suspended on the ropes.

(d) The wrench or other device for operating the locking device shall be removable.

(e) The locking device shall be designed to withdraw the bars should it come in contact with the landing locks if the car is operated on the up motion.

(f) A metal plate shall be provided in the elevator car which shall bear the words "Capacity Lifting Safes" in letters followed by figures giving the capacity in pounds for lifting safes for which the machine is designed, the letters and figures to be no less than one-quarter ($\frac{1}{4}$) inch high, stamped, etched, or raised on the surface of the plate.

(g) The car platform, car frame, sheaves, shafts, ropes, and locking device shall be designed for the specified "Capacity Lifting Safes" with a factor of safety of not less than five (5).

(h) The car safeties shall be designed to stop and hold the specified "Capacity Lifting Safes" with the ropes intact.

(i) Where there is a passageway under the hoistway, the machine shall be designed to operate with the "Capacity Lifting Safes" at slow speed and the car safety shall be designed to stop and hold the car and "Capacity Lifting Safes" independently of the ropes.

33.06 Operating Switch Location

(a) All elevator machines equipped for carrying safes or other one-piece loads greater than the contract load of the elevator shall be provided with a special car switch near the machine for operating under such conditions.

34.00 Car and Counterweight Safeties and Speed Governors

34.01 Power elevators suspended by ropes shall be provided with car safeties installed in or on a safety

plank located beneath the car platform. Where multiple-type safeties are installed, one such safety shall be located in or on the safety plank located beneath the car platform. The safety or safeties shall be capable of stopping and sustaining the car with contract load.

(a) The application of the safety shall not cause the car platform to become out of level in excess of one-half (½) inch per foot, measured in any direction.

(b) When the car safety is applied, no decrease in the tension of the governor rope or motion of the car in the descending direction shall release the car safety.

(c) It is permissible to release the safety by reversing the direction of the motion of the machine.

(d) Car safeties shall be operated by speed governors.

(e) Jaws and other parts of safeties of the sliding type, if made of forged steel of an ultimate strength of not less than 55,000 lbs. per sq. in. and cast steel of an ultimate strength of not less than 65,000 lbs. per sq. in., may, in action, be stressed to 17,000 lbs. per sq. in. For steels of greater strength the allowable stresses may be increased proportionately based on ultimate strength.

(f) Bearings for safety drums and screw-shafts shall be of non-ferrous material.

(g) Where two (duplex) safeties are provided, the lower safety device shall be capable of developing not less than one-half (1/2) of the force required to stop the entire car with rated load. Duplexed safety devices shall be arranged so as to function approximately simultaneously.

Type A or Type C safety devices (see Rule 34.19) shall not be used in multiple (duplexed).

(h) Type B safeties shall stop the car with its rated load from governor tripping speed within the range of the stopping distances shown by Table No. 34.01 (1).

Table No. 34.01 (i)

Maximum and Minimum Stopping Distances

Type B Car Safeties With Rated Load, and of Type B Counterweight Safeties

Rated Speed in Feet Per Minute	Maximum Governor Trip Speed in Feet Per Minute	Stopping Distances in Feet-Inches	
		Minimum	Maximum
0 to 125	175	0-6	1-3
150	210	0-6	1-4
175	250	0-8	1-7
200	280	0-9	1-10
225	308	0-10	2-0
250	337	0-11	2-3
300	395	1-1	2-9
350	452	1-3	3-4
400	510	1-6	4-0
450	568	1-9	4-10
500	625	2-1	5-8
600	740	2-9	7-7
700	855	3-7	9-10
800	970	4-6	12-6
900	1085	5-5	15-3
1000	1200	6-8	18-6
1100	1320	7-11	22-4
1200	1440	9-4	26-4
1300	1560	10-11	30-11
1400	1680	12-7	35-7
1500	1800	14-5	40-10

(j) Counterweight safeties where furnished shall conform to the requirements for car safeties except where otherwise specified.

Exceptions:

1. Where otherwise specified in Rule 34.03.
2. For rated speeds of not over one hundred twenty-five (125) feet per minute counterweight safeties may be operated as the result of breaking or slackening of the hoisting ropes and may be of the inertia or other approved type without governors. (See Rule 34.03)

(k) Safeties shall be so designed that on their application the forces which provide the stopping action shall be compressive forces on each side of the guide-rail section.

Rule 34.02 -

Speed governors for car safeties shall be set to trip at overspeeds as follows:

1. At not less than one hundred and fifteen (115) per cent of rated speed.
2. At not more than the tripping speed listed opposite the applicable rated speed in Table No. 34.02 (a).

(a) (The following Table No. 34.02 (a) is new.)

Table No. 34.02 (a)

Maximum Speeds at Which Speed Governor Trips and Governor Overspeed Switch Operates

Rated Speed in Feet Per Minute	Maximum Governor Trip Speed in Feet Per Minute	Maximum Speed at Which Governor Overspeed Switch Operates, Down Feet Per Minute
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
700	855	812
800	970	921
900	1085	1031
1000	1200	1140
1100	1320	1254
1200	1440	1368
1300	1560	1482
1400	1680	1596
1500	1800	1710

*Governor Overspeed Switch Not Required

Rule 34.03 -

The counterweight safety, where required, shall be operated by a separate speed governor. Provision shall be made to cause the application of the counterweight safety at a speed greater than that at which the car safety is applied, but not more than ten per cent (10%) above that speed. Broken rope safeties of the instantaneous type may be used on counterweights within the limits of the following:-

Contract Speed	Total Weight of Counterweight
250 fpm	2000 lbs.
200 fpm	3000 lbs.
160 fpm	4000 lbs.
125 fpm	5000 lbs.

Exception: Speed governors are not required for the operation of counterweight safeties having a rated speed of not more than one hundred twenty-five (125) feet per minute.

Every car safety shall be provided with a switch operated by the car safety mechanism. This switch shall conform to the requirements of Rule 34. 10.

34.04 Car safeties shall be either of the instantaneous type or shall be of the sliding type which will bring the car to a stop or within the limits of the retardation hereinafter specified. Instantaneous type car safeties shall not be used for contract speeds exceeding 125 F.P.M.

34.05 The distance between the safety jaws shall not be less than the thickness of the guide rail plus three thirty-seconds (3/32) of an inch and the jaws shall not drag against the rail. Where roller or other types of guide shoes are used arranged with springs or other means which provide for a definite and limited movement of the car or counterweight with respect to the guide rails, minimum clearance specified shall be increased by an amount sufficient to prevent the safety jaws from coming in contact with the guide rails should the maximum car movement permitted by the guide shoes occur.

34.06 Safeties shall be marked by the manufacturer with the range of weight and speed for which they are designed; said weight to include the complete car structure, the safety, the contract load in the car, and all moving equipment the weight of which is borne by the safety.

34.07 Overspeed instantaneous safeties shall be applied by the governor. On the parting of the hoisting ropes governor applied instantaneous safeties shall apply instantly and independently of the speed action of the governor.

34.08 No safety shall be permitted for stopping an ascending car. or counterweights

34.09 The governor shall be located where it cannot be struck by the car in case of overtravel and where

there is sufficient space for full movement of governor parts.

34.10 **A switch shall be provided on the speed governor and operated by the overspeed action of the governor when used with Type B and C car safeties of elevators having a rated speed exceeding one hundred and twenty-five (125) feet per minute, and when used with counterweight safeties.**

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.

(a) The setting of the car speed-governor overspeed switch shall conform to the following:

1. **For rated speeds more than one hundred and twenty-five (125) feet per minute, up to and including five hundred (500) feet per minute, the car speed-governor overspeed switch shall open in the down direction of the elevator at not more than ninety (90) per cent of the speed at which the governor is set to trip in the down direction.**
2. **For rated speeds more than five hundred (500) feet per minute, the car speed-governor overspeed switch shall open in the down direction of the elevator at not more than ninety-five (95) per cent of the speed at which the governor is set to trip in the down direction.**
3. **The switch, when set as specified in either subdivision 1 or 2 of this rule, shall open in the up direction at not more than one hundred (100) per cent of the speed at which the governor is set to trip in the down direction.**

Exception: The speed-governor overspeed switch may be set to open in the down direction of the elevator at not more than one hundred (100) per cent of the speed at which the governor is set to trip in the down direction, subject to the following requirements:

(1) A speed-reducing switch of the manually reset type is provided on the governor which will reduce the speed of the elevator in case of overspeed, and which shall be set to open as specified in 1 and 2 above.

(2) Subsequent to the first stop of the car following the opening of the speed-reducing switch, the car shall remain inoperative until the switch is manually reset.

(b) Switches used to perform the functions specified shall be positively opened. Overspeed and speed-reducing switches, permitted by the exception to Rule 34.10 (a), operated by the speed governor shall remain in the open position until manually reset. Switches operated by the car safety mechanism shall be of a type which will not reset unless the car safety mechanism has been returned to the off position.

34.11 The size, material, and construction of the governor rope, together with the rated tripping speed of the governor, shall be stamped on the governor stand or given on a brass plate attached to it in letters not less than one-quarter (¼) inch in height.

34.12 The arc of contact between the governor rope and the driving sheave shall, in conjunction with a tension device, provide sufficient traction to cause proper operation of the governor.

(a) The minimum length of governor jaws shall be such that no serious cutting, tearing, or deformation of the rope shall result from the operation of the safety.

(b) Governor jaws for sliding type safeties shall be so designed that the rope will pull through these jaws on the application of a stress exceeding that required to operate the safety so as to stop the car.

34.13 Elevators having winding-drum machines shall be provided with a slack-rope device which will cut off the power and stop the elevator machine if the car is obstructed in its descent. Slack-rope switches shall be so constructed that they will not automatically reset when the slack in the rope is removed.

34.14 No car safety which depends on the completion or maintenance of an electric circuit for the application of the safety shall be used. Car safeties shall be applied mechanically.

34.15 The gripping surfaces of the car or counterweight safeties shall not be used to guide the car or counterweights.

34.16 A pawl or ratchet or chisel point safety shall not be used.

34.17 **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 or freed of 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.**

34.18 Each governor shall be sealed directly after testing by the authorized inspector conducting the test. No person other than an authorized inspector shall tamper with, break, or remove the seal.

34.19 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 sixty (60) per cent of the pull-through tension developed by the governor; and the carrier shall be designed so that the pull-out tension cannot be adjusted in a normal manner to exceed the amount specified.

34.20 Car safety devices (safeties) are identified and classified on the basis of performance characteristics after the safety begins to apply pressure on the guide rails. On this basis, there are three types of safeties:

(a) Type A Safeties. Safeties which develop a rapidly increasing pressure on the guide rails 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 rails through eccentrics, rollers or similar devices, without any flexible medium purposely introduced to limit the retarding force and increase the stopping distance.

(b) Type B Safeties. Safeties which apply limited pressure on the guide rails 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 Rule 34.01 (h).

(c) Type C Safeties (Type A with Oil Buffers). 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 rails. The stopping distance is equal to the effective stroke of the buffers.

34.21 Type C safeties may be used subject to the following requirements:

1. The rated speed shall be not more than five hundred (500) feet per minute.

2. The oil buffers shall conform to all requirements specified in Rule 62.00 for oil buffers, except that the stroke shall be based on governor tripping speed and on an average retardation not exceeding 32.2 feet per second.

3. After the buffer stroke, as defined in subdivision 2, has been completed, provision shall be made for an additional travel of the plunger or piston of not less than ten (10) per cent of the buffer stroke to prevent excessive impact on the buffer parts and the auxiliary safety plank.

4. Where the distance between guide rails exceeds eight (8) feet, the safety shall be provided with two oil buffers of substantially identical calibration; and the buffers shall be so located as to develop minimum stresses in the auxiliary safety plank during safety operation.
   Buffers shall be located in line with and symmetrically between the guide rails.

5. The auxiliary safety plank shall be so supported and guided below the car frame that the clearances specified in Rule 34.05 for the safety parts are maintained during normal operation.
   The auxiliary safety plank shall be so designed that the maximum stresses in the plank shall not exceed those specified for similar car-frame members in Rule 30.00.

6. The rail-gripping device of the auxiliary safety plank shall be so arranged and connected as to prevent the plank from being out of level more than one-half (1/2) inch in the length of the plank when the safety is operated to stop the car.

7. An electric switch shall be provided and so arranged and connected that the elevator cannot be operated by means of the normal operating device if any buffer is compressed more than ten (10) per cent of its stroke.

8. Means shall be provided to prevent operation of the elevator by means of the normal operating device if the oil level in any buffer is below the minimum allowable level.

34.22 For all type B safeties the movement of the governor rope, relative to the car or the counterweight 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 rails, shall not exceed the following values based on rated speed:

(a) For Car Safeties.
200 feet per minute or less--forty-two (42) inches
201 to 375 feet per minute--thirty-six (36) inches
Over 375 feet per minute--thirty (30) inches

(b) For Counterweight Safeties.
All speeds --forty-two (42) inches

Drum-operated car and counterweight safeties, requiring continual unwinding of the safety drum rope to fully apply the safety, shall be so designed that not less than three (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.

35.00 Car Speeds

35.01 The maximum contract speeds of elevators shall be as follows:

(a) Type of control:
Variable voltage or unit multi-voltage shall not exceed fifteen hundred (1500) feet per minute.
Direct current rheostatic shall not exceed six-hundred (600) feet per minute.
Hydraulic shall not exceed five hundred (500) feet per minute.
Alternating current two hundred (200) feet per minute.
Continuous pressure one hundred and fifty (150) feet per minute.
Electro-hydraulic one hundred and fifty (150) feet per minute.

36.00 Car Lighting

36.01 Every elevator car shall be equipped with electric lights.

36.02 Every elevator car shall be lighted at all times when in use.

36.03 The minimum illumination shall not be less than five (5) foot candles at the landing edge of the car platform when the car and landing doors are open.

36.04 For passenger elevators, lighting devices or luminaries provided with shades, reflectors, or glassware shall be of the railroad-train-lighting type with integral base, husk, and spring clamp holder. If suspended glass bowls or plates are used, they shall rest in, and be fastened to, a metal supporting ring provided with at least a three-point suspension. Such glass shall not be drilled for attachment to ring suspension.

36.05 For passenger elevators, glassware larger than one hundred and fifteen (115) square inches in area shall be laminated or shall be of wired glass or sur-

rounded by a guard of wire not less than No. 22 B.W.G. (0.028 inches diameter) and of mesh that will reject a one-half (½) inch diameter ball. Guards shall be securely fastened to holder or suspension.

36.06 The switch for the elevator car light shall be located within the car enclosure and in or near the car station panel.

37.00 Contract-Load Test

37.01 A contract-load test under the supervision of the authorized inspector shall be made of every new power elevator before the elevator is placed in regular service. This test shall be made with contract load in the car. The brakes, limit switches, buffers, car safety, and speed governor shall be caused to function in each test, and approval of any elevator shall be granted only upon satisfactory completion of such test.

37.02 Car and counterweight safeties and governors shall be tested as follows:

(a) Governor operated instantaneous type safeties or sliding type safeties of alternating current elevators shall be tested at rated speed by tripping the governor by hand. In such cases, the governor shall be separately tested for tripping speed.

(b) Sliding type safeties of elevators other than alternating current type shall be tested at governor tripping speed with the wire ropes attached and all electrical apparatus operative except for the overspeed control switch on the governor, if any.

(c) On overspeed tests, the stopping distance of sliding type safeties shall be determined by measuring the marks made on the guide rails by the safety jaws and with rated load in the car shall not be less than shown by curve 1, Figure 1, or greater than curve 2, Figure 1.

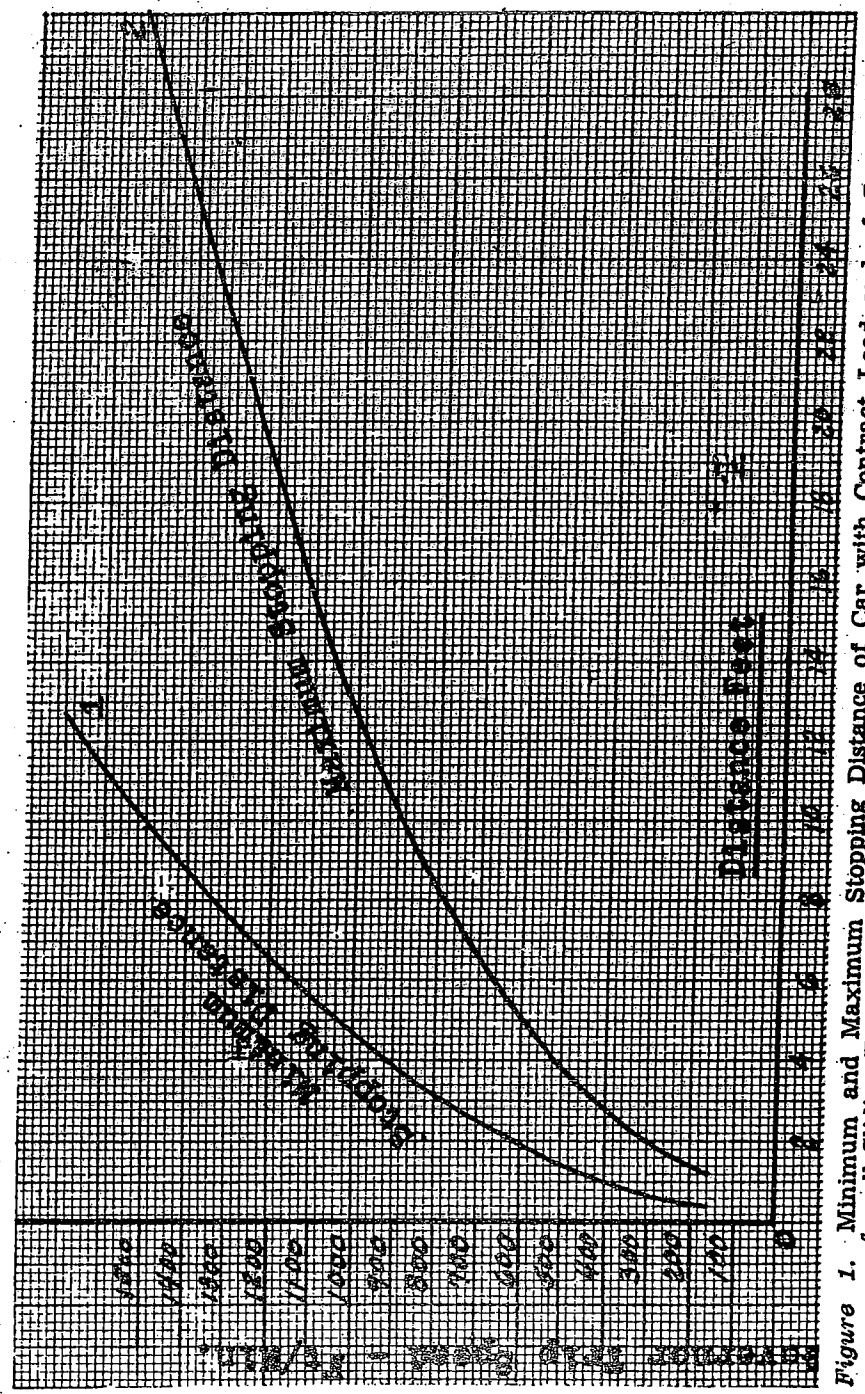

Figure 1. Minimum and Maximum Stopping Distance of Car with Contract Load and of Counterweight for all Sliding Type Safeties

40.00 Machines and Machine Safeties

41.00 Machines and Machinery

41.01 Drums and leading sheaves shall be of cast iron or steel, and shall have finished grooves. U-grooves shall be not more than one-sixteenth (1/16") inch larger than the ropes. The pitch diameter of sheaves or drums for hoisting or counterweight ropes shall be not less than forty (40) times the nominal diameter of the rope. Opening in drums shall be drilled at an angle of not over forty-five degrees (45°) with the run of the rope and shall be provided with a rounded corner with a radius at least equal to that of the rope.

41.02 The factor of safety based on the static load to be used in the design of elevator hoisting machines shall be not less than ten (10) for cast iron, cast steel, or materials other than wrought iron or wrought steel. For wrought iron or wrought steel, the factor of safety shall be eight (8).

41.03 No set-screw fastenings shall be used in lieu of keys or pins if the connection is subject to torque or tension.

41.04 No friction gearing or clutch mechanism shall be used for connecting the drums or sheaves to the main driving gear of power elevators.

41.05 No belt or chain-driven machine shall be used to drive any power elevator.

41.06 No worm gearing having cast iron teeth shall be used for any power elevator machine.

41.07 Electric elevator machines shall be equipped with electrically released brakes which are applied by compression springs. No brakes shall be released until power has been applied to the motor.

41.08 No single-ground, short-circuit, or counter-voltage shall prevent the action of the brake magnet from allowing the brake to set in the intended manner during normal operation. No motorfield discharge, counter-voltage, single ground, or accidental short-circuit shall retard the action of the brake magnet in allowing the brake to set during emergency stops.

42.00 Hydraulic and Electro-Hydraulic Elevator Machines, Tanks, Pumps, Valves and Gauges.

42.01 General Construction and Roping.

(a) Rope geared hydraulic and electro-hydraulic elevator machines, whether of the vertical or horizontal type, shall be so constructed and so roped that the piston will be stopped before the car can be drawn into the overhead work. Stops of ample strength shall be provided to bring the piston to rest when under full pressure without causing damage to the cylinder or cylinder head.

42.02 Metal guide rails and side frames for traveling sheaves of vertical rope geared hydraulic elevators.

(a) Traveling sheaves where more than three (3) to one (1) ratio of roping is employed shall be guided.

(b) Side frames where used shall be either of structural or forged steel.

(c) The construction commonly known as the 'U-strap connection' shall not be used between the piston rods and the traveling sheaves.

42.03 Piston rods and equalizers for pulling-type rope geared hydraulic elevators.

(a) Where more than one piston rod is used, an equalizing crosshead shall be provided for attaching the rods to the traveling-sheave frame to insure an equal distribution of load on each rod.

(b) Spherical washers shall be used under the piston rod nuts to insure a true bearing.

(c) The design of piston rods shall be based on the cross-sectional area at the root of the thread.

42.04 Gas releases.

(a) Cylinders of hydraulic-elevator machines shall be provided with means for releasing air or other gas.

42.05 Tanks, pipes and fittings.

(a) The outlet of pressure tanks shall be so located near the bottom to prevent the entrance of air or other gas into the elevator piping and cylinder under any condition of service.

(b) Pressure tanks that may be subjected to

vacuum shall be provided with one or more vacuum relief valves to prevent the collapse of the tanks.

(c) Pressure tanks shall be so located and supported that inspection may be made of the entire exterior.

(d) Discharge tanks shall be covered to prevent the entrance of foreign material and provided with a suitable vent to the atmosphere.

(e) Pressure tanks, pipes and fittings shall be made and tested in accordance with the best practice. In case any question arises as to what is the best practice, work done according to the requirements of the A.S.M.E. Unfired Pressure Vessels Code shall be considered as conforming to the best practice.

42.06 Relief Valves on pumps.

(a) Pumps for hydraulic elevators, other than centrifugal pumps having a shut-off pressure less than or equal to the safe working pressure, shall be equipped with a relief valve, so installed that it cannot be shut off. The relief valve shall be of sufficient size and so set as to pass the full capacity of the pump at full speed without exceeding the safe working pressure of the pump or other parts of the elevator machinery subject to pressure. The relief valve shall be piped to discharge into the discharge tank or the pump suction. Two or more relief valves may be used to obtain the capacity.

42.07 Gages.

(a) Each pressure tank shall be provided with a gage glass, having fittings and valves of material that will not be corroded by the fluid, and equipped to automatically shut off the fluid in case of failure of the gage glass. The gage glass shall be attached directly to the tank and so located as to indicate the level of the fluid within the working limits.

(b) Each pressure tank shall have a pressure gage which correctly indicates pressure to at least one and one-half (1½) times the normal working pressure allowed in the tank. This gage shall be connected to the tank by a pipe of such material

that it will not be corroded by the fluid and in such a manner that the gage cannot be shut off from the tank except by a cock with a "T" or lever handle. The cock shall be located near the gage.

(c) Pressure tanks shall be provided with a one-quarter (¼) inch pipe-size valved connection for attaching an inspector's test gage while the tank is in service.

42.08 Elevators operated by steam or gas.

(a) Hydraulic elevators operated from a pressure tank where the fluid pressure is obtained by directly admitting steam, air or other gas to the tank shall comply with all the rules covering hydraulic elevators.

42.09 Plungers and cylinders of hydraulic elevators.

(a) The plunger shall be of uniform diameter and as nearly as possible of uniform thickness and finished on the outside. The pressure end of the plunger shall be provided with a plunger bottom either of greater diameter than the plunger or other means shall be provided to prevent the plunger from traveling beyond the limits of the cylinder without loss of fluid and to prevent the car striking the limits of the hoistway.

(b) Plungers of hydraulic elevators shall be of ample strength and rigidity as a column to support the loads and to withstand the compressive forces impressed upon them with a factor of safety not less than three (3) for any position of the car in the hoistway. Walls of plungers of hydraulic elevators, subject to external pressure, shall be of sufficient thickness to insure stability of the cross-section with a factor of safety not less than three (3).

(c) Cylinders of hydraulic elevators shall be designed with a factor of safety of at least five (5) against bursting.

(d) Where plungers are composed of more than one section, the strength at the joints shall be equal to or greater than the strength of the plunger

(e) Plungers of plunger elevators shall be securely fastened to the car frame or car platform.

(f) Where plunger elevators are provided with a counterbalance and the length and weight of the plunger is such that the weight of the counterweight and counterweight ropes exceeds the weight of the elevator car, the fastening between the plunger and the car frame or platform shall be of sufficient strength to support the entire weight of the plunger. In addition, a rod or loop of galvanized wire rope shall be provided inside the plunger, attached to the bottom of the plunger and the car frame, of sufficient strength to support the weight of the plunger in case the fastening between the top of the plunger and the car should fail.

(g) Sufficient clearance shall be provided at the bottom of the cylinder of hydraulic elevators so that the bottom end of the plunger will not strike the bottom head of the cylinder when the car is resting on the fully compressed buffers or stops.

42.10 General Requirements for Plunger Elevators:

(a) Cars of plunger elevators are not required to be provided with car safeties. Buffers are not required on plunger elevators unless the contract speed exceeds fifty (50) feet per minute. For contract speeds over fifty (50) feet per minute, spring buffers shall be provided for such elevators.

(b) Top clearances of plunger elevator cars and counterweights shall comply with the following for contract speeds not in excess of one hundred (100) f.p.m.:

There shall be a clear distance of not less than two (2) feet between the highest point on the car and the corresponding point of any obstruction in the hoistway vertically above it when the plunger is in its fully extended position.

There shall be a clear distance of not less than six (6) inches above the top of the counterweight

where provided and the corresponding point of any obstruction in the hoistway vertically above it when the plunger is in its lowest position.

(c) Plunger elevators shall have car guide rails of metal of such dimensions and strength as to withstand the thrusts to which they are subjected.

(d) In all other respects, plunger elevators shall be subject to the requirements for freight and passenger elevators.

50.00 WIRE ROPES

51.00 Hoisting Ropes

51.01 Power elevators shall be provided with iron or steel wire hoist and counterweight ropes.

51.02 No covering shall be permitted on ropes other than where liability to excessive corrosion or other hazard exists, in which case marline covering may be used.

51.03 The factor of safety based on static loads for car and counterweight ropes for power passenger and freight elevators shall be not less than the values given in Figures 2 and 3, corresponding to the contract speed of the car.

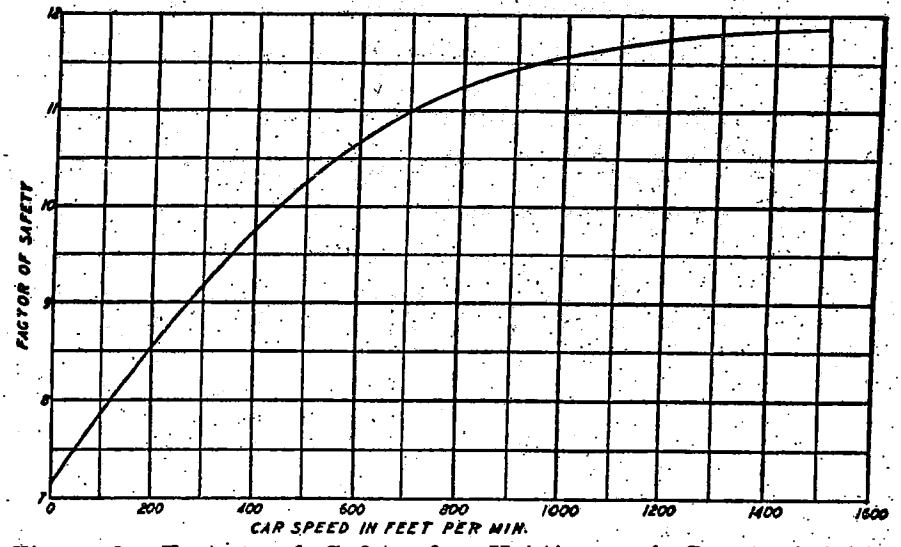

Figure 2. Factors of Safety for Hoisting and Counterweight Ropes for Power Passenger Elevators

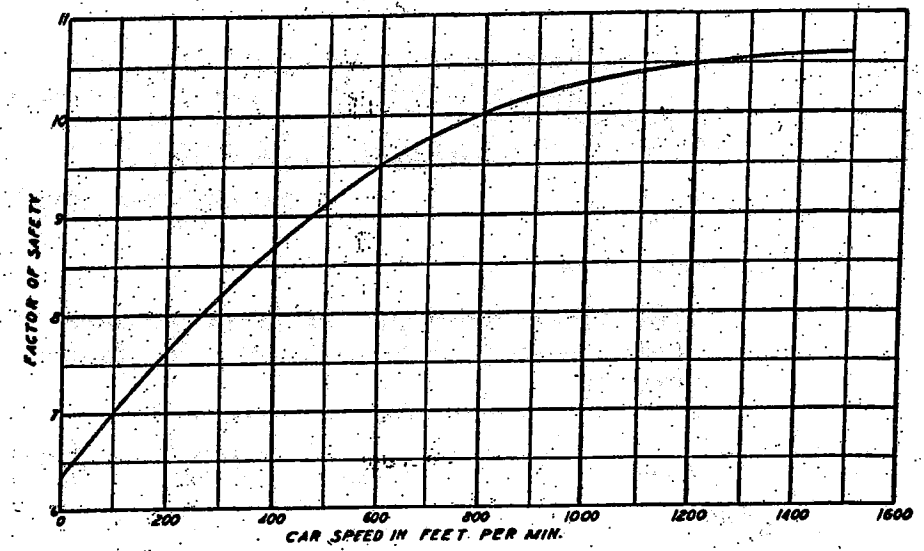

Figure 3. Factors of Safety for Hoisting and Counterweight Ropes for Power Freight Elevators

51.04 Hoisting ropes shall be not less than one-half inch (½") in diameter.

51.05 The minimum number of hoisting ropes shall be determined by using the factor of safety found in Figures 2 and 3, together with the rated ultimate strength of the wire rope. The computed load on the car hoisting ropes shall be the weight of the elevator car plus the contract load, plus the weight of the car-hoisting rope and the compensation minus the weight of the independent car counterweight, if any.

51.06 The minimum number of hoisting ropes used with traction elevators shall be three (3).

51.07 The minimum number of ropes used with winding-drum elevators shall be two car-hoisting ropes and two ropes for each counterweight used.

51.08 Where winding-drum machines are used, the required crosshead capacity plate shall bear the following information:

WIRE ROPE SPECIFICATIONS

Rope	*Number*	*Diameter in inches*	*Rated Ultimate Strength in lbs.*
Hoisting	.....	.....	.....
Car Counterweight	.....	.....	.....
Machine Counterweight	.....	.....	.....

(a) Where traction machines are used, the crosshead capacity plate shall bear the following information:

WIRE ROPE SPECIFICATIONS

Rope	*Number*	*Diameter in inches*	*Rated Ultimate Strength in lbs.*
Hoisting Ropes	.....	.....	.....

(b) Where hydraulic machines are used, the crosshead capacity plate shall bear the following information:

WIRE ROPE SPECIFICATIONS

Rope	*Number*	*Diameter in inches*	*Rated Ultimate Strength in lbs.*
Hoisting	.....	.....	.....
Car Counterweight	.....	.....	.....

51.09 A metal tag shall be attached to the rope fastenings. On this tag shall be stated the following:

(a) Diameter.
(b) Rated ultimate strength.
(c) Material of the ropes.
(d) Date of the rope installation.
(e) Name of company or person installing ropes.
(f) Name of manufacturer.
(g) Whether non-preformed or preformed.

A tag shall be reinstalled at each rope renewal.

51.10 Where wire rope equalizers are used, the equalizers and their fastenings in their several parts and assembly shall have a strength of not less than ten per cent (10%) in excess of the required strength of the rope. Rope equalizers, when used, other than those of the single swing tree type used with drum type machines and those of the individual compression spring type capable of being fully compressed without failure, shall be approved on the basis of tests, made by a competent designated laboratory, showing the ultimate strength of the equalizer and its fastenings in its several parts and assembly.

51.11 All wire ropes anchored to a winding drum shall have not less than one (1) turn of rope on the winding drum when the car or counterweight has reached the extreme limit of its over-travel.

51.12 No car or counterweight rope shall be lengthened or repaired by splicing.

51.13 The winding-drum ends of car or counterweight ropes shall be secured by clamps on the inside of the drums or by individual tapered babbitted sockets.

51.14 The car and counterweight ends of ropes shall be fastened by spliced eyes, by return loop, or by individual tapered babbitted sockets.

51.15 Where socketed rope fastenings are used, adjustable shackle rods shall be provided to attach wire ropes to cars and counterweights in such a manner that all portions of the rope other than the portion within the socket shall be readily visible.

51.16 Method of Splicing Wire Ropes.

(a) Where a spliced eye is used a metal thimble shall be placed within the eye and the splice made with not less than the following number of tucks: first strand, two tucks; second strand, three tucks; third strand, four tucks; remainder of strands, five tucks. The eye shall be drawn tightly around the thimble, the strands drawn tight after each tuck and the tucks smoothly laid. After the last tuck is made, each strand shall be cut off not closer than one-fourth inch (¼") from the tuck and beaten down flush. The splice may be left bare or served with marline.

51.17 Method of making return loops.

(a) When the two ends of one continuous wire rope are both secured to the winding drum, to the car, or to the counterweight, a return loop may be made at the counterweight or car without cutting the rope. To form such a loop, the wire rope shall be passed around a metal thimble closely fitting the rope. Immediately above the thimble a clamp shall be placed on the doubled rope and securely bolted to prevent slipping of either leg of the rope through the clamp, should the opposite leg be entirely released.

51.18 Method of socketing wire ropes.

(a) Where a babbitted socket is used, the length of the socket shall be not less than four and seventy-five hundredths (4.75) times the nominal diameter of the rope.

(b) The hole at the small end shall be as given in the following table:

Relation of Wire Rope to Small Diameter of Wire Rope Socket

Nominal Diameter or Rope in in.	Inside Diameter of Small End of Rope Socket
¼ to 7/16 inclusive	shall not be more than 1/16 in. larger than actual rope diameter
½ to ¾ inclusive	shall not be more than 3/32 in. larger than actual rope diameter
⅞ to 1⅛ inclusive	shall not be more than ⅛ in. larger than actual rope diameter
1¼ to 1½ inclusive	shall not be more than 3/16 in. larger than actual rope diameter

(c) The hole opening at the small end of the socket shall be rounded and free from cutting edges.

(d) The hole opening at the large end of the socket shall be not less than (2.25) two and twenty-five hundredths times the nominal diameter of the rope.

(e) The socket shall be drop-forged steel, or steel casting.

(f) The socket shall be of such strength that the rope will break before the socket is perceptibly deformed.

(g) Rope ends to be socketed shall be served with three seizings at each side of any point at which the rope is to be cut.

(h) Only annealed iron wire shall be used as seizing wire. The wires shall be wound tight and even. The twisted ends of the seizing shall be so placed that they fall into the valleys between strands and away from the ends of the rope, as otherwise the seizing will not pass through the small hole end of the socket.

(i) For five-eighths (⅝) inch or smaller wire rope, the first two seizings shall be not less than one-half (½) inch long, and the third seizing not less than three-quarters (¾) inch long. The first seizing shall be close to the cut, and the second seizing shall be spaced back from the first seizing

the length of the end to be turned in. The third seizing shall be at a distance from the second seizing equal to the length of the socket. Larger rope require longer seizing than specified above.

(j) Tape shall not be used for seizing.

(k) The rope thus served shall be entered at the small hole and slipped through the socket a sufficient distance for manipulating, and after removing the first two seizings the strands shall be spread and the hemp center cut out as close as possible to the remaining seizing and removed. All grease shall be carefully removed by wiping off the extended strands and washing with a non-flammable solvent. The strand ends shall then be bent and turned in and bunched closely together. The portion turned in shall have a length not less than two and one-half (2½) times the nominal diameter of the rope. Then, with the rope end pulled as far as possible into the socket, the turned ends or loops in the strand of all socketed ropes shall be turned toward the center of the socket and shall project above the babbitted end not more than one-quarter (¼) inch and not less than one-eighth (⅛) inch. The third seizing shall slightly project outside the hole at the small end of the socket. The socket, when ready for pouring, shall be held vertical and the rope held truly axial with the socket. Tape or waste may be wound around the rope at the small end of the socket to prevent the metal from seeping through but shall be removed after the metal has cooled.

(l) Only clean babbitt metal free from dross shall be used heated to a fluidity just sufficient to char a piece of soft wood without igniting it.

(m) Where the seizing and socketing has been done properly, the original and uniform relation of rope lay will not be disturbed. Any disturbance of rope lay is a clear indication of careless seizing and socketing and is not permitted.

(n) Whenever elevator ropes are replaced or

shortened, the counterweight top clearances shall not be reduced below those required.

52.00 Governor Ropes

52.01 Governor ropes shall be of uncovered iron, steel, or monel metal.

52.02 Governor ropes shall not be of tiller rope construction.

52.03 Governor ropes shall be not less than three-eighths inch (⅜") in diameter.

52.04 Governor ropes shall run clear of governor jaws during the normal operation of the elevator.

52.05 Governor ropes shall run not more than one-eighth inch (⅛") either side of the common center line of the governor jaws.

52.06 Governor rope ends shall be fastened by spliced eyes, tapered babbitted sockets or by at least two (2) clamps. Clamps shall not be used for the fastening at the end of the governor rope which leads down from the governor sheave to the safety operating lever or to the releasing carrier clevis at the car connection.

52.07 Where socketed rope fastenings are used, the length of the socket shall conform to the requirements for wire rope sockets for hoisting ropes and shall be not less than four and seventy-five hundredths (4.75) times the nominal diameter of the rope and shall be installed in such manner that all portions of the rope other than the portion within the socket shall be readily visible.

53.00 Tail-Ropes

53.01 Tail-ropes used to attach governor ropes to car of counterweight safety operating drums may be of tiller rope construction.

53.02 Tail-ropes shall be of corrosion resistant metals.

53.03 Sheradized or galvanized iron or steel rope shall not be used for tail-rope.

53.04 Tail-ropes shall be secured to car on counter-

weight safety operating drums by clamps or tapered babbitted sockets on the inside of the drum.

53.05 Tail-ropes shall be connected to governor ropes by tapered babbitted sockets.

53.06 Deflecting sheaves for tail-ropes shall be fastened by metal brackets to car frame safety planks.

54.00 Compensating ropes or chains

54.01 Compensating chains shall be firmly secured to the car frame, the counterweight, or the hoistway.

54.02 Compensating ropes shall be of uncovered iron or steel.

54.03 Whenever compensating ropes are employed, a compensating rope tension sheave shall be installed in the elevator pit. This tension sheave shall be guided and equipped with a contact switch arranged to positively open the motor and brake operating circuits before the compensating sheave reaches its upper or lower limit of travel.

60.00 GUIDE RAILS: BUFFERS AND COUNTERWEIGHTS

61.00 Guide Rails

61.01 General.

(a) Guide rails for power elevator cars and counterweights shall be of steel, other than where the use of steel rails presents an accident hazard, as in chemical or explosive industries wood guide rails may be used.

61.02 Length of guide rails.

(a) For hydraulic elevator where the car is secured directly to the top of a hydraulic plunger the guide rails shall be extended at the top and bottom to prevent the guide shoes from running off when the plunger is fully extended or fully compressed.

(b) For all other power elevators the guide rails shall be continuous from the bottom to the top of the hoistway.

61.03 Weight of guide rails.

(a) The weight of steel guide rails shall not be less than given in the following table:

TABLE III

Total Weight of car and load. Total Weight of Counterweight per pair of rails (pounds).		Minimum weight of each car guide rail (pounds per lineal foot).	Minimum weight of each counterweight guide rail (pounds per lineal foot).		
		With guide rail safeties	Without guide rail safeties		
Above:	To and including		1 to 1 Roping	2 to 1 Roping	
	4,000**	7.5**	7.5*	7.5	7.5
4,000	15,000	15.	15.	7.5	7.5
15,000	27,500	22.5	22.5	15.	15.
27,500	40,000	30.	30.	15.	15.

* If the rails are effectively bracketed or tied at intervals of six feet (6′) or less to prevent spreading, this load may be doubled. This applies only to seven and one-half (7½) pound rails and only when such rails are used for counterweights.

** If car guide rails weighing seven and one-half (7½) pounds were effectively bracketed or tied at ten-foot (10′) intervals. the 4,000 lb. load may be increased to 4,500 lbs., and if bracketed or tied at six and one-half foot (6½′) intervals, this load may be increased to 5,000 lbs.

(b) Where cars equipped with duplex safety devices are employed, the Maximum Car and Load Weights given in Table III may be multiplied by the following factors based upon the vertical distance between centers of safeties:

Car Duplex Safeties

Distance Between Safeties in Feet	Multiply Maximum Load Given in Table III by
18 (or over)	2.0
15	1.83
12	1.67
9	1.50
6	1.33

(c) Where counterweights equipped with duplex-safety devices are employed, the Maximum Counterweight with Safety Weights given in Table III may be multiplied by the following factors based upon the vertical distance between centers of Safeties:

Distance Between Counterweight Duplex-Safeties	Factor
15′ (or over)	2.0
10′ to 14.99 incl.	1.67
5′ to 9.99 incl.	1.33

61.04 Joints of steel guide rails shall be:

(a) Accurately machined with tongue and groove through the webs at right angles to the base and through the flanges parallel to the base, and fitted with fishplates each secured with not less than four (4) substantial bolts through each rail; or,

(b) Accurately machined with tongue and groove through the webs and with backs of the flanges where the fishplates bear accurately machined at right angles to the tongue and groove and fitted with finished fishplates each secured with not less than four (4) substantial bolts through each rail.

61.05 Guide rail bolts for fishplates, ties, brackets, backing, clips through bolts, and supports shall be not less than the sizes given in the following table:

Size of Guide Rail Bolts

Weight of Rails per Foot	Diameter of Bolt in Inches
7.5 lb to 8.2 lb	½
14.0 lb to 16.0 lb	⅝
22.5 lb to 23.0 lb	¾
30.0 lb to 32.0 lb	¾

61.06 Guide rail brackets.

(a) Guide rails shall be securely fastened in position with brackets, through bolts, ties, clips, or backing of steel of such strength, design, and spacing that the guide rails and their fastenings shall not deflect between supports more than one-quarter inch (¼″) under normal operation. Welding may be used to fasten rail supports to building steel provided the welding is done by certified welders approved by the enforcing authority.

(b) Where the supports are more than fourteen feet (14′) on centers, rail backing shall be used regardless of the deflection under normal operation.

(c) Where an elevator is intended to handle heavy loads the guide rails, fastenings, backing, brackets, and supports shall be designed to sustain the thrusts

imposed upon them when a concentrated load is on the car sill in addition to when the concentrated load is in place on the car platform.

61.07 Bolt holes in steel beams for bracket bolts shall not exceed the diameter of the bolt by more than one-sixteenth inch (1/16″). Such bolt holes shall be drilled or punched. They shall not be cut with a torch.

61.08 Where the use of steel guide rails creates an explosion hazard, the use of wood guide rails is permitted, provided:

(a) The contract speed is not in excess of one hundred feet (100′) per minute, and,

(b) The guide rails are of straight grained maple without knots, and,

(c) The size of the rails is either not less than 2″ x 2½″ where the car and load is not in excess of five thousand pounds (5,000lb) or not less than 2⅝″ x 3″ where the car and load is not in excess of eight thousand pounds (8,000lb).

61.09 Where car or counterweight safeties are used, the guide rails and their supports shall be capable of withstanding the application of the safety when stopping the car with contract load or the counterweight when descending at governor tripping speed.

62.00 Car and counterweight buffers

62.01 Buffers of the spring, oil, or equivalent type shall be installed under cars and counterweights.

62.02 Spring buffers may be used with elevators having a contract speed not in excess of 200 feet per minute.

(a) Oil buffers shall be used with elevators having a contract speed in excess of 200 feet per minute.

62.03 The minimum stroke of spring buffers shall be as follows, based on contract speed:

100 feet per minute or less—1½ inch stroke
101 to 150 feet per minute—2½ inch stroke
151 to 200 feet per minute—4 inch stroke

NOTE: Stroke as applying to spring buffers is the difference between the free length of the spring and its length when compressed to a point where all coils are practically in contact.

62.04 The static load required to compress spring buffers a distance equal to their stroke shall be within a minimum of twice and a maximum of three times the total weight of the car plus contract load or of the counterweight, respectively.

62.05 Each spring buffer shall be provided with a metal plate marked in a legible and permanent manner to show the stroke or compression of the spring and the maximum and the minimum loads for which the spring may be used in conformity with this rule. This plate shall not be wired or attached to the spring coils in such manner as to become unfastened when the spring is fully compressed.

62.06 The minimum stroke of oil buffers shall be based on the following:

(a) The stroke shall be such that the car or the counterweight on striking the buffer at one hundred and fifteen per cent (115%) of contract speed shall be brought to rest with an average retardation not exceeding thirty-two and two-tenths feet (32.2′) per second per second.

(b) Where a speed retarding device is installed that will limit the speed at which the car or the counterweight can strike their buffers, the buffer stroke shall be based on at least one hundred and fifteen per cent (115%) of such reduced striking speed and an average retardation not exceeding thirty-two and two-tenths feet (32.2′) per second per second. In no case shall the stroke used under such conditions be less than fifty per cent (50%) of the stroke required by 62.06 (a), or less than seventeen inches (17″), whichever is greater.

62.07 Car and counterweight oil buffers shall develop an average retardation not in excess of thirty-two and two-tenths feet (32.2′) per second per second and shall develop no peak retardation greater than eighty and five-tenths feet (80.5′) per second per second

having a duration exceeding one twenty-fifth (1/25th) of a second with any load in the car from contract load to a minimum load of one hundred and fifty (150) pounds when the buffers are struck with an initial speed of not more than:

(a) One hundred and fifteen per cent (115%) of contract speed where no speed retarding device is used, and

(b) One hundred and fifteen per cent (115%) of the pre-determined reduced speed for buffers where a speed retarding device is used.

62.08 Oil buffers shall be provided with means for determining that the oil level is within maximum allowable limits. Glass sight gauges shall not be used.

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

62.10 Counterweight buffers similar to those required for cars shall be installed symmetrically under the counterweights of power elevators.

62.11 Car and counterweight oil buffers shall be field tested by running on to them with the car and contract load and the counterweight, respectively, at contract speed with the normal terminal slow-down device inoperative and final limit switches operative.

(a) Where a speed retarding device is installed the buffers shall be field tested by running on to them at the reduced striking speed with the car and contract load and the counterweight, respectively, with the normal terminal slow-down device and the speed-retarding device inoperative, and final limit switches operative.

62.12 Car and counterweight oil buffers when installed and filled with oil shall be fully compressed and, when released, the buffers shall return to the fully extended position within ninety (90) seconds.

62.13 Buffers of the spring return type shall be tested for plunger return with a fifty (50) pound test weight resting on the plunger during the test. The plunger shall be depressed two inches (2″) and, when

released, the plunger while supporting the test weight, shall return to the fully extended position within thirty (30) seconds.

62.14 No field test of spring buffers is required.

62.15 Car and counterweight oil buffers may be compressed not to exceed twenty-five per cent (25%) of their stroke when the car is level with the terminal landings.

62.16 Every oil buffer installed shall be provided with a metal plate marked by the manufacturer in a legible and permanent manner indicating:

(a) The maximum and the minimum loads and the maximum striking speed for which the buffer may be used.
(b) The permissible range in viscosity of the buffer oil to be used at 100° F.
(c) The viscosity index number of the oil to be used.
(d) The pour point in degrees F. of the oil to be used.

63.00 Counterweights

63.01 Counterweights shall run on guide rails within the elevator hoistway.

63.02 Where two counterweights run on the same guides, the car counterweight shall be above the machine counterweight and there shall be a clearance of not less than eight inches (8″) between the counterweights. The ropes of the machine counterweight shall be covered or protected by metal or fiber sleeves firmly attached to the ropes. These sleeves shall be not less than six inches (6″) longer than the car counterweight. The ends of metal sleeves shall be carefully reamed before being placed on the ropes.

63.03 Where an independent car counterweight is used, it shall be of a weight to prevent undue slackening in any of the ropes during acceleration or retardation of the car.

63.04 All counterweight sections shall be secured by at least two (2) tie rods passing through holes in all the sections. The tie rods shall have lock nuts at each end, secured by cotter pins.

63.05 Counterweights shall be located only in the hoistway of the elevators to which they are connected.

63.06 No elevator car shall counterbalance another car.

70.00 CONTROL AND OPERATING DEVICES AND SYSTEMS

71.00 General

71.01 The frame of the electric elevator machine, the frame of the controller, and frames of electric appliances in or on the elevator car shall be effectively grounded.

71.02 No circuit-breaker operated automatically by a fire alarm system shall cut off the power of a power elevator.

71.03 Each electric power elevator driven by a polyphase alternating-current motor shall be provided with a device which will prevent starting the motor if:

(a) the phase rotation is in the wrong direction, or,

(b) there is a failure in any phase.

This regulation does not apply to AC motor used to drive motor-generator sets.

71.04 Where an overload circuit-breaker is used for a direct current electric elevator, the wiring shall be arranged so that the circuit of the brake-magnet coil is opened at the same time that the line circuit is opened.

71.05 Electric slack-rope switches shall be enclosed.

71.06 The installation of condensers which may either by functioning or failure cause an unsafe operating condition is prohibited.

71.07 No person shall at any time make any required safety device or electrical protective device inoperative, except where necessary during tests, inspections, and maintenance. Immediately upon completion of such tests, inspections, and maintenance, such devices shall be restored to their normal operating condition in conformity with applicable requirements of this code.

72.00 Control Devices

72.01 A manually operated multipole disconnecting switch shall be installed in the main line of each electric elevator machine or motor-generator set.

72.02 The disconnect switch shall be located adjacent to and visible from the elevator machine or motor-generator set to which it is connected and should, where

practicable, be located in the machine room at the lock-jamb side of the entrance door.

72.03 No provision shall be made to close the disconnecting switch from any other part of the building.

72.04 No control system shall be used which depends on the completion or maintenance of an electric circuit for the interruption of the power and the application of electro-mechanical brakes at the terminals, for the application of safeties, or for the closing of contactor by an emergency button. This regulation does not apply to dynamic braking or to speed control devices.

72.05 On electro-hydraulic elevators all stop valves shall be arranged so to be opened electrically and to be closed either by gravity or by springs in compression, or by hydrostatic pressure, or by any combination of the above.

73.00 Operating Devices

73.01 No power elevator shall be operated by a direct hand-operated rope, cable, or rod, or by a wheel or lever mechanism which motivates an operating rope or cable.

73.02 The maximum rated system or circuit voltage permitted in the operating devices of power elevators shall be two hundred and fifty (250) volts.

73.03 The handle of car-switch operating devices shall be arranged to return to the 'stop' position and lock there automatically when the hand of the operator is removed.

73.04 Where more than one operating device of the car switch or continuous pressure type is used in a car, the operating devices shall be so interlocked that only one can be used at a time.

73.05 Where a single operating device is used, it shall be so located as to be near the car opening serving the greatest number of landing openings.

73.06 An emergency stop switch which will cut off the sources of power shall be provided in the car adjacent to the operating device for all elevators and shall be suitably identified and of a distinctive color.

73.07 Emergency stop switches may be operated by

buttons or levers but shall be of the manually opened and closed type so installed that when opened gravity will not tend to close the switch.

73.08 An emergency stop switch shall be installed in the pit of every elevator and on the top of every elevator car. The switch on the car top shall be located near the center of the car crosshead facing the front of the car.

73.09 Contacts of emergency stop switches or buttons shall be directly opened mechanically and shall not be solely dependent upon springs for the opening of the contacts.

73.10 There shall not be installed on the top of any elevator car any permanent switches or buttons for the purpose of operating the car. This regulation shall not prevent the use of temporary operating devices by a licensed elevator mechanic for construction, inspection and testing purposes, provided that such devices are operative only when the normal operating devices are inoperative and all hoistway doors are closed and locked.

73.11 One lead to the emergency stop switch shall be run to the car through a separate and independent traveling cable where electric elevators have winding-drum machines.

73.12 Both leads to the emergency stop switch shall not be run to the car in the same traveling cable.

73.13 Where springs are used to break the circuit to stop an automatic-operation elevator at the terminal, they shall be of the compression type.

73.14 The completion of another electric circuit shall not be depended upon to break the circuit to stop an automatic-operation elevator at the terminals. The interruption of the electric circuit shall prevent the movement of the car.

73.15 Levers of operating devices for car switch operation elevators shall be so arranged that the movement of the lever toward the car gate which the operator usually faces will cause the car to descend and the movement of the lever away from the gate will cause the car to ascend. The direction of travel shall be indicated on the car switch.

73.16 Automatic-operation elevators shall conform to the following requirements:

(a) When the car has started for a given landing, no impulse may be given from any landing to send the car in the reverse direction until the car has reached the destination corresponding to the first impulse. The car may stop at any intermediate landing to take on or discharge passengers going in the original direction.

(b) When the car has been stopped to take on or discharge passengers and is to continue in the direction determined by the first impulse, the car may be started by the closing of the car door or gate contact.

(c) The car cannot be started under normal operation by the operating devices unless every hoistway door is closed and locked in the closed position and every car door or gate is closed in the closed position.

73.17 Continuous-pressure operation shall not be used for elevators unless they are provided with all of the safety devices required for automatic operation.

73.18 Load-weighing devices which will prevent operation of the elevator shall not be installed in connection with passenger elevators.

74.00 Terminal Stopping

74.01 Power elevators shall be provided with upper and lower normal terminal stopping devices arranged to stop the car automatically from any speed attained in normal operation within the top and bottom overtravel independently of the position of the operating devices and the final terminal stopping devices and before the buffer is fully compressed.

74.02 Normal terminal stopping devices shall be installed in connection with power elevators as follows:

(a) Electric power elevators having winding-drum machines shall have stopping switches on the car or in the hoistway, operated by the movement of the car.

(b) Electric power elevators having traction machines shall have stopping switches on the car, or in the machine room or in the hoistway operated

by the movement of the car. If located in the machine room, the stopping contacts shall be mounted on and operated by a stopping device mechanically connected to the car, and with no dependence on friction as a driving means. An automatic safety switch shall be provided which will stop the machine should the tape, chain, rope, or other similar device mechanically connecting the stopping device to the car, fail. In the case of electric power elevators using floor controllers or other similar devices for automatic stopping at the floor landings, only one set of floor-stop contacts is necessary for each terminal landing, provided these contacts and the means for operating them comply with the requirements for terminal stopping devices. These contacts then serve also as normal terminal stopping devices.

(c) Hydraulic elevators having a contract speed in excess of one hundred feet per minute (100 fpm) shall have an automatic stop valve independent of the normal control valve or valves, operated either by the car or the machine.

74.03 Electric power elevators shall be provided with upper and lower final terminal stopping devices arranged to stop automatically the car and counterweight from contract speed within the top clearance and bottom overtravel independently of the operation of the normal terminal stopping devices and the operating device, but with buffers operative. Final-limit switches shall be set to operate with the car as close to the terminal landing as practical without interfering with the normal operation of the elevator. Where spring buffers are provided, the final-limit switches shall be set to open before the buffer is engaged. Where oil buffers are provided and also means to prevent jumping of the car or counterweight, the final-limit switch shall open before the buffer is fully compressed.

74.04 Final terminal stopping devices shall be installed in connection with electric power elevators as follows:

(a) Electric power elevators having winding-drum machines shall have stopping switches on the

machines and also in the hoistway operated by the movement of the car.

(b) Electric power elevators having traction machines shall have stopping switches in the hoistway operated by the movement of the car.

74.05 The final terminal stopping device shall act to prevent movement of the car in both directions of travel. The normal and final terminal stopping devices shall not control the same switches on the controller **unless two or more separate and independent switches are provided, two of which shall be closed to complete the motor and brake circuit in each direction of travel.**

When two-phase or three-phase alternating current is used to operate the elevator, the above switches shall be of the multi-pole type. If the final terminal stopping device controls the same controller switch or switches as the operating device or the normal terminal stopping device, it shall be connected into the control circuit on the opposite side of the line.

74.06 Chain, rope, or belt driven final machine terminal stopping devices shall not be used for power elevators having winding-drum machines.

74.07 Electric power elevators having winding-drum machines driven by two-phase or three-phase alternating-current motors shall have the mainline circuit to the motor and brake directly opened either by contact in the machine stop-motion switch or by hoistway limit switches operated by a cam attached to the car. The opening of these contacts shall take place before or coincident with the opening of the final terminal stopping device and shall prevent movement of the machine in either direction. Elevator machines with alternating current motors and direct current brakes and direct current mainline potential switches controlled by final terminal hoistway stopping switches do not require a mainline machine stop motion switch.

74.08 Normal and final terminal stopping switches, whether on the car or in the hoistway, shall be of enclosed type. Normal and final terminal stopping devices, where on the car or in the hoistway, shall be securely mounted in such a manner that the movement of the switch lever or roller to open the contacts shall be in a

direction as nearly at right angle as is possible to a line drawn between the face of the car guide rails. The cam or cams for operating the terminal stopping switches shall be of metal and shall be so located and of sufficient length to maintain the switch in the open position when the car is in contact with the overhead structure or resting on the fully compressed buffer with the overhead structure and the buffer in their normal position.

74.09 The contacts of all terminal stopping devices shall be directly opened mechanically. Spring or gravity arrangements permitting the opening of the contact on withdrawal of the cam, lug, or similar device are prohibited.

75.00 Signals

75.01 Landing Signals.

(a) Every power elevator, other than continuous pressure operation, automatic operation type elevators and elevators arranged to stop automatically at the floor landings, shall be equipped with a signal system indicating the landing at which the car is desired.

75.02 Emergency Signals.

(a) Every elevator shall be provided with an emergency signal audible outside of the hoistway, that is operative from within the car or shall be provided with a telephone connected to a switchboard in the building. Where a telephone is used in an automatic or continuous pressure operation elevator, in place of an audible emergency signal, it shall be connected to a switchboard in the building which is continuously manned or permanently connected with a central exchange.

80.00 General

80.01 Installations Placed Out of Service

When installations governed by ELV-2 are placed out of service for a definite period, the following precautions must be taken.

(a) The elevator inspector having jurisdiction must be notified by the owner, lessee, or agent, so that said inspector can make his recommendations.

(b) Periodic and maintenance inspections and tests may be discontinued for the out-of-service period.

(c) Before such installation is again placed in service, it shall be subject to a complete inspection test in accordance with Section 64, Chapter 143, of the General Laws, as amended, provided the out-of-service period exceeds one year.

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

(a) BOLTS. Bolts, where used through sloping flanges of structural members, shall have boltheads of the tipped-head type or shall be fitted with beveled washers.

(b) NUTS. Nuts, used on sloping flanges of structural members, shall seat on beveled washers.

(c) WELDING. Welding of all parts of apparatus governed by ELV-2 and upon which safe operation depends shall be done in accordance with the appropriate standards established by the American Welding Society.

80.03 Information on Elevator Layouts

Elevator layout drawings shall, in addition to other data, indicate the following:

(a) Bracket spacing.

(b) The estimated vertical force on the guide rails on application of the safety device.

(c) In case of freight elevators for Class B or C loading (see Rule 33.03), the horizontal forces on the guide rail faces during loading and unloading, and the estimated maximum horizontal forces in a post-wise direction on the guide rail faces on the application of the safety device.

(d) The size and weight per foot of any rail reinforcements where provided.

PART 3 - HAND ELEVATORS

10.00 SHAFTWAY ENCLOSURES

11.00 General

11.01 The shaftways of all elevators shall be enclosed throughout their height.

11.02 Where the elevator shaftway penetrates any fully enclosed solid floor above the bottom landing, the walls shall be of not less than two hour fire resistive rating, and in addition any portion of the walls exposed to automotive traffic shall be of solid masonry not less than eight (8) inches in thickness to a height of not less than four feet six inches (4' 6") above finished floor.

11.03 Where the elevator either serves only open construction floors or serves only open balcony floors within one story, the wall shall be of non-combustible materials of either solid construction or open metal construction which will reject a two-inch (2") ball, provided such open construction fronts or panels are not less than two (2) inches from any moving equipment within the enclosure. Where less than two (2) inches from moving equipment, open construction shall reject a one-half (1/2) inch ball.

11.04 Shaftway windows shall be located only in exterior walls of the building, or in hoistway walls above the roof.

11.05 Not more than two elevators shall be installed in the same shaftway.

11.06 The dividing wall partition which is located within an elevator shaftway shall be constructed with a solid wall of not less than three-quarter hour fire resistive construction.

11.07 Where a hoistway extends into the top story of a building, fire-resistive hoistway or machinery enclosures, where required, shall be carried to the underside of the roof if the roof is of fire-resistive construction, and at least three feet (3') above the top surface of the roof if the roof is of non-fire-resistive construction.

11.08 Where shaftway enclosures are not required to continue through the roof, the top of the shaftway shall be of fire resistive construction equivalent to that required for the walls.

12.00 Machine Rooms

12.01 Machine rooms shall be located above or adjacent to any side of the shaftway.

12.02 Machine rooms located above any shaftway shall be provided with a flooring which is either above or level with the top of the machine supporting beams.

(a) Machine room floors shall be designed to support a uniformly distributed load of not less than fifty pounds per square foot.

12.03 Machine room enclosures shall be constructed as follows:

(a) Where solid construction shaftways are required by these regulations, the walls shall be of not less than two hour fire resistive construction, other than for doors, windows, louvers, or ventilators.

(b) Where open construction shaftways are permitted by these regulations, the walls shall be of non-combustible materials which shall be either solid construction walls, or open metal construction which will reject a two-inch (2″) ball, and shall be not less than six (6) feet high.

(c) Where the machine room is located within the building and where solid construction shaftways are required by these regulations, the ceiling of each machine room shall be of not less than two hour fire resistive construction.

(d) Where an open construction hoistway is permitted, the machine room ceiling may be omitted.

12.04 Elevator machine rooms shall not be used as public thoroughfares.

12.05 Loads on overhead beams and their supports shall be computed as follows:

(a) The total load on overhead beams shall be assumed as equal to the weight of all apparatus resting on the beam plus twice the maximum load suspended from the beams.

(b) The load resting on the beams shall include the complete weights of machine, sheaves, etc. The load suspended from the beams shall include the sum of the tensions of all ropes suspended from the beams.

12.06 The required factor of safety for all overhead beams and their supports, based upon both the average ultimate strength of the material and the loads shall not be less than -- 5.

13.00 VENTING OF HOISTWAYS

13.01 Hoistways of elevators serving more than three stories shall be provided with means for venting smoke and hot gases to the outer air in case of fire.

Exception: Hoistways not extending into the top story of a building, other than hotels, apartment houses, hospitals, and similar buildings with overnight sleeping quarters, where the hoistways are equipped with approved automatic sprinklers connected to the building water-supply system or to an approved automatic sprinkler system. (In case any question arises as to what is the best practice, work done in accordance with the requirements of NBFU Standards No. 13, entitled "Sprinkler Systems", dated June, 1953, will be considered as compliance).

13.02 Location of Vents

Vents shall be located -

1. In the side of the hoistway enclosure directly below the floor or floors at the top of the hoistway, and shall open directly to the outer air or through incombustible ducts to the outer air; or,

2. In the wall or roof of the penthouse or overhead machinery space above the roof, provided that openings of at least equivalent area are provided in the floor or floors at the top of the hoistway.

13.03 Area of Vents

The area of the vents shall be not less than three and one-half ($3\frac{1}{2}$) per cent of the area of the hoistway nor less than three (3) square feet for each elevator car, whichever is greater. Of the required vent area, not less than one-third (1/3) shall be of the permanently open type.

Exceptions: Where mechanical ventilation providing equivalent venting of the hoistway is provided in the overhead elevator machine room (see Rule 12.08), required vent area may be reduced subject to the following:

1. The building is not a hotel, apartment house, hospital, or similar building with overnight sleeping quarters;

2. The machine room is so located that it

has no outside exposure;

3. The hoistway does not extend to the top story of the building;

4. The machine room exhaust fan is automatically reactivated by thermostatic means.

13.04 Closed Vents

Closed portions of the required vent area shall consist of windows, skylights, or duct openings glazed with plain glass not more than one-eighth (1/8) inch thick.

13.05 Window and Skylight Frames and Sash

Window and skylight frames and sash shall be of metal.

13.06 Skylight Guards

A guard, securely anchored to the supporting structure, consisting of a wire-mesh screen of at least #13 steel wire gauge with openings which will reject a ball one (1) inch in diameter, or an expanded metal screen of equivalent strength and open area, shall be installed above every elevator skylight. A similar screen of at least #18 steel wire gauge, or of expanded metal of equivalent strength and open area, shall be installed below every elevator skylight.

13.07 All windows and window frames in fire-resistive hoistway enclosures shall be fire windows conforming to local laws and ordinances.

13.08 Exterior windows in the hoistway less than one hundred feet (100') above the ground or less than thirty feet (30') above an adjacent roof shall be guarded on the outside by one of the following methods:

1. By vertical barsnot less than five-eighths (5/8) inches in diameter, or equivalent, spaced not less than ten inches (10") on centers, and not more than ten inches (10") between the window jamb and the center of the nearest bar.

2. By metal sash having solid-section steel muntins of not less than one-eighth inch (1/8") thickness, spaced not more than eight inches (8") apart.

14.00 Hoistway Guards

14.01 Counterweight runways of hand elevators located in the elevator hoistway shall be enclosed from a point twelve (12) inches above the floor of the pit to a point at least seven (7) feet above the floor of its own pit and any other pit adjacent to such counterweight runway.

14.02 Rope Enclosures

(a) Where ropes pass through floors on the outside of the shaftway, they shall be enclosed completely from floor to ceiling at all floors with solid enclosures of not less than two (2) hour fire resistive construction.

15.00 Thoroughfares

15.01 If a shaftway does not extend to the lowest floor of a building, and the space under the bottom of the shaftway is used for any purpose, the following conditions shall exist:

(a) The car and counterweight shall be provided with safety devices.

(b) There shall be a structure under the shaftway sufficiently strong to withstand without failure the impact of the car with contract load or the impact of the counterweight under free fall conditions.

16.00 Pipes and Wiring

16.01 No pipes, ducts, vessels, electrical conduits or cables shall be located within an elevator shaftway or hoistway or its pit other than those used to furnish or control light, heat, sprinklers, communications or signals for the elevator or hoistway, or for low voltage fire detection systems for the hoistway.

16.02 The fixed electrical conductors installed in elevator or counterweight hoistway, machine room and pit shall be encased in rigid metal conduits or electrical metallic tubing.

16.03 The traveling electrical conductors connecting the car to the fixed wiring in the hoistway shall have a flame retardant and moisture resistant outer cover.

16.04 Pipes, conduits and armored cables shall be securely fastened to the hoistway construction.

16.05 Pressure in steam pipes shall not exceed fifteen (15) pounds above atmospheric pressure.

16.06 No pipes, ducts or vessels conveying gases or liquids shall be discharged or vented into the hoistway or shaftway.

16.07 All wiring for electricity shall be done in accordance with the best practice. In case any question arises as to what is the best practice, work done according to the requirements of the National Board of Fire Underwriters shall be considered as so done.

20.00 SHAFTWAY DOORS

21.00 General

21.01 All landing openings in hand elevator fire resistive shaftways shall be provided with doors, panels or fronts of not less than one and one-half (1½) hour fire resistive construction. When fire resistive shaftway enclosures are not required, doors may be of open metal construction which will reject a ball two (2) inches in diameter.

21.02 All shaftway doors shall be normally closed when the elevator is not in use.

21.03 Shaftway doors shall be equipped to close automatically in case of fire.

21.04 Each landing opening shall be provided with a vertical sliding type semi-automatic gate not less than forty-two (42) inches high and meeting the following requirements:

(a) Vertical sliding counterbalanced gates shall be of wood or metal of a design which will reject a two (2) inch ball. Such gates shall be so constructed and guided as to withstand a lateral force of one hundred (100) pounds concentrated at the

center of the gate without being deflected past the line of the car sill; and a force of two hundred and fifty (250) pounds without forcing the gate from its guides, or without causing it to break and permanently deform.

(b) The bottom of all landing gates shall be not more than two (2) inches above the landing sill.

(c) Gates at landing openings in outside walls shall be not less than six (6) feet high and shall be equipped with a locking device which will prevent the opening of the gate from the outside unless the car is at the landing, and shall be arranged to close and lock automatically when the car leaves the landing.

(d) Gate shoes and guides shall be of metal.

(e) Gate counterweights shall be enclosed or shall run in metal guides from which they cannot be dislodged.

(f) The bottom of all gate weight boxes or of the guides shall be so constructed that the counterweights will be securely held if the counterweight ropes should break.

30.00 CARS

31.00 Car Construction

31.01 Car platforms shall not exceed six (6) feet by six (6) feet in area or a total capacity of two thousand (2,000) pounds.

31.02 Hand elevators shall have cars enclosed on top and sides not used for entrance. The car enclosure shall be secured to the car platform or frame in such a manner that it cannot work loose or become displaced in ordinary service.

31.03 Car frames and platforms shall be of metal or sound seasoned wood designed with a factor of safety of not less than four (4) for metal and six (6) for wood, based on the contract load uniformly distributed. If of wood, the frame members shall be securely bolted and braced.

34.04 No glass shall be used in elevator cars except to cover certificates.

34.05 Elevator cars operating in hoistways outside

the building, which are enclosed only at the bottom landing, shall be protected on the exposed side or sides by independently operated gates which shall be provided with a lock or latch.

32.00 Capacity and Loading

32.01 The contract load of hand elevators shall be not less than fifty (50) pounds per square foot of net inside car area.

32.02 Capacity plate for hand power elevators.

(a) In each hand elevator car, a metal plate shall be provided which shall be fastened in a conspicuous place and shall bear the following information in not less than one-quarter (¼) inch letters or figures stamped in, etched, or raised on the surface of the plate:

CAPACITY (X) POUNDS

(The contract load of the elevator in pounds shall be inserted in space (X) above)

33.00 Car Safeties

33.01 All hand elevators shall be provided with a safety attached to the underside of the car frame capable of stopping and sustaining the car and contract load.

33.02 The application of the safety shall not cause the car platform to become out of level.

33.03 Car safeties shall be of the instantaneous type.

33.04 Safeties shall be marked by the manufacturer with the range of weight for which they are designed.

33.05 A pawl and ratchet or chisel point safety shall not be used.

33.06 When the travel exceeds thirty (30) feet, hand power elevator machines having hand operated brakes shall also be equipped with an automatic speed retarder.

34.00 Contact-Load Test of Car Safety Devices

34.01 A contract-load test of the car safety devices under the supervision of the authorized inspector shall be made of every new hand elevator before the elevator

is placed in regular service. This test shall be made with contract load in car.

40.00 MACHINES AND MACHINE SAFETIES

41.00 Machines and Machinery

41.01 Hand elevators shall be equipped with brakes that operate in either direction of motion of the elevators. When the brake has been applied, it shall remain locked in the 'on' position until released by the operator.

41.02 Brakes shall be capable of stopping and holding the elevator with contract load.

41.03 The factors of safety based on the static loads to be used in the design of all parts of hoisting machines shall be not less than eight (8) for wrought iron or wrought steel and ten (10) for cast iron or other materials.

41.04 If suspension stirrups are used for the sheaves or idlers of hand elevators, they shall be of steel.

41.05 Adequate means of access shall be provided to sheaves and machines for maintenance and inspection.

41.06 No hand elevator machine shall be equipped with any means or attachment for applying any other power unless such elevator is permanently and completely converted into a power elevator complying with the requirements of the code for power elevators.

42.00 Suspension Means

42.01 Suspension members shall be wire ropes or chains.

42.02 A durable plate shall be placed upon the crosshead, bearing the following information in not less than one-quarter (¼) inch letters or figures stamped, etched, or raised on the surface of the plate:

(a) The rope suspension date.

(b) Number, diameter, material, and rated ultimate strength of the suspension means used, as follows:

SUSPENSION SPECIFICATIONS

Suspension Material	Material	Nominal Size	Rated Ultimate Strength in Lbs.
Hoisting			
Counterweight			

42.03 In addition, a durable tag shall be attached to the suspension fastenings, stating the size, rated ultimate strength and material of the suspension, and the date of its installation.

42.04 The factor of safety used in determining the size of the suspension member shall be five (5), based on the weight of the car and its contract load.

42.05 Suspension members shall be so adjusted that, when the car or counterweight of a hand elevator rests on its buffers or supports, there shall be a minimum clearance of twelve (12) inches above the counterweight or car, respectively.

42.06 No bottom runby is required for hand elevators.

42.07 Suspension members secured to a winding drum shall have not less than one (1) complete turn of the suspension member around the winding drum when the car or counterweight has reached the extreme limit of its overtravel.

42.08 The drum end of suspension members shall be secured by clamps or sockets inside the drum.

42.09 Not less than two suspension members shall be provided for each car and each counterweight.

50.00 GUIDE RAILS AND COUNTERWEIGHTS

51.00 Guide Rails

51.01 Car and counterweight guide rails shall be of steel or straight-grained, seasoned wood free from knots, shakes, dry rot or other imperfections. Guide rails shall be securely fastened with through bolts, screws or clips of such strength, design and spacing that the guide rails and their fastenings shall not deflect more than one-quarter (¼) inch under normal operation, particularly where in contact with the guide shoe when the car is at the landing. Guide rails shall withstand the application of the safety when stopping a fully loaded car or the

counterweight. The guiding surfaces of the guide rails for elevators requiring safeties shall be finished smooth. The guide rails shall be "bottomed" on suitable supports and extended at the top to prevent guide shoes running off in case the overtravel is extended.

52.00 Counterweights

52.01 Counterweights shall run in guides, or be fully enclosed in a counterweight box.

52.02 Sections of counterweights, whether carried in frames or not, shall be secured by at least two tie rods passing through holes in the sections. The tie rods shall have lock nuts secured by cotter pins at each end.

PART 4 - DUMBWAITERS

10.00 SHAFTWAY ENCLOSURES

11.00 General

11.01 The shaftways of all dumbwaiters shall be enclosed throughout their height.

11.02 Where the dumbwaiter shaftway penetrates any fully enclosed solid floor above the bottom landing, the walls shall be of not less than two-hour fire-resistive rating.

11.03 Where the dumbwaiter either serves only open construction floors or serves only open balcony floors within one story, the walls shall be of non-combustible materials of either solid construction or open metal construction which will reject a two (2) inch ball, provided such open construction fronts or panels are not less than two (2) inches from any moving equipment within the enclosure. Where less than two (2) inches from moving equipment, open construction shall reject a half-inch (1/2") ball.

11.04 Where a hoistway extends into the top story of a building, fire-resistive hoistway or machinery enclosures, where required, shall be carried to the underside of the roof if the roof is of fire-resistive construction, and at least three feet (3') above the top surface of the roof if the roof is of nonfire-resistive construction.

11.05 Where shaftway enclosures are not required to continue through the roof, the top of the shaftway shall be of fire-resistive construction equivalent to that required for the walls.

11.06 More than one dumbwaiter may be installed in the same shaftway.

12.00 Machine Sheave Enclosures

12.01 Dumbwaiter machines or sheaves shall be enclosed.

12.02 Where fire-resistive hoistway enclosures are required, machine room enclosures shall be of solid construction and of not less than two-hour fire-resistive construction. Where fire-resistive hoistway enclosures are not required, machine room enclosures shall be of non-combustible material, either solid or openwork which shall reject a two (2) inch ball.

12.03 Enclosures shall be located:

(a) Above the top of the shaftway;

(b) Below the shaftway;

(c) Adjacent to and on any side of the shaftway;

(d) Within the shaftway itself, in which instance the shaftway may serve as the enclosure.

12.04 Dumbwaiter support beams shall be of steel, designed with a factor of safety of not less than five (5).

12.05 Flooring or floor covering within enclosures, where provided, shall be of materials other than wood.

12.06 Doors to machine or sheave enclosures shall be of not less than one and one-half (1½) hour fire-resistive construction and shall be equipped with locks. Swing type doors shall be self-closing.

12.07 Loads on overhead beams and their supports shall be computed as follows:

(a) The total load on overhead beams shall be equal to the weight of all apparatus resting on the beams plus twice the maximum static load suspended from the beams.

13.00 VENTING OF HOISTWAYS

13.01 Hoistways of dumbwaiters serving more than three stories shall be provided with means for venting smoke and hot gases to the outer air in case of fire.

Exception: Hoistways not extending into the top story of a building, other than hotels, apartment houses, hospitals, and similar buildings with overnight sleeping quarters, where the hoistways are equipped with approved automatic sprinklers connected to the building water-supply system or to an approved automatic sprinkler system. (In case any question arises as to what is the best practice, work done in accordance with the requirements of NBFU Standards No. 13, entitled "Sprinkler Systems", dated June, 1953, will be considered as compliance.)

13.02 Location of Vents

Vents shall be located -

1. In the side of the hoistway enclosure directly below the floor or floors at the top of the hoistway, and shall open directly to the outer air or through incombustible ducts to the outer air; or,

2. In the wall or roof of the penthouse or overhead machinery space above the roof, provided that openings of at least equivalent area are provided in the floor or floors at the top of the hoistway.

13.03 Area of Vents

The area of the vents shall be not less than three and one-half (3½) per cent of the area of the hoistway nor less than one-

half (1/2) square foot of each dumbwaiter car, whichever is greater. Of the total vent area described, not less than one-third (1/3) shall be of the permanently open type.

Exceptions: Where mechanical ventilation providing equivalent venting of the hoistway is provided in the overhead elevator machine room (see Rule 12.08, Part 2), required vent area may be reduced subject to the following:

1. The building is not a hotel, apartment house, hospital, or similar building with overnight sleeping quarters;

2. The machine room is so located that it has no outside exposure;

3. The hoistway does not extend to the top story of the building;

4. The machine room exhaust fan is automatically reactivated by thermostatic means.

13.04 Closed Vents

Closed portions of the required vent area shall consist of windows, skylights, or duct openings glazed with plain glass not more than one-eighth (1/8) inch thick.

13.05 Window and Skylight Frames and Sash

Window and skylight frames and sash shall be of metal.

13.06 Skylight Guards

A guard, securely anchored to the supporting structure, consisting of a wire-mesh screen of at least #13 steel wire gauge with openings which will reject a ball one inch (1") in diameter, or an expanded metal screen of equivalent strength and open area, shall be installed above every dumbwaiter skylight. A similar screen of at least #18 steel wire gauge, or of expanded metal of equivalent strength and open area, shall be installed below every dumbwaiter skylight.

13.07 Windows are permitted only in external walls of hoistway enclosures.

13.08 All windows and window frames in fire-resistive hoistway enclosures shall be fire windows conforming to local laws and ordinances.

13.09 Exterior windows in the hoistway less than one hundred

feet (100') above the ground or less than thirty feet (30') above an adjacent roof shall be guarded on the outside by one of the following methods:

1. By vertical bars not less than 5/8" in diameter, or equivalent, spaced not less than ten inches (10") on centers, and not more than ten inches (10") between the window jamb and the center of the nearest bar.

2. By metal sash having solid-section steel muntins of not less than 1/8" thickness, spaced not more than eight inches (8") apart.

14.00 Thoroughfares

14.01 If the shaftway of a dumbwaiter does not extend to the lowest floor of a building and the space under the bottom of the car or counterweight is used for any purpose, the following requirements shall be met:

(a) The car and its counterweight shall be provided with a safety device of the instantaneous type, designed and installed to apply and stop the fully loaded car and counterweight without appreciable delay on the breaking of the suspension means, irrespective of the location of the break.

(b) The construction of the hoistway under the car and counterweight shall be sufficiently strong to withstand, without failure the impact of the fully loaded car and of the counterweight descending at one hundred and twenty-five per cent (125%) of contract speed.

(c) Where calculations, based on good engineering

practice demonstrate that the structure under the hoistway is capable of withstanding, without failure, the impact of the fully loaded car or its counterweight, falling freely from their upper limits of travel, no safety device shall be required for the car or counterweight.

15.00 Pipes and Wiring

15.01 No electrical conduits or cables or any other installation other than those used to furnish or control power, light, heat or signals for the dumbwaiter or hoistway shall, in any way, be located within the shaftway.

15.02 Pipes, conduits and armored cables shall be securely fastened in the hoistway construction.

15.03 Pressure in steam pipes shall not exceed fifteen (15) pounds above atmospheric pressure.

15.04 No part of any electric circuit having a rated system or circuit voltage in excess of two hundred and fifty (250) volts shall be used either for any operating circuit or for any control circuit on any equipment which is located in the hoistway, on the car, on the landing doors, or at the landing openings.

15.05 All wiring for electricity shall be done in accordance with the best practice. In case any question arises as to what is the best practice, work done according to the requirements of the National Board of Fire Underwriters shall be considered as so done.

20.00 — DUMBWAITER SHAFTWAY DOORS

21.00 General

21.01 All landing openings in dumbwaiter fire-resistive shaftways shall be provided with doors, panels or fronts of not less than one and one-half (1½) hour fire-resistive construction. Where fire-resistive shaftway enclosures are not required, doors may be of open metal construction which will reject a ball two inches (2″) in diameter.

21.02 The landing door opening shall not exceed the width and height of the car and in no case shall the height exceed four feet (4′) provided that one landing door may be of a larger size to permit installing or removing the car.

21.03 Shaftway landing doors of power driven dumbwaiters, other than where hoistway type interlocks are used, shall be of the vertical sliding type and shall be provided with hoistway unit-system type contacts and mechanical locks which are arranged so that the car cannot be operated unless each hoistway landing door is in the closed position.

21.04 Mechanical locks, where used, shall be of a double hook or multiple hook type arranged to lock the door after the car departs from the landing zone.

22.00 Landing Doors For Hand-Powered Dumbwaiters

22.01 Landing doors in shaftways for hand-powered dumbwaiters shall be of the self-closing type, or shall be equipped to close automatically in case of fire.

30.00 CARS

31.00 Car Construction

31.01 Dumbwaiter cars shall be of rigid construction and designed to sustain the contract load.

31.02 Cars shall be made of wood or metal.

31.03 Cars for power dumbwaiters shall be reinforced with metal from the bottom of the car to the point of suspension.

31.04 Metal cars shall be of metal sections rigidly riveted, welded or bolted together.

31.05 Cars may be provided with hinged or removable shelves.

31.06 Dumbwaiter cars shall be capable of sustaining the loads given in Table IV below with factors of safety not less than six (6) for steel and nine (9) for cast iron or other materials. The motive power need not be sufficient to raise the structural-capacity load.

Table IV.

Effective Platform Area (Sq. ft.)	Minimum Design Capacity (lbs.)
4	100
5	150
6.25	300
9	500

31.07 A metal capacity plate shall be provided which shall be fastened in a conspicuous place and shall bear the following information in not less than one-quarter inch (¼") letters or figures, stamped, etched, or raised on the surface of the plate:

CONTRACT LOAD ..... POUNDS

40.00 MACHINES AND MACHINE SAFETIES

41.00 Dumbwaiter Machines

41.01 Dumbwaiter machines shall be securely fastened to their supports. The factors of safety, based upon the ultimate strength of the materials and the contract load, plus the weight of the car, ropes, counterweights, to be used in the design of dumbwaiter machines shall be not less than six (6) for steel, and nine (9) for cast iron or other materials.

41.02 Sheaves or idlers shall not be suspended in cast iron stirrups from the under side of the supporting beam.

41.03 Belts and chains may be used as the driving means between motors and driving sheaves or drums of power dumbwaiters subject only to the following restrictions:

(a) When flat belts are used, the contract speed shall not exceed 50 F.P.M.
(b) Where multiple "V" belts are used, the contract speed shall not exceed 150 F.P.M.

42.00 Terminal Stopping and Machine Safety Devices

42.01 Power dumbwaiters shall be provided at each terminal with means independent of manual operation to stop the car automatically within the limits of overtravel.

42.02 Power dumbwaiters, other than hydraulic dumbwaiters, shall be equipped with brakes which are automatically applied when the power is cut off the motor.

42.03 Power dumbwaiters operated by winding-drum machines shall be provided with a slack-rope device.

50.00 SUSPENSION MEANS

51.00 Power dumbwaiters other than those of the direct plunger type shall be provided with one or more iron or steel hoisting ropes or chains. No covering shall be permitted on ropes other than where liability to excessive corrosion or other hazards exists, in which case Marline covering may be used. Chains, when used, shall be of the roller or block type.

52.00 The factor of safety for car and counterweight ropes based on static loads and ultimate strength of the rope shall be not less than the values given in Figure 4, below, corresponding to the contract speed of the car. For chains the factor of safety shall be not less than twenty-five percent (25%) greater than given in Fig. 4.

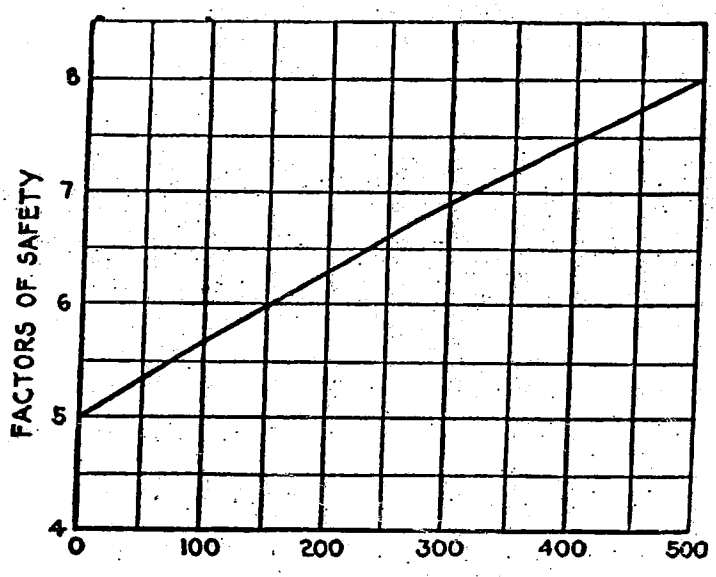

Figure 4. Factors of Safety for Hoisting Ropes for Dumbwaiters

PART 5 -- SIDEWALK ELEVATORS AND MANLIFTS

New installation of sidewalk elevators and manlifts shall be prohibited after the effective date of these regulations.

PART 6 -- OPERATION OF ELEVATORS

10.00 LICENSED OPERATORS

11.00 General

11.01 No person shall operate, and no owner, lessee, employer or his agent shall cause or permit to be operated, any elevator except by a person duly licensed for such service by the Commissioner of Public Safety, except:

(a) In case of emergency, such operation by a competent unlicensed person may be permitted for a period not exceeding two (2) consecutive days, provided the Department of Public Safety is immediately notified. Such period may be extended by the department where necessary to avoid undue hardship, but no single extension shall exceed a period of more than seven (7) consecutive days.

(b) Licensed operators are not required for automatic operation or continuous pressure operation passenger or freight elevators or existing shipper rope elevators, when equipped with the proper safeguards. Where an operator has been designated to be in permanent charge of such elevators or where a car switch is employed, said operator shall be licensed.

(c) An operator's license shall not be required of an elevator contractor or of a qualified mechanic engaged in the construction, maintenance, or repair of elevators or elevator shaftways, or of an inspector having authority to inspect elevators.

12.00 GRANTING OF LICENSES

12.01 Whoever desires to act as an operator of eleva-

tors herein required to be operated by a licensed person shall make application to the department on blanks to be furnished by the said department. A license shall not be granted to a person less than eighteen (18) years of age.

12.02 The applicant shall be given a practical examination as to his knowledge of the operation of elevators, particularly as to the safeguarding of passengers and the requirements of these regulations, and if found competent shall be granted a license by the Commissioner.

12.03 Licenses shall be for the term of one year from the date thereof, and may be renewed yearly by the department. If a license has not been renewed within three (3) years from the date of issuance, a re-examination shall be required.

12.04 Should a license become lost, a duplicate thereof shall be granted upon application to the department.

12.05 The fee for a new license shall be one dollar; the fee for the renewal of a license shall be fifty cents; the fee for a duplicate license shall be fifty cents.

13.00 DISPLAY OF LICENSES

13.01 A licensed operator shall at all times when operating an elevator be prepared to display his license on demand of the owner or tenant of the building, or of any person authorized to inspect the elevator, or of any police officer.

14.00 REVOCATION AND SUSPENSION OF LICENSES

14.01 A wilful falsification in the matter of a statement in an application shall be deemed sufficient cause for the revocation at any time of a license granted on said application.

14.02 A license may be suspended or revoked by the Commissioner, if the holder is incompetent or untrustworthy or fails to comply with these regulations.

20.00 INSTRUCTIONS TO OPERATORS

21.00 Learn These Instructions Thoroughly and Keep A Copy Available For Use At All Times

21.01 Always open the service switch or lock the operating mechanism when placing the elevator out of service.

21.02 Be sure the operating mechanism is in the "STOP" position before closing the service switch.

21.03 Report any defects promptly to the person in charge.

21.04 Do not attempt to make any repairs.

21.05 Carry no passengers or freight while inspections, repairs, or adjustments are in progress, and operate the car only in response to directions from the inspector or person in charge. Do not move the car when anyone is in the pit or on top of the car except as he may direct.

21.06 When in the opinion of the operator an excess load is to be carried, do not ride or allow others to ride on the elevator.

21.07 Hoistway doors or gates shall always be closed and locked before the car is started. The car shall be brought to a stop at the landing level before either the car door or car gate where provided or the hoistway door or hoistway gate is opened manually.

21.08 Keep car gates closed while car is running, and where no car gates are provided, keep passengers away from the open edge of the car platform.

21.09 Limit the number of passengers or load to the contract capacity of the car and do not permit crowding or overloading.

21.10 Do not reverse the operating device suddenly; stop the car before reversing.

21.11 Move operating device to the stop position on approaching the terminal landings. Do not depend on the terminal stops in the ordinary operation of the car.

21.12 Should the power go off while the car is in motion, move the operating device to the "STOP" position and start the car in the usual manner upon return of the power.

21.13 Familiarize yourself with the emergency devices, understand their function, and know how to operate them.

21.14 Should the car stop suddenly, shut off the power, call for the person in charge and operate the elevator only at his direction. While waiting, keep calm. Do not attempt to release any safety device; remember that it is safer to stay in the car until help arrives than to try to get out, and so instruct your passengers.

21.15 Should the car refuse to stop, do not attempt to jump off.

21.16 Before loading or unloading elevators with hand-rope type operation, lock the operating mechanism in the "STOP" position.

21.17 Never leave the car in the ordinary course of operation nor leave the operating mechanism unprotected. When going off duty for any reason, even for a few minutes, be sure that the power is disconnected or

that the operating mechanism is locked and the hoistway doors are closed.

21.18 Always leave a hydraulic elevator operated by a lever at the lower landing with the lever in the position for down motion.

21.19 In running a belt-driven elevator, be sure to pull the hand-rope as far as possible when starting the car. In doing so, you throw the belt full on the tight pulley, and thus prevent it from slipping. In stopping, use the centering rope.

21.20 Never allow anyone to scuffle or fool on the elevator. It is always dangerous.

21.21 Never, under any condition, allow anyone to get on or off the car while it is in motion.

21.22 Keep your mind on your work. Always remain at your post while the car is moving, so that you can stop it quickly in an emergency.

21.23 If an accident causing material damage or injury to a person by an elevator, escalator, dumbwaiter, or other devices governed by these regulations, requires medical attention, the person having knowledge of the accident, be he the owner, lessee, operator, or other person in charge, shall immediately report such accident to the inspector having jurisdiction, who shall forthwith inspect such elevator or devices herein described. Said inspector shall file a complete written report of his inspection with the Commissioner of Public Safety.

PART 7 — MOVING STAIRWAYS

10.00 MOVING STAIRWAY CONSTRUCTION

11.00 Protection of Floor Openings

11.01 Floor openings for moving stairways not constituting required means of egress shall be protected as follows:

11.02 Floor openings shall be provided with enclosures as required for stairways

OR

11.03 In buildings completely protected by an approved automatic sprinkler system, each moving stairway floor opening shall be protected against the passage of fire, smoke and gases to the story above by one of the following alternative methods of protection: Sprinkler-Vent method (11.04); Rolling Shutter method (11.05); or Spray Nozzle method (11.06); and, in addition to the manual controls specified, each moving stairway shall be provided with an automatic stopping device which will stop the unit when any one of the protective methods specified functions.

11.04 SPRINKLER-VENT method — a combination of an automatic water curtain meeting the following requirements:

(a) The exhaust system shall be of such capacity as to create a downdraft, through the moving stairway floor opening, having an average velocity of not less than three hundred (300) feet per minute under normal conditions for a period of not less than thirty (30) minutes.

NOTE: This requirement can be met by the provision of an air intake from the outside of the building above the floor opening. The test of the system under 'normal' conditions requires that the velocity of the downdraft be developed when windows or doors normally used for ventilation are open. The size of the exhaust fan and exhaust ducts must be sufficient to meet such ventilation conditions. Experience indicates that fan capacity should be based on a rating of not less than 500 cfm per square foot of moving stairway opening

to obtain the 300 ft./min. required. If the building is provided with an air-conditioning system arranged to be automatically shut down in the event of fire, the test conditions should be met with the air-conditioning system shut down. The 300 ft./min. downdraft through the opening provides for the testing of the exhaust system without requiring an expansion of air present under actual fire conditions.

(b) Operation of the exhaust system for any floor opening shall be initiated by an approved thermostatic device in the story involved and shall also result from the functioning of other required automatic fire detection devices within the building or section of the building. There shall also be provided a manual means of operating and testing the system.

NOTE: Supervised smoke detection devices ordinarily provide earlier detection of fire than automatic sprinkler systems and if used to actuate the exhaust system automatically should provide an added life-safety advantage.

(c) To assure reliability of the electrical supply to all parts of the exhaust system and control devices, the circuits shall be supplied directly from the bus bars of the main switchboard, or by a main connected to the bus bars of the main switchboard but not used for any other purpose.

(d) Fans and ducts used in connection with automatic exhaust systems shall be constructed and installed in accordance with the best engineering practice.

(e) Periodic tests, not less frequently than quarterly, shall be made of the automatic exhaust system to maintain the system and the various control devices in good working order.

(f) The water curtain shall be formed by open sprinklers or spray nozzles so located as to form a complete water barrier along all exposed sides of the floor opening and reaching from the ceiling to the floor.

11.05 ROLLING SHUTTER method — an automatic self-closing rolling shutter which will completely enclose the top of each moving stairway opening above the street floor, meeting the following requirements:

(a) The shutter shall close off the wellway opening immediately upon the automatic detection, by an approved device, of either fire or smoke in the vicinity of the moving stairway, and in addition there shall be provided a manual means of operating and testing the operation of the shutter.

(b) The shutter assembly shall be capable of supporting a weight of one hundred (100) pounds on any one square foot of area, and not less resistant to fire or heat than twenty-four (24) gage steel.

(c) The shutter shall operate at a speed of not greater than thirty (30) feet per minute and shall be equipped with a sensitive leading edge. The leading edge shall arrest the progress of the moving shutter and cause it to retract a distance of approximately six (6) inches upon the application of a force not in excess of twenty (20) pounds applied on the surface of the leading edge. The shutter, following retraction, shall continue to closure immediately.

(d) To assure reliability of the electrical supply to the control devices for, and for actuation of, the automatic rolling shutter, the circuits shall be supplied directly from the bus bars of the main switchboard, or by a main connected to the bus bars of the main switchboard but not used for any other purpose.

11.06 SPRAY NOZZLE method — a combination of an automatic smoke or fire detection system and a system of high velocity water spray nozzles, meeting the following requirements:

(a) Spray nozzles shall be of the open type and shall have a solid conical spray pattern. The number of nozzles, discharge angles and location shall be such that the moving stairway floor opening will

be completely covered by a dense spray upon the operation of the system.

(b) The number and size of nozzles and water supply shall be sufficient to deliver a discharge of two and one-half (2½) gallons of water per square foot per minute through the floor opening.

(c) Spray nozzles shall be located near the top of the wellway housing and so positioned that the center line of discharge is at an angle not less than sixty (60) degrees with the plane of the opening to be protected.

(d) Spray nozzles shall be provided with a water supply, separate from the water supply system for automatic sprinklers, at a minimum flowing pressure of at least twenty-five (25) pounds per square inch. Oversize piping shall be used to minimize friction loss.

(e) Control valves shall be readily accessible to minimize water damage. Thermal control valves may be used, if piping is arranged and sized so that any one control valve can supply simultaneously all the spray nozzles intended for the protection of the moving stairway floor opening.

(f) A noncombustible draft curtain, extending twenty (20) to thirty (30) inches below and around the opening and a solid non-combustible wellway housing above the floor shall be provided at each moving stairway floor opening. Spray nozzles shall be protected by sheet metal deflectors against mechanical injury.

(g) Means of manual operation of the spray nozzle system for any floor opening shall be provided, and the system shall also be actuated by approved smoke detection or thermostatic devices in the story in which fire may occur. Supervised smoke detection devices located in or near the moving stairway floor opening may be used to meet this requirement. Thermostatic fire detection devices, such as rate-of-rise or fixed temperature systems, used to initiate the operation of the spray nozzle system shall be so located as to assure the

operation of the system in advance of the passage of smoke through the moving stairway floor opening.

12.00 Angle of Inclination

12.01 The angle of inclination of a moving stairway shall not exceed thirty (30) degrees from the horizontal.

13.00 Width

13.01 The width between moving stairway balustrade shall be not less than twenty-two (22) inches nor more than forty-eight (48) inches, measured on the incline at a height of twenty-seven (27) inches vertically above the nose line of the steps. In no case shall such width exceed the width of the steps by more than thirteen (13) inches.

14.00 Balustrading and Hand Rails

14.01 Moving stairways shall be provided on each side with solid balustrading. On the step side, the balustrading shall be smooth, without depressed or raised paneling or molding. Necessary protective molding parallel to the run of the steps and vertical molding not more than one-quarter (¼) inch and properly beveled may be used to cover joints of panels.

14.02 Where glass panels are used in balustrading, they shall be of shatterproof or tempered type glass.

14.03 The clearance between the step treads and the balustrading curtain guard shall not exceed one-eighth (⅛th) inch.

14.04 There shall be no abrupt change in the width between the balustrades. Any change shall be not more than eight (8) per cent of the greatest width. In changing from the greater to the smaller width, the change in the direction of the balustrading shall be not more than fifteen (15) degrees from the line of travel.

14.05 Each balustrading shall be equipped with a moving handrail travelling at substantially the same speed and in the same direction as the travel of the steps. Each moving handrail shall extend at normal handrail height not less than twelve (12) inches beyond

the line of the comb-plate teeth at the upper and lower landing.

14.06 Hand or finger guards shall be provided at the point where the handrail enters the balustrading.

14.07 Where the intersection of the outside balustrade or deck board and the ceiling or soffit is within twenty-four (24) inches of the centerline of the handrail, a vertical guard plate of solid construction shall be installed in the apex of the intersecting angle. The vertical face of the guard shall project at least fourteen (14) inches measured horizontally from the apex of the angle. Where glass plates are used, they shall be of shatterproof glass. Vertical end of the guard plate shall be rounded to eliminate a shear hazard.

15.00 Step Frames and Treads

15.01 Step frames and treads shall be of non-combustible material. Step treads shall be horizontal and of a material and design affording a secure foothold.

15.02 The depth of any step tread in the direction of travel shall be not less than fifteen and three-quarter (15¾) inches, and the rise between treads shall not exceed eight and one-half (8½) inches. In no case shall the width of a step tread be less than sixteen (16) inches.

15.03 The maximum clearance between treads on the horizontal run shall be one-eighth (⅛th) inch.

15.04 The tread surface of each step shall be slotted in a direction parallel to the travel of the steps. Each slot shall be not more than one-quarter (¼) inch wide and not less than three-eights (⅜ths) inch deep, and the distance from center to center of adjoining slots shall be not more than three-eighths (⅜ths) inch.

15.05 There shall be a comb-plate at the entrance and exit of every moving stairway. The comb-plate teeth shall be meshed with and set into the slots in the surface of the tread, so that the points of the comb teeth are always below the top surface of the treads.

15.06 Comb-plates shall be adjustable in both the horizontal and vertical directions.

15.07 Sections forming the comb-plate teeth shall be so arranged as to be readily replaceable.

16.00 Design of Trusses or Girders

16.01 The truss or girder shall be so designed that it will safely sustain the steps and running gear in case of failure of the track system to retain the running gear in its guides.

17.00 Track Arrangement

17.01 The track arrangement shall be designed to prevent displacement of the steps and running gear if a step chain breaks.

18.00 Capacity and Loading

18.01 The contract load, in pounds, shall be computed by the following formula:

$$\text{Contract load} = 4.6\ W\ A$$

In this formula, W is the width in inches between the moving stairway balustrades measured thirty (30) inches vertically above the nose line of the steps, and A the horizontally projected distance in feet between the upper and lower comb-plate teeth.

19.00 Factors of Safety

19.01 The factors of safety to be used in the design of moving stairways shall be at least the following, based on the static loads:

(a) For trusses and all structural members, including tracks, five (5);

(b) For moving stairway driving machines—for wrought iron or wrought steel, eight (8); for cast iron, cast steel, or other materials, ten (10).

(c) For power transmission members, ten (10), other than step chains composed of cast steel links which shall be thoroughly annealed, in which case the factor of safety shall be not less than twenty (20).

20.00 SAFETY REQUIREMENTS

21.00 Limits of Speed

21.01 The rate of travel of the steps measured along

the angle of inclination shall not exceed one hundred and twenty-five (125) feet per minute.

22.00 Application of Power

22.01 Each moving stairway shall be driven by an individual motor.

22.02 No belt or cast iron pinion shall be used.

23.00 Safety Devices

23.01 The following safety devices shall be provided:

(a) An emergency stop button, accessible to the public and not enclosed, shall be conspicuously located at both the top landing and bottom landing of each moving stairway not more than five (5) feet above the landing level. The operation of either one of these buttons shall be arranged to cause the interruption of power to the moving stairway . It shall be impossible to start a moving stairway by means of these buttons. Each of these buttons shall be marked "EMERGENCY STOP BUTTONS."

(b) Starting buttons or switches shall be located within sight of the moving stairway and shall be of the key-operated type.

(c) Each moving stairway shall be provided with a speed governor which will cause the interruption of power to the moving stairway in case the speed exceeds a pre-determined value which shall be not more than forty (40) per cent in excess of the normal running speed.

(d) Each moving stairway shall be provided with a broken step chain device which will cause the interruption of power to the moving stairway in case a step chain breaks. Where no automatic chain tension device is provided, this device shall also function in case excessive sag occurs in either step chain.

(e) Where a moving stairway is equipped with tightening devices operated by means of tension weights, provision shall be made to retain these weights in the moving stairway-truss or frame in case the weights should fail.

(f) Each moving stairway shall be provided with an electrically released, mechanically applied brake of sufficient power to stop it when fully loaded.

This brake shall automatically stop the moving stairway when operating or tending to operate in the descending direction in case any of the safety devices function.

(g) Where the drive machine is connected to the main drive-shaft by a chain, a device shall be provided which will cause the application of a brake on the main drive-shaft in case the drive chain parts.

24.00 Lights and Access

24.01 There shall be an electric light in every moving stairway machine room, which can be lighted without passing over or reaching over any part of the machinery.

24.02 Free access to the moving stairway inspection doors shall be provided for inspection and maintenance.

30.00 TESTS

31.00 Each type of moving stairway shall be type-tested for the contract load for which it is designed to carry. Such tests may be made at the option of the manufacturer in his plant or on the first moving stairway of that type installed in a building. In case the first installation of a given type is not of sufficient rise and/or width to permit testing it for the maximum rated load of the type, subsequent type-tests shall be made with load until a maximum load test has been made.

31.01 **Speed Test** — The application of the overspeed safety device shall be obtained by causing the moving stairway to travel at governor tripping speed. Where an alternating current driving motor is used, the governor switch may be tripped by hand at normal speed.

31.02 **Broken Step Chain** — The broken step chain device shall be tested by operating the actuating device by hand.

31.03 **Broken Drive Chain** — The broken drive chain device, where a drive chain is provided, shall be tested by operating the actuating device by hand.

31.04 **Stop Buttons** — The emergency stop buttons shall be tested by operating these buttons when the moving stairway is operated in each direction of travel.

PART 8 — PRIVATE RESIDENCE ELEVATOR CODE

10.00 Scope

The rules in this part of the code apply only to power passenger elevators serving only a single family, installed in a single residential building and having a contract load not in excess of 700 lbs. the contract speed not in excess of 50 fpm and a clear platform area not in excess of 12 sq. ft.

and a rise not in excess of 50 ft.

All regulations shall comply with local laws and ordinances.

For requirements governing hand-elevators, refer to the appropriate sections of the Mass. ELV-2 for Elevators, Dumbwaiters, and Escalators.

11.00 Hoistways

11.01 Enclosure. The hoistway shall be solidly enclosed, other than for exterior windows, throughout its height, without grillework or openings other than for landing or access doors. Enclosures shall be of sufficient strength to support in true alignment the hoistway doors and gates and their locking equipment. Elevators operating in an open stair well shall be enclosed on the unused sides to a height of not less than 7 feet above the stair treads and landings with wood, metal or open grillework. Where enclosures are not solid, the mesh shall not be larger than ⅜″ square.

11.02 (a) If the contract speed is 30 fpm or less, the enclosure may be omitted in the lowest story served if there is no pit and if the car platform is equipped with a device which, when obstructed in its downward travel by a force not to exceed 4 lbs. applied anywhere at its lower surface, will open an electric contact in the control circuit and thus stop down travel of the car within the range of the free suspension of the device and not exceeding 3 in.

(b) If the contract speed is 30 fpm or less, the hoistway landing door or doors at the lower landing may be omitted on elevators located in existing open stairway areas or other existing open areas if the car platform is equipped with a device which will meet the requirements of 11.02 (a), and stop the car when it is obstructed in its down-

ward travel, and provided that the unused sides of the hoistway are protected.

11.03 Car Clearances

(a) There shall be a clearance of not less than ¾ in. between the car and the hoistway enclosure, and between the car and its counterweight.

(b) The clearance between the car platform and the landing threshold shall be not less than ½ in. nor more than 1 in.

11.04 Pits and Overtravel

(a) The structure at bottom of hoistway shall be sufficiently strong to withstand without failure the impact of the car with contract load, also the impact of the counterweight, when either is descending at contract speed, or at governor tripping speed if governor-operated safety is used. (See Rule 34.00 Part 2.)

(b) A pit is not required at the bottom of the hoistway and the car may stop immediately on or above the bottom landing floor, or a pit may be provided to permit the car floor to stop flush with the landing floor, if equipped with a device that will meet the requirements of Paragraph 11.02.

(c) A pit shall not be provided when there is no hoistway enclosure at the lowest story served.

(d) At the top landing, there shall be a top clearance of not less than 4 in. plus 1 in. for each 3 1/3 fpm speed in excess of 30 fpm.

11.05 Overhead Support

(a) All machinery and sheaves shall be so supported and secured as effectually to prevent any part becoming loose or displaced.

The supporting beams shall be steel, sound timber or reinforced concrete.

(b) Loads on overhead beams and their supports shall be computed as follows: The total load on overhead beams shall be assumed as equal to the weight of all apparatus resting on the beams plus twice the maximum load suspended from the beams. The load resting on the beams shall include the complete weights of machine sheaves, controller, etc. The load suspended from the beams shall in-

clude the sum of the tensions of all ropes suspended from the beams.

NOTE: The object in doubling the suspended load is to allow for impact, acceleration stresses, etc.

(c) No elevator machinery or sheaves shall be fastened to the underside of the supporting beams at the top of the hoistway.

Other Than: The idler or deflecting sheaves with their guards and frames

Supporting members for sheaves and other elevator machinery hung underneath beams shall not depend solely on cast iron in tension.

(d) The factor of safety for overhead beams and their supports shall be

For steel 5

For timber and reinforced concrete 6

11.06 Pipes and Wiring

(a) All electric wiring shall be in accordance with the rules and regulations made in accordance with the provisions of General Laws, Chapter 143, Section 3L, as most recently amended.

(b) No pipes, ducts, vessels, electrical conduits or cables shall be located within an elevator shaftway or hoistway or its pit other than those used to furnish or control light, heat, sprinklers, communications or signals for the elevator or hoistway, or for low voltage fire detection systems for the hoistway.

(c) No electric circuit having a nominal voltage in excess of 250 volts, shall be used for the operation, control or motor circuit.

(d) All live parts of electrical apparatus in the hoistway shall be suitably enclosed to protect against accidental contact.

12.00 Hoistway Guards

12.01 Counterweight Runway.

(a) Where the counterweight runway comes down to a floor or passes a floor or stairs, it shall be enclosed at least 7 ft. above the floor or stairs by an enclosure which is either solid or with openings

not exceeding ⅜ in. square.

(b) Access shall be provided for inspection, maintenance and repair of counterweight and ropes. The door to the counterweight runway enclosure shall be self-closing.

12.02 Protection of Hoist Ropes.

(a) Where hoist ropes pass through a floor or stairs outside the hoistway enclosure, they shall be solidly enclosed to a height of not less than 7 ft. above the floor or the stair tread. The floor openings shall not be greater than necessary for free passage of the ropes.

(b) Hoist ropes immediately adjacent to stairs shall be guarded with solid or grille panel on the stair side to a height of not less than 7 ft. above the stair treads. Enclosures shall be solid, or open work with openings not exceeding ⅜ in. square.

13.00 Landings

13.01 Hoistway Doors.

(a) Where a hoistway enclosure is required, landing openings shall be protected by swing or horizontal slide doors. Where the hoistway enclosure is solid, these doors shall be solid.

(b) The clearance between the hoistway enclosure door and the hoistway edge of the landing sill shall not exceed 2 in. and the distance between the hoistway face of the landing door and the car door or gate shall not exceed 4 in.

(c) The hoistway face of the landing door shall not project into the hoistway beyond the landing sill. No hardware, except that required for locks, contacts or signals shall project into the hoistway beyond the line of the landing sill.

(d) Hoistway doors shall be provided with locking devices and electric contacts conforming to the following: "The locking device shall either be of a type which will prevent starting the car unless the door is locked in the closed position, or it may permit the car to start with the door in the closed position and not locked, provided the device will stop the car if the door fails to lock, before the car has moved more than 12 in. away from the

landing. The device shall also prevent opening any hoistway door unless the car is within 12 in. of that landing."

(e) No means shall be provided which will open any landing door from the landing side when the car is not in the landing zone.

(f) Hoistway doors shall be so arranged that it will not be necessary to reach back of any panel, jamb or sash to operate them.

(g) Means shall be provided to prevent hangers for sliding hoistway doors from jumping the track. Stops will be provided to prevent the hanger carriage from leaving either end of the track, or suitable stops shall be provided on the door.

13.02 Light in Car.

There shall be an electric light to illuminate the car, with its switch place near the car entrance within easy reach of a person before entering the car.

Other than: Elevators in unenclosed hoistways.

13.03 Guide Rail Construction.

(a) Car and counterweight guide rails shall be of steel.

(b) Guide rails shall be securely fastened.

Guide rails and their fastenings shall not deflect more than ¼ in. under normal operation.

Joints of guide rails shall be well fitted and strongly secured.

Guide rails and their joints and fastenings shall withstand the application of the "SAFETY" when stopping the fully loaded car.

(c) The guide rails shall extend from the bottom of the hoistway to a height above the top landing sufficient to prevent the guide shoe from running off the guides when the car or counterweight are at the extreme upper position.

14.00 Counterweight

(a) Counterweights, where used, shall run in guides.

(b) If a car counterweight is used, it shall not be

of sufficient weight to cause undue slackening of any car hoist rope at start or stop of the car.

(c) The counterweight sections, whether or not carried in a frame, shall be fastened together to prevent rattle and displacement.

(d) There shall be no gas lines under the car or counterweight runways.

14.01 Car Construction.

(a) Elevator cars shall have metal or combination metal and wood suspension frames and platforms with safety factor of not less than five (5) based on the contract load.

(b) Cast iron shall not be used in the construction of any member of the car frame or platform other than for guide shoes and guide shoe brackets.

(c) No glass shall be used in a residence elevator car except for car light and appliances necessary for the operation of the car.

(d) The car shall have but one compartment.

(e) No elevator shall have more than two (2) openings.

14.02 Car Enclosure.

(a) Other than at the entrance the car shall be enclosed at sides and top. The enclosure at the sides shall be solid or of open work which will reject a ⅜ in. diameter ball.

(b) The car enclosure shall be secured in such manner that it cannot work loose or become displaced in regular service.

14.03 Car Gate.

(a) A car door or gate shall be provided at each entrance to the car. This door or gate shall, when closed, guard the opening to a height of at least 5 ft. 6 in. and if on an electric or electrically controlled hydraulic elevator, shall be provided with an electric contact which will prevent operation of the elevator unless the car door or gate is within 2 in. of full closure.

(b) The car door or gate may be manually operated, power operated, or may be closed by a weight or spring. Collapsible gates shall not be power-

opened more than 9 in. from full closure.

(c) Car gates shall be of a design that when fully expanded will reject a 3-inch diameter ball.

(d) When the shaftway enclosure is omitted at the bottom landing the car gate shall be provided with a mechanical lock which shall lock it in the closed position when the car is more than 6 in. away from any landing. Car door release shall be provided to permit the door or gate to be opened at any point of car travel.

(e) Car door or gate contacts shall be positively opened by a lever or other device attached to and operated by the door or gate.

(f) Car door or gate contacts shall be maintained in the open position by the action of gravity or a restrained compression spring or both, or by means of a positive linkage.

15.00 Safeties

15.01 Safety Construction and Operation.

(a) Elevator cars suspended by wire ropes or chains shall be provided with a car safety capable of stopping and sustaining the car with contract load.

(b) The car safety shall be of a type operated as the result of the breaking of the hoist ropes, or by a speed governor. If of the speed governor type, it must operate to set the safety at a maximum speed of 175 fpm. On breaking of the hoist ropes, the safety shall operate without appreciable delay and independently of the governor speed action.

(c) If a speed governor is used, it shall be located where it cannot be struck by the car or counterweight in case of over-travel and where there is sufficient space for full movement of the governor parts.

(d) The motor-control circuit and the break control circuit shall be opened before or at the same time the safety applies.

(e) The governor ropes shall be of iron, steel Monel metal or phosphor bronze not less than ¼ in. in diameter. Tiller rope construction shall not be used for governor ropes.

(f) Elevators of the winding drum type with rope suspension shall be provided with a slack rope device of the manually reset type which will cut off the power and stop the elevator machine if the car is obstructed in its descent and the hoist ropes slacken. Elevators with roller chain suspension shall be provided with a slack chain device which will cut off the power and stop the elevator machine if the car is obstructed in its descent and the hoist chains slacken. This device need not be of the manually reset type if the chain sprockets are guarded to prevent the chain from jumping off the sprockets.

(g) No safety device which depends upon the completion and maintenance of an electric circuit for the application of the safety shall be used. Car safeties shall be applied mechanically.

Cast iron shall not be used in the construction of a car safety where its breakage might result in the failure of the safety to function to sustain the car.

15.02 Tests

Test of the car safety with contract load in the car shall be made before the elevator is put into service. Governor operation of instantaneous type safeties shall be tested at contract speed by tripping the governor by hand. Safeties operated as the result of the breaking of the hoist ropes shall be tested by obtaining the necessary slack rope to cause them to function.

15.03 Capacity Plate

A metal plate shall be fastened in a conspicuous place in the car stating the contract load in pounds, in letters and figures not less than ¼ in. high.

15.04 Limitations of Load, Speed and Platform area

Where the contract load exceeds 700 lbs. or the contract speed exceeds 50 fpm, or the net inside car platform area exceeds 12 sq. ft., the elevator shall not be considered a "Private Residence Elevator" and shall conform to all requirements for "Power Elevators".

16.00 Machines

16.01 Machines.

(a) Winding drums, traction sheaves and overhead and deflecting sheaves shall be of cast iron, or steel, of diameter not less than thirty times the diameter of the wire hoist ropes. The rope grooves shall be machined.

Where 8 x 19 plow steel ropes are used, the diameter of drums and sheaves may be reduced to twenty times the diameter of the rope.

(b) The factor of safety based on the static load (the contract load plus the weight of car, ropes, counterweights, etc.) to be used in the design of resistance elevator hoisting machines shall not be less than:
Eight (8) for wrought iron and steel.
ten (10) for cast iron, cast steel and other material.

(c) Set-screw fastenings shall not be used in lieu of keys or pins at a connection subject to torque or tension.

(d) No friction gearing or clutch mechanism shall be used for connecting the hoist drum or sheaves to the main driving gear.

(e) Gearing have cast iron teeth shall not be used.

(f) Electric elevator machines shall be equipped with electrically-released spring-applied brakes.

(g) No single ground, short circuit, counter-voltage or motor field discharge shall prevent the brake magnet from allowing the brake to set in the intended manner during normal operation.

(h) Electric elevator machine shall be arranged for manual operation by a crank in case of power failure and a suitable crank shall be provided and kept near the machine.

16.02 Limit Switches.

Upper and lower normal stopping devices shall be provided, set to stop the car at the upper and lower terminal landings. Final stopping devices shall be provided, set to operate if the car passes the terminal landings and stop the car before it strikes the overhead or pit bottom.

Where no hoistway enclosure is provided at the lower landing the final stopping device may be omitted at this landing.

The final terminal stopping device shall act to prevent movement of the car in both directions of travel.

The normal and final terminal stopping devices shall not control the same switches on the controller unless two or more separate and independent switches are provided, two of which shall be closed to complete the motor and brake circuit in each direction of travel.

16.03 Operation.

(a) The following methods of operation are permitted:

(1) Continuous pressure operation.

(2) Momentary pressure operation with up-down buttons or switches in the car and up-buttons or switches, or call buttons, at each landing. It is not required that the operation be selective.

(3) Single automatic operation.

(b) A stop switch shall be provided on or adjacent to the operating panel. Stop switches shall be of the manually opened and closed type and shall be conspicuously marked "stop".

(c) No control system shall be used which depends upon the completion or maintenance of an electric circuit for:

(1) Interruption of the power and application of the electro-mechanical brake at the terminals,

(2) Operation of the car safeties, or

(3) Stopping in response to the opening of the emergency stop switch.

(d) Hand-rope operation shall not be used.

(e) The sticking or freezing of any single electrically-operated switch, relay or contactor, or the occurrence of a single accidental ground, shall not permit the car to start if any hoistway or car door or gate is in the open position, and shall not permit the car to move more than 12 in. away from a floor with the hoistway door unlocked.

17.00 Suspension

17.01 Suspension Means

(a) Suspension means shall be wire ropes or steel roller-type chains.

(b) There shall not be less than two such ropes or chains.

(c) Steel tapes as suspension means are prohibited.

(d) On elevators having a contract load of less than 450 lbs. and operating at a contract speed of less than 30 fpm, ropes shall not be less than ¼ in. in diameter. Where the contract load exceeds 450 lbs. or the contract speed exceeds 30 fpm, ropes shall not be less than ⅜ in. in diameter.

(e) The factor of safety of the suspension means shall not be less than seven (7).

(f) When the car and counterweight are suspended by steel ropes and the driving means between the machine and the counterweight is an endless steel roller-type chain drive, the factor of safety of such chain with rated load on the car shall not be less than 8.

(g) The arc of contact of a wire rope on attraction sheave shall be sufficient to produce adequate traction under all load conditions. The arc of contact of a chain on a driving sprocket shall not be less than 140 deg.

(h) All wire ropes anchored to a winding drum shall have not less than one full turn of rope on the drum when the car or counterweight has reached its extreme limit of possible over-travel.

(i) No car or counterweight wire rope shall be lengthened or repaired by splicing. Broken or worn suspension chains may be repaired but the entire chain shall comply with Rule 17.01 sub. (f).

(j) The winding drum ends of car and counterweight wire ropes shall be secured by clamps on the inside of the drum or by one of the methods specified in (k) below for fastening wire ropes to car or counterweight.

(k) The car or counterweight ends of wire ropes shall be fastened by return loop, spliced eyes, or individual tapered babbitted sockets or by properly attached fittings. Clamps of the U-bolt type shall not be used.

18.00 Emergency Signal

18.01 Emergency Signal.

(a) An emergency signal shall be provided operative from the car. This signal shall be audible outside the hoistway and may be a telephone connected to a central exchange.

PART 9 — PRIVATE RESIDENCE INCLINED POWER PASSENGER LIFTS

10.00 Definition

A private residence inclined passenger lift is a power lift installed on a stairway serving only a single family in a single residential building.

(a) The capacity shall not exceed two persons. The contract load shall not be less than 250 lbs. for a single-seat lift and shall not be less than 400 lbs. for a lift having two seats.

(b) The contract speed along the incline shall not exceed 50 fpm.

(c) The carriage (or chair) shall have a foot platform with a seat or seats, and shall have hand grips so arranged as to provide safe support for passengers. Seats shall be provided with backs.

(d) The equipment shall be so constructed as to permit a free exit width of not less than 20 in. throughout the length of the stairway. If the seat and platform fold automatically when not in use, this clearance may be measured from the folded position.

(e) The carriage shall be securely anchored to a truck which supports it. The truck shall be retained in a track or guide rail assembly.

(f) The supporting guide rails shall be securely anchored to the stairs or side wall.

(g) The factor of safety used in the design of the carriage, truck, guide rails, sprockets and sheaves shall be not less than five (5) based on contract load.

(h) The power unit shall be mounted on the carriage or placed at a remote location. If remotely located, all intervening sheaves or sprockets shall be placed so that the rope or chain travels in proper alignment. All machines, ropes, and sheaves shall be enclosed or guarded.

(i) The carriage shall be provided with a safety of the instantaneous type operating on failure or slackening of the hoist rope or chain. Operation of the safety shall open the motor and brake circuits. A slack-rope switch shall be provided which will cut off the power to the motor and brake if the hoist rope or chain fails or slackens, other than self-locking drives utilizing a lead-screw or other positive gearing which will stop and hold the carriage with contract load within not over 4 in. of down-travel after power is cut off.

(j) The lift shall be operated by continuous pressure up and down switches on the carriage and/or at the terminal landings.

(k) Winding drums and sheaves shall be of cast iron or steel of diameter not less than thirty times the diameter of the wire hoist ropes. The rope grooves shall be machined.

Where 8 x 19 plow steel ropes are used, the diameter of drums and sheaves may be reduced to twenty times the diameter of the rope.

A single hoist rope or roller-type chain may be used. Ropes shall not be less than ¼ in. in diameter. The factor of safety of hoist ropes or chains shall be not less than seven (7).

(l) Upper and lower normal terminal stop switches shall be provided set to stop the carriage at the normal top and bottom terminals of travel. A final stop switch shall be provided, set to stop the carriage should it over-travel the normal top terminal.

The final terminal stopping device shall act to prevent movement of the carriage in both directions of travel.

The normal and final terminal stopping devices shall not control the same switches on the controller unless two or more separate and independent switches are provided, two of which shall be closed to complete the motor and brake circuits in each direction of travel.

(m) A machine brake shall be provided, of the electrically-released spring-applied type, other than self-locking drives utilizing a lead-screw or other positive gearing which will stop and hold the carriage with contract load within not over 4 in. of down-travel after power is cut off.

The hoisting machine shall be directly connected to the motor, or may be connected to the motor by multiple V-belts, or by a multiple-link belt-type chain. Where a chain or belt-drive machine is used, a broken-chain or broken-belt switch shall be provided to cut off the power to the motor and brake if the chain or belt fails or slackens.

(n) All electric wiring shall be in accordance with the rules and regulations made in accordance with the provisions of General Laws, Chapter 143, Section 3L, as most recently amended.

PART 10 - BUILDERS' ELEVATORS

10.00 Definition

The term builders' elevators shall mean elevators which have been erected for temporary use and built in or adjoining a building under construction or alterations.

11.00 Supporting Structures

11.01 The supporting structures of builders' elevators shall be enclosed the entire height with heavy mesh wire except at loading or unloading platforms or landings. The wire enclosure shall have not greater than two (2) inch mesh, and shall be securely fastened to the shaftway cross-bracing and struts.

11.02 Guide rails shall be securely fastened in position and of such strength and design that the guides and their fastenings shall not deflect between their supports to cause the guide rails to spread causing failure of the safety dogs when applied to retard the car.

12.00 Protection of Openings

12.01 Inside landing openings of all such elevators shall be protected by a movable bar or bars forty-two inches (42") high, measured from the landing floor to the top of the upper bar and set back twelve inches (12") from the shaft line. Said bar or bars are to be of metal or of hard wood of at least as great fiber strength as ash and are to be strong and rigid and so constructed and installed that they cannot be sprung from their guides.

12.02 The outside landing opening shall be protected to its full height and width by a gate or door, either solid or slatted, and if slatted it must be able to reject a ball two inches (2") in diameter. The lower bar shall be not more than two inches (2") above the landing sill.

12.03 An electric contact shall be installed on each movable bar or gate which will act as a signal to the operator when the bar or gate is open. All contacts shall be kept in good operating condition.

13.00 Car Construction

13.01 The car frame or sling of all such elevators shall be constructed and designed to adequately and safely sustain the maximum load to be imposed upon it. Where wood is used for the car floor, it shall be sound and at least two (2) inches in thickness and

shall be securely fastened and braced to the stiles. It likewise shall be capable of sustaining the maximum load imposed upon it. If the floors of cars are covered with metal they shall have a non-slip surface.

13.02

Builders' elevators shall be equipped with a car safety device which shall bring the car to rest if the hoisting ropes become slack or break. If any part of the car of such elevators, including the car frame, sling or floor, is of other than steel construction, the elevator shall be equipped with undercar safeties.

14.00 Ropes

14.01 Ropes for builders' elevators shall not be less than one-half (½) inch in diameter. They shall be of steel and shall possess a factor of safety of at least eight (8). A metal tag shall be placed on each rope, at a point readily accessible to inspectors, showing the size and material of the rope, including the maximum safe load and the date of installation.

14.02 The ends of ropes shall be fastened by spliced eyes, individual tapered sockets or clamps. Where spliced eyes are used, a thimble connection shall be installed in the eye. Where tapered sockets are used, the ends of each strand shall be rosed into the socket after which it shall be filled with zinc or babbit. Where clamps are used, the fastenings shall consist of not less than three (3) approved clamps on each rope and thimbles shall be installed. Clamps shall be installed with the "U" bolt on the dead end of the rope. Splicing of ropes is prohibited.

14.03 Ropes and fastenings shall be maintained in safe operating condition.

14.04 Ropes shall be prevented from "overriding" on the drum by use of a swivel "snatch block" or deflector sheave, which will permit proper wrapping of the rope on the drum. All "snatch blocks" or deflector sheaves shall be securely fastened to the legs or base of the supporting structure.

15.00 Signals

15.01 An audible, manually operated signal system, which can be operated from each floor landing, shall be used on all builders' elevators. The system shall include and be connected to a gong which shall be not less than six inches (6″) in diameter and shall be located in the machine room. The system shall be kept in good operating condition.

16.00 Inspection

16.01 Builders' elevators shall not be put in use until written approval has been received from the department or inspector having jurisdiction. The approval shall be posted in a conspicuous place in the enclosure housing the hoisting mechanism.

17.00 Riders

17.01 No person shall be allowed to ride on builders' elevators.

ELV-2

PART 11.

CERTAIN ELEVATOR EQUIPMENT USED AS AUTOMOBILE PARKING DEVICES

ELV-2

PART 11. CERTAIN ELEVATOR EQUIPMENT USED AS AUTOMOBILE PARKING DEVICES.

10.00 IN GENERAL

10.01 Reasons for Special Regulations for So-called Automatic Parking.

This part of the Elevator and Escalator Regulations has been developed in response to demands for a separate section of the rules to cover the installation of certain elevator equipment in buildings or structures used exclusively for the parking of motor vehicles. It was felt that in many such installations, particularly where no person rides the elevator during the parking process, reasonable safety does not require that the elevators meet all of the requirements of the Massachusetts Elevator Code for conventional elevator installations.

10.02 Reference to Safety Codes.

Reference is made in these regulations to "ASA A17.1" and to "ASA A12-32". ASA A17.1 refers to the code published in 1955 by the American Society of Mechanical Engineers, located at 29 West 39th Street, New York 18, New York, and entitled "American Standard Code for Elevators, ASA A17.1".

ASA A12-32 refers to the code published in 1932 by the American Standards Association, located at 70 East 45th Street, New York 17, New York, and entitled "Safety Code for Floors and Wall Openings, Railings and Toe Boards".

Copies of ASA A17.1 and ASA A12-32 are on file with the Secretary of State of the Commonwealth. Copies may be obtained upon request and payment of the fee from the Board of Elevator Regulations, 1010 Commonwealth Ave., Boston, Massachusetts, and from the publishers at the addresses above referred to.

11.00 SCOPE AND CLASSIFICATION

11.01 Scope.

(a) Part 11, "Certain Elevator Equipment Used as Automobile Parking Devices", applies only to:

> Elevators used exclusively for the parking of automobiles where, during the parking process, each automobile is moved either under its own power, or by means of a power-driven parking device onto and off the elevator directly into parking spaces or cubicles in line with the elevator, where no persons are normally employed or stationed in the parking areas.

(b) Part 11, "Certain Elevator Equipment Used as Automobile Parking Devices", does not apply to:

The design of the structure, of a crane or similar device on which the elevator may be mounted, or the design of any automobile parking dolly or mechanism, except the interlocking of the control of such device with the elevator control.

11.02 Classification.

Elevator equipment subject to Part 11 shall be classified as follows:

Class I. Elevators on which, during the parking process, one attendant rides for the purpose of operating the elevator and for the purpose of operating a power-driven parking device or dolly to move the automobile onto and off the elevator, but is not required to get off the elevator.

Class II. Elevators on which, during the parking process, one attendant rides for the purpose of operating the elevator and driving the automobile, under its own power, onto and off the elevator.

Class III. Elevators operated from a central dispatching station or stations and on which the garage attendants do not ride during the parking process, and the operation of the elevators and the entire process of parking the automobile is automatically controlled.

12.00 DEFINITIONS

Definitions applicable to Part 11, "Certain Elevator Equipment Used as Automobile Parking Devices", shall be those in ASA A17.1, Section 3, unless otherwise modified herein.

13.00 CONSTRUCTION OF HOISTWAYS AND HOISTWAY ENCLOSURES

13.01 Hoistway Enclosures at Levels Where Patrons Deliver or Receive Motor Vehicles.

Hoistway enclosures for Class I, II and III elevators shall be provided as follows:

At all floors at which the customer delivers or receives his motor vehicle, hoistway enclosures shall be provided at portions of the hoistway accessible to the public. Enclosures shall comply with ASA A17.1, Rule 100.1c except that the enclosures may be perforated for their entire height and need not be higher than six feet (6'-0").

13.02 Hoistway Opening Protection at Floors Where Patrons Deliver or Receive Motor Vehicles.

Hoistway gates conforming to Section 14.00 shall be provided at each hoistway opening accessible to the public.

14.00 HOISTWAY GATES IN NON-FIRE-RESISTIVE HOISTWAYS

14.01 Operation of Hoistway Gates.

Gates shall be power-operated, or they may be power-opened and may close by gravity if means are provided to limit the closing speed. Power opening and closing shall conform to the requirements of ASA A17.1, Section 112.

Exception: The requirements of ASA A17.1, Rules 112.3b, paragraph 3 and 112.3d shall not apply.

14.02 Design and Construction of Hoistway Gates.

Gates shall conform to ASA A17.1, Rule 100.1c and Rule 110.1c, except that they may be perforated for their entire height, and need not be higher than six feet (6'-0"). Hangers, guides and guide shoes shall conform to ASA A17.1, Rule 110.10.

14.03 Hoistway Gate Locking Devices.

Hoistway gates on Class I, II and II elevators shall be provided with interlocks, mechanical locks and contacts, or separate mechanical locks conforming to ASA A17.1, Section 111.

Exception: Locking devices are not required on vertically-sliding gates whose unbalanced weight is sixty-five pounds (65 lbs) or more when the car is not at the landing.

14.04 Devices for Preventing Movement of Car Unless Gate is Closed.

Means shall be provided to prevent movement of the car in either the vertical or horizontal direction away from a landing unless the gate at that landing is in the closed position, as specified in ASA A17.1, Rule 111.8.

Exception: The means provided may permit horizontal movement of the car with the gate open in a zone of not more than two feet (2'-0") in either direction, provided that protective guards not less than six feet (6'-0") high and the width of the zone are installed on each side of the tower.

14.05 Clearance Beneath Hoistway Gate.

The vertical clearance beneath the lower edge of the gate and the landing sill shall be not more than eight inches (8").

15.00 PROTECTION AT OTHER LEVELS

At levels other than floors where patrons deliver or receive motor vehicles, hoistway opening protection shall conform to the following:

(a) Adequate means shall be provided to retain the automobiles in the parking cubicles against the force of the wind or of gravity.

(b) Ropes or other dividers not less than forty-two inches (42") high shall be provided between the parking cubicles.

16.00 GUIDE RAILS, GUIDE RAIL SUPPORTS AND FASTENINGS

Guide rails, guide rail supports and fastenings shall conform to ASA A17.1, Section 200.

17.00 CAR AND COUNTERWEIGHT BUFFERS

Car and counterweight buffers shall conform to the following:

(a) Class I and II Elevators. Car and counterweight buffers shall be installed in accordance with the requirements of ASA A17.1, Section 201, for electric elevators; of ASA A17.1, Section 311 for plunger or roped hydraulic elevators; or with the requirements of ASA A17.1, Section 109 where there are occupied spaces or passageways below the hoistway. In all cases buffers may be located at each side of the car.

Exception: Spring buffers may be used under the following conditions:

1) For electric elevators whose rated speed is not more than 300 feet per minute.

2) For hydraulic elevators whose maximum speed in the down direction with rated load is not more than 300 feet per minute.

3) The stroke of spring buffers for car speeds exceeding 200 feet per minute shall be equal to or greater than the following:

201 - 250 ft. per min. - 6 1/4"
251 - 300 ft. per min. - 9"

(b) Class III Elevators. Car and counterweight buffers shall be required only where there are occupied spaces or passageways underneath the hoistway, in which case both car and counterweight buffers shall be installed in accordance with the requirements of ASA A17.1, Section 109, provided that such buffers may be located at each side of the car frame.

17.01 COUNTERWEIGHTS

Counterweights, where provided, shall conform to ASA A17.1, Section 202.

18.00 CAR FRAMES AND PLATFORMS

18.01 Design Requirements.

Car frames, car platforms and their guiding members of Class I, II and III elevators shall conform to the requirements of ASA A17.1, Section 203 for electric and roped hydraulic elevators; ASA A17.1, Section 313 for direct plunger hydraulic elevators.

Exceptions:

(a) The flooring may be perforated provided the openings will reject a ball having a diameter of two inches (2") or more.

(b) Where a parking dolly is used the portion of the floor where the dolly travels may be depressed.

(c) Four corner suspension roped hydraulic elevators are not required to have car crossheads, subject to the requirements of ASA A17.1, Section 212.

19.00 CAR ENCLOSURES AND CAR GATES

19.01 Car Enclosures.

Cars shall be enclosed on all sides not used for entrance and exit, with enclosures conforming to ASA A17.1, Section 204, provided that the enclosure need be only six feet (6'-0") high, may be of openwork construction for its entire height, and no car top shall be required.

Exceptions:

(a) For Class I and II Elevators the enclosures may be omitted provided:

1) The car can be operated from the car only and the car-operating device is permanently located and is of a type which will return automatically to the stop position when the hand of the operator is removed.

2) The operator's station is protected on the outside with an openwork metal enclosure at least six feet (6'-0") high which will reject a ball one and one-half inches (1 1/2") in diameter and where no car gate is provided is located not less than four feet (4'-0") from the nearer end of the platform.

3) A metal railing at least forty-two inches (42") high is provided, on the sides of the car not used for entrance and exit, which conforms to the requirements of ASA A12-32.

(b) For Class III Elevators -
The enclosure specified may be omitted if a metal railing at least forty-two inches (42") high, conforming to the requirements of ASA A12-32, is provided on the sides of the car not used for entrance and exit.

19.02 Car Gates.

A car gate shall be provided at each car entrance and shall be equipped with means to prvent the movement of the car in either the vertical or horizontal direction away from a landing unless the gate is in the closed position as specified in ASA A17.1, Rule 111.8.

Exceptions:

(a) The means provided to prevent movement of the car may permit horizontal movement of the car with the gate open in a zone of not more than two feet (2') in either direction provided protective guards not less than six feet (6') high and the width of the zone are installed on each side of the tower.

(b) The car gate may be omitted provided the following conditions are conformed with:

1) Where a dolly is used, means are provided to prevent operation of the elevator unless the dolly is properly positioned on the car platform.

2) When the motor vehicle is on the car platform, means are provided to prevent operation of the elevator unless the motor car is properly centered on the platform so that no portion of the vehicle projects beyond the platform.

3) For Class I and II elevators where the elevator can be operated from the car only by means of a permanently located operating device of a type which will return automatically to the stop position when the hand of the operator is removed.

20.00 CAR AND COUNTERWEIGHT SAFETIES AND SPEED GOVERNORS

20.01 Car Safeties.

Car safeties conforming to ASA A17.1, Section 205, shall be provided. All operating parts of the safety shall be protected from the elements.

Exceptions:

(a) Car safeties may be omitted on:

1) Direct plunger elevators.

2) On Class III elevators where there is no occupied space or passageway underneath the hoistway.

(b) The car safety device may be located in the upper part of the car frame instead of beneath the platform provided the car frame, car platform, car safety and the guide rails and their supports are designed to withstand the forces from loading and unloading and from application of the car safety at governor tripping speed with rated load on the platform within the stresses and deflections permitted by ASA A17.1, Section 203.

20.02 Counterweight Safeties.

Counterweight safeties conforming to ASA A17.1, Section 205 shall be provided where there is an occupied space or passage underneath the hoistway. ASA A17.1, Section 109.

20.03 Speed Governors.

Car or counterweight safeties, where required or used, shall be operated by speed governors conforming to ASA A17.1, Section 206.

Exceptions:
The tripping speed of speed governors for roped hydraulic elevators shall be based on the maximum speed attained by the elevator car in the down direction with rated load on the platform instead of on rated speed.

21.00 DRIVING MACHINES

21.01 Electric Driving Machines.

Electric driving machines shall conform to the requirements of ASA A17.1, Section 208.

21.02 Hydraulic Driving Machines, Valves, Piping, Connections and Tanks.

Hydraulic driving machines, valves, piping, connections and tanks shall conform to the requirements of ASA A17.1, Part III, entitled "Hydraulic Elevators".

Exception:
Roped hydraulic driving machines may be used provided they conform to the applicable requirements of Section 22.00.

22.00 ROPED HYDRAULIC ELEVATORS

22.01 Piston Rod Stops.

Piston rods of roped hydraulic elevators shall be so constructed and so roped that the piston shall be stopped before the car can be drawn into the overhead structure. Travel-limiting stops of ample strength shall be provided in the cylinder to bring the piston to rest under full pressure without damage to the cylinder assembly or hydraulic system. Such stops shall be of the solid metal-to-metal type.

22.02 Traveling Sheaves.

Traveling sheaves of roped hydraulic elevators shall be guided in metal guides. Sheave frames, where used, shall be of structural or forged steel having an elongation of not less than fourteen per cent (14%) in a length of two inches (2") and shall be designed and constructed with a factor of safety of at least eight (8). A single continuous strap shall not be used for the sheave frame.

22.03 Cylinders, Valves, Piping, Connections and Tanks.

Cylinders, valves, piping, connections and tanks shall conform to the requirements of ASA A17.1, Part III, entitled "Hydraulic Elevators".

22.04 Piston Rods.

Piston rods of roped hydraulic elevators shall conform to the following:

(a) Piston rods in compression shall be designed and constructed in accordance with the applicable formula in ASA A17.1 Section 1202; ASA A17.1, Rule 1202.1, subdivision a or b for plungers.

(b) Piston rods in tension shall be designed and constructed in accordance with the following formula:

$$W = 7500A$$

Where: W = Allowable gross load, pounds applied to piston rod

A = Net cross-sectional area at root of threads in square inches.

(c) Means shall be provided to prevent eccentric loading on piston rods and to equalize loading on piston rods where two or more are used.

23.00 CAPACITY AND LOADING

23.01 Requirements for.

The capacity and loading requirements of ASA A17.1, Section 207 shall be conformed with, provided that the minimum rated load shall be based on the maximum weight of the motor vehicles to be parked and shall in no case be less than five thousand pounds (5,000 lbs.) per vehicle to be carried.

In addition to the information required by ASA A17.1, Rule 207.3b-2, the crosshead data plate or a separate plate attached to the crosshead shall indicate the maximum speed of the car in the down direction with rated load on the platform for which the elevator is designed.

24.00 TERMINAL-STOPPING DEVICES AND OPERATING AND CONTROL DEVICES

24.01 Terminal-Stopping Devices.

Terminal-stopping devices shall conform to ASA A17.1, Section 209 for electric elevators and ASA A17.1, Section 320 for hydraulic elevators, provided that for roped hydraulic elevators there shall be installed, in addition to the terminal-stopping devices therein specified, a separate automatic stop valve independent of the normal control valve and mechanically operated directly by the movement of the car.

24.02 Operating and Control Devices.

Operating and control devices shall conform to the requirements of ASA A17.1, Section 210 for electric elevators, and ASA A17.1, Section 321 for hydraulic elevators.

Exceptions:

(a) Roped hydraulic elevators may have lever type operating devices provided they are self centeringwhen released by the operator.

(b) The following electrical protective devices shall not be required:

1) Top of car operating device.
2) Stop switch on top of car.
3) Hoistway door interlocks or electric contacts. (See Section 14.03)
4) Car door or gate electric contacts. (See section 19.02)
5) Stop switch in pit.
6) Car emergency stop switch for roped hydraulic elevators with lever type operating devices.

Class III elevator cars shall be provided with a constant pressure operating device for operating the car for inspection, maintenance, and during emergencies, which shall be operative only when the operating device at the control dispatching station is inoperative. Means shall be provided at the central dispatching station for disconnecting the normal operating device and for making the constant pressure operating device in the car operative.

25.00 SUSPENSION MEANS

25.01 Requirements for

The suspension means for electric and hydraulic elevators shall conform to ASA A17.1, Section 212.

Car platforms may be suspended by wire ropes attached to each corner of the platform, subject to the following:

(a) A center car frame conforming in all respects to ASA A17.1, Section 203 shall be provided except that the car crosshead may be omitted, providing:

1) The car frame stiles extend partly above and partly below the car platform so that the vertical distance between the top and bottom guide shoes on the car frame is not less than forty per cent (40%) of the distance between guiderails or of the length of the car platform, whichever is greater.

2) Guiding members or rope connections are so designed and installed as to prevent binding of the car frame in the guide rails when the car is raised and lowered.

(b) The car safety required by Section 20.00 is mounted on the center car frame located as required in ASA A17.1, Rule 205.1.

(c) The car safety shall be operated by a speed governor.

26.00 INSPECTIONS, TESTS, MAINTENANCE AND ALTERATIONS

Inspections, tests, maintenance and alterations shall conform to the requirements of ASA A17.1, Parts IX, X and XI respectively.

27.00 MEMBERS OF THE PUBLIC NOT ALLOWED ABOVE RECEIVING LEVEL.

No person other than those whose services are necessary for the operation, maintenance, or safety of the premises shall be permitted on an elevator or on any level other than the receiving level.

28.00 OPERATORS TO BE LICENSED

No person shall operate, and no owner, lessee, employer or his agent shall cause or permit any elevator to be operated except by a person duly licensed for such service by the Commissioner of Public Safety.

Exception:
An operator's license shall not be required of an elevator contractor or of a qualified licensed mechanic engaged in the construction, maintenance, or repair of elevators or elevator hoistways, or of an inspector having authority to inspect elevators.

28.01 Granting of Licenses

(a) Whoever desires to act as an operator of elevators herein required to be operated by a licensed person shall make application to the Commissioner on blanks to be furnished by the department of Public Safety. A license shall not be granted to a person less than eighteen (18) years of age.

(b) The applicant shall be given a practical examination as to his knowledge of the operation of elevators, and if found competent shall be granted a license by the Commissioner.

(c) Special licenses shall be issued for Class I, Class II, and Class III elevators respectively. No license shall be valid except for the class elevator for which it has been issued. Licenses shall be for the term of one year from the date thereof, and may be renewed yearly by the department. If a license has not been renewed within three (3) years from the date of issuance, a re-examination shall be required.

28.02 Display of Licenses

A licensed operator shall at all times when operating an elevator be prepared to display his license on demand of the owner or tenant of the building, or of any person authorized to inspect the elevator, or of any police officer.

28.03 Revocation and Suspension of Licenses

(a) A wilful falsification in the matter of a statement in an application shall be deemed sufficient cause for the revocation at any time of a license granted on said application.

(b) A license may be suspended or revoked by the Commissioner, if the holder is incompetent or untrustworthy or fails to comply with these regulations.

ELV-2

PART 12

SPECIAL INDUSTRIAL POWER OPERATED SERVICE ELEVATORS

PART 12. SPECIAL INDUSTRIAL POWER OPERATED SERVICE ELEVATORS

10.00 GENERAL.

This part of the code applies to elevators installed in broadcasting towers, cement storage towers, and similar structures which are not accessible to the general public, and for the exclusive use of special designated operating and maintenance employees only, where transportation of one and not more than three employees is required to attend or service machinery or other equipment requiring attention.

10.01 No persons other than employees as described above shall be permitted to operate or ride thereon. Such elevators shall be removed when the structure is no longer used for the purpose for which it was originally designed.

10.02 Elevators complying with the following regulations and where reference is made to ELV-2 which is inclusive and must be complied with may be installed.

10.03 In no case shall the following conditions be exceeded:

1. Inside area of car nine (9) square feet.
2. Speed with load one hundred (100) feet per minute.
3. Contract load 750 pounds.
4. Operation only by means of push buttons.

10.04 Plans and specifications for such elevators shall be filed with the department where the elevators are to be installed and an erection permit secured in accordance with the requirements of Section 62, Chapter 143 of the General Laws governing elevators before any work of installation is started. On completion of such elevators they shall be inspected and tested by the inspector having jurisdiction and shall not be placed in regular operation for the use of the persons for whom they are intended until the department has issued a Certificate of Operation. Such special elevators shall be subject to inspection at least once each year in accordance with Section 64, Chapter 143, General Laws governing elevators, and, in addition, all safety devices shall be examined each six months.

11.00 HOISTWAY ENCLOSURE

11.01 The hoistway shall be constructed and enclosed in accordance with the requirements of ELV-2, Part 2, elevator regulations of this Commonwealth, except where building is of open construction throughout, and elevator does not travel through fireproof floors, grille or lattice work enclosure six feet high shall be provided around the hoistway at each floor. An enclosure shall be provided full height on open side or sides of the hoistway when hazards exist, such as stairways, passageways, and similar conditions.

12.00 CAR CLEARANCES

12.01 There shall be a clearance of not less than three-fourths (3/4) inch between the car and the hoistway enclosure, and between the car and its counterweight.

12.02 The clearance between the car platform and the landing threshold shall be not less than one-half (½) inch, nor more than one and one-half (1½) inches.

13.00 PITS AND OVERTRAVEL

13.01 The structure at bottom of hoistway shall be sufficiently strong to withstand without failure the impact of the car with contract load, also the impact of the counterweight, when either is descending at contract speed, or at governor tripping speed if governor-operated safety is used.

13.02 A pit not less than two (2) feet in depth shall be provided at the lowest story served and a substantial spring bumper shall be located therein set to strike steel safety plank of car. A minimum of one foot clearance shall be provided under the platform when the car rests on the fully compressed bumper.

13.03 At the top landings there shall be a clearance between top of car crosshead and machine supports or any other obstruction vertically above the car of not less than two (2) feet when the counterweight rests on its fully compressed buffers and a clearance between the top of the counterweight and any obstruction vertically above it of not less than six (6) inches when the car rests on its fully compressed buffers. Where no counterweight is provided, clearance between the top of the car crosshead and the machines, supports or other obstruction vertically above it when the car is at its uppermost landing shall be not less than two feet six inches (2'6").

14.00 MACHINE AND MACHINERY SUPPORTS

14.01 All machinery and sheaves shall be supported and secured so as to effectually prevent any part becoming loose or displaced. The supporting beams shall be steel.

14.02 Loads on overhead beams and their supports shall be computed as follows:- the total load on overhead beams shall be assumed as equal to the weight of all apparatus resting on the beams plus twice the maximum load suspended from the beams. The load resting on the beams shall include the complete weights of machine, sheaves, controller, etc. The load suspended from the beams shall include the sum of the tensions of all ropes suspended from the beams.

Note: The object in doubling the suspended load is to allow for impact, acceleration stresses, etc.

14.03 No elevator machinery or sheaves shall be fastened to the underside of the supporting beams at the top of the hoistway.

Exception: The idler or deflecting sheaves with their guards and frames.

Supporting members for sheaves and other elevator machinery underneath beams shall not be of cast iron in tension.

14.04 The factor of safety for overhead beams and their supports shall be for steel 5

15.00 PIPES AND WIRING

All wiring shall comply with requirements of Regulation 17.00 ELV-2, Part 2.

15.01 No pipes conveying steam, gas or liquids, which if discharged into the hoistway would endanger life, shall be installed in the elevator or counterweight hoistway.

15.02 Voltage of control circuits shall not be in excess of 250 volts.

15.03 All live parts of electrical apparatus in the hoistway shall be suitably enclosed to protect against accidental contact.

16.00 COUNTERWEIGHT RUNWAY

16.01 Sides of the counterweight runway exposed to the outside of the hoistway or structure shall be guarded, except where building is of open construction throughout, and elevator does not travel through fireproof floors, grille or lattice work enclosure six feet high shall be provided around the hoistway at each floor. An enclosure shall be provided full height on open side or sides of the hoistway when hazards exist such as stairways, passageways and similar conditions.

17.00 PROTECTION OF HOIST ROPES

17.01 All hoist and counterweight ropes shall be located inside the hoistway enclosure.

18.00 HOISTWAY DOORS

18.01 Landing openings shall be protected by manually-operated doors or gates of the horizontally swinging or sliding type or vertically sliding type. Grille or lattice type construction shall not be used where fire resistive hoistway enclosures are required. The construction of doors and gates shall conform to Regulation 20.00 ELV-2, Part 2.

Exception: Where the car operates in open steel towers without designated landing floors or levels.

18.02 Where swing type doors are used, the clearance between the hoistway enclosure door or gate and the hoistway edge of the landing sill shall not exceed two (2) inches and the distance between the hoistway face of the landing door and the car door or gate shall

not exceed four (4) inches. Where sliding type doors with door closures are used, the clearances specified may be increased to 2¼" and 5½" respectively.

18.03 The hoistway face of the landing door or gate shall not project into the hoistway beyond the landing sill. No hardware, except that required for door-operating devices, locks, contacts or signals, shall project into the hoistway beyond the line of the landing sill.

18.04 Hoistway doors shall be provided with approved interlocks conforming to Regulation 24.00 ELV-2, Part 2.

18.05 No means shall be provided which will open any landing door from the landing side when the car is not in the landing zone.

18.06 Hoistway doors shall be so arranged that it will not be necessary to reach back of any panel, jamb or sash to operate them.

18.07 Means shall be provided to prevent hangers for sliding hoistway doors from jumping the track. Stops will be provided to prevent the hanger carriage from leaving either end of the track, or suitable stops shall be provided on the door.

19.00 LIGHT IN CAR

19.01 There shall be an electric light to illuminate the car with its switch placed near the car entrance within easy reach of a person before entering the car.

20.00 GUIDE RAIL CONSTRUCTION

20.01 Car and counterweight guide rails shall be of steel.

20.02 Guide rails shall be securely fastened in position with brackets, through bolts, ties, clips or backing of such strength, design and spacing that the guide rails and their fastenings shall not deflect between supports more than one-quarter (¼) inch under normal operation. Joints of guide rails shall be accurately machined with tongue and groove if tee rails are used, or doweled if other solid shape rails are used, and fastened with splice plates to prevent movement in any direction.

20.03 The guide rail shall extend from the bottom of the hoistway to a height above the top landing sufficient to prevent the guide shoes from running off the guides when the car or counterweight is at the extreme upper position.

21.00 COUNTERWEIGHT

21.01 Counterweights, where used, shall run in guides located within the elevator hoistway and shall comply with Regulation 61.00 ELV-2, Part 2.

22.00 CAR CONSTRUCTION

22.01 Elevator cars shall have metal car frames and outside frames of platforms with a safety factor of not less than five (5) based on the rated load.

22.02 Cast iron shall not be used in the construction of any member of the car frame or platform other than for guide shoes and guide shoes brackets.

22.03 No glass shall be used in an elevator car except for car light and appliances necessary for the operation of the car.

22.04 The car shall have but one compartment.

22.05 The car shall be so constructed and weighted that it will descend upon failure of the suspension means.

23.00 CAR ENCLOSURE

23.01 Except at the entrance, the car shall be enclosed at sides and top. The enclosure at the sides shall be solid or of open work which will reject a one-half (½) inch diameter ball.

Exception: An aperture not in excess of 30 square inches shall be permissible in the inside of car enclosures of elevators operating in open steel towers. Such apertures shall be located not less than 54 inches nor more than 60 inches above the car floor and shall be equipped with a horizontal sliding cover to close the opening when not in use.

23.02 The car enclosure shall be secured in such manner that it cannot work loose or become displaced in regular service.

24.00 CAR GATE

24.01 A car door or gate shall be provided at each entrance to the car. This door or gate shall, when closed, guard the full height of the opening. and if on an electric or electrically controlled hydraulic elevator shall be provided with an electric contact or interlock which will prevent operation of the elevator unless the car door or gate is within two (2) inches of full closure. Car doors or gates may be horizontal or vertical sliding.

24.02 The door or gate shall be manually operated.

24.03 Car gates shall be of a design that when fully expanded will reject a three (3) inch ball.

24.04 Car door or gate contacts shall be positively opened by a lever or other device attached to and operated by the door or gate and shall not be solely dependent on gravity or springs or both for their opening.

24.05 Car door or gate contacts shall be maintained in the open position by the action of gravity or a restrained compression spring or both, or by means of a positive linkage.

25.00 CAR SAFETY CONSTRUCTION AND OPERATION

25.01 Elevator cars suspended by wire ropes shall be provided with a car safety located beneath the car platform and capable of stopping and sustaining the car with contract load.

25.02 The car safety shall be of a type operated as the result of the breaking of the suspension means, or by a speed governor. If of the speed governor type, it must operate to set the safety at a maximum speed of 175 feet per minute, except that on the breaking of the hoist ropes, the safety shall operate without appreciable delay and independently of the governor speed action.

25.03 If a speed governor is used, it shall be located where it cannot be struck by the car or counterweight in case of overtravel and where there is sufficient space for full movement of the governor parts.

25.04 The motor-control circuit and the brake-control circuit shall be opened before or at the same time the safety applies.

25.05 The governor rope shall be iron, steel, Monel metal or phosphor bronze not less than three-eighths (3/8) inch in diameter. Tiller rope construction shall not be used for governor ropes.

25.06 Elevators of the winding drum type with wire ropes suspension shall be provided with a slack rope device of the manually reset type which will cut off the power and stop the elevator machine if the car is obstructed in its descent and the hoist ropes slacken.

25.07 No safety device which depends upon the completion and maintenance of an electric circuit for the application of the safety shall be used. Car safeties shall be applied mechanically. Cast iron shall not be used in the construction of a car safety where its breakage might result in the failure of the safety to function to sustain the car.

26.00 TESTS

26.01 Test of the car safety with contract load in the car shall be made before the elevator is put into service. Governor operation of instantaneous type safeties shall be tested at contract speed by tripping the governor by hand. Safeties operated as the result of the breaking of the hoist ropes shall be tested by obtaining the necessary slack rope to cause them to function.

27.00 CAPACITY PLATES

27.01 A metal plate shall be fastened in a conspicuous place in the car stating the contract load in pounds, in letters and figures not less than one-quarter (¼) inch high.

28.00 LIMITATIONS OF LOAD, SPEED AND PLATFORM AREA

28.01 Where conditions do not conform in all respects with the requirements of Part 12 of these regulations, the elevator installation shall conform to all requirements of ELV-2, Part 2.

29.00 MACHINES AND SHEAVES

29.01 Winding drums, traction sheaves and overhead and deflecting sheaves shall be of cast iron or steel, of diameter not less than 40 times the diameter of the wire hoist ropes. The rope grooves shall be machined.

29.02 The factor of safety based on the static load (the contract load plus the weight of car, ropes, counterweights, etc.) to be used in the design of these elevator hoisting machines shall not be less than

Eight (8) for wrought iron and steel.
Ten (10) for cast iron, cast steel and other material.

29.03 Set-screw fastenings shall not be used in lieu of keys or pins at a connection subject to torque or tension.

29.04 No friction gearing or clutch mechanism shall be used for connecting the hoist drum or sheaves to the main driving gear.

29.05 Gearing having cast iron teeth shall not be used.

29.06 Electric elevator machines shall be equipped with electrically released spring applied brakes which will apply automatically when the operating device or stopping contacts are in the stop position.

29.07 No single ground, short-circuit, counter-voltage or motor-field discharge shall prevent the brake magnet from allowing the brake to set when the operating device or stopping contacts are in the stop position.

29.08 Electric elevator machines may be arranged for manual operation by crank in case of power failure and a suitable crank should be provided and kept near the machine.

30.00 LIMIT SWITCHES

30.01 Upper and lower normal stopping devices shall be provided, set to stop the car at the upper and lower terminal landings operated by switches and cams attached to the car and hoistway. Final stopping devices shall be provided, set to operate if the car passes the terminal landings and stop the car before it strikes the overhead or pit bottom. The final terminal stopping device shall act to prevent movement of the car in both directions of travel. The normal and final terminal stopping devices shall not control the same switches on the controller unless two or more separate and independent switches are provided, two of which shall be closed to complete the motor and brake circuit in each direction of travel. Drum type machines shall also be provided with automatic machine terminal stop switches.

31.00 OPERATION AND OPERATING DEVICES

31.01 The following methods of operation are permitted:

1. Double button control.
2. Momentary pressure operation with up-down buttons or switches in the car and up-down buttons or switches, or call buttons, at each landing. It is not required that the operation be selective.
3. Single automatic operation.
4. Operation may be by remote control.

31.02 A stop switch shall be provided on or adjacent to the operating panel. Stop switches shall be of the manually opened and closed type and shall be conspicuously marked "stop" and the operating button or handle shall be of a different color from any other switch in the car. The opening of the switch contacts shall not be solely dependent on springs.

31.03 The control systems shall be designed so that the direction of travel of the elevator can be reversed at any point in the hoistway after stopping the elevator from the stop switch or any other method. No control systems shall be used which depend upon completion of maintenance of an electric circuit for:-

1. Interruption of the power and application of the electro-mechanical brake at the terminals.
2. Operation of the car safeties, or
3. Stopping in response to the opening of the emergency stop switch.

31.04 Hand-rope operation shall not be used.

31.05 The sticking or freezing of any single electrically operated switch, relay, or contactor or the occurrence of a single accidental ground shall not permit the car to start if any hoistway landing door is open or unlocked, or if any car door or gate is not within two inches of full closure.

31.06 Each electric power elevator driven by a polyphase alternating current motor shall be provided with a device which will prevent starting the motor if:-

(a) the phase rotation is in the wrong direction, or,

(b) there is a failure in any phase.

This regulation does not apply to AC motor used to drive motor-generator sets.

32.00 SUSPENSION MEANS

32.01 Suspension means shall be wire ropes. Tiller rope is not permissible.

32.02 There shall be not less than two (2) such ropes.

32.03 Steel tapes as suspension means are prohibited.

32.04 Ropes shall not be less than one-half inch in diameter.

32.05 The factor of safety of the suspension means shall not be less than 7.

32.06 The arc of contact of a wire rope on a traction sheave shall be sufficient to produce adequate traction under all load conditions.

32.07 All wire ropes anchored to a winding drum shall have not less than one full turn of rope on the drum when the car or counterweight has reached its extreme limit of possible over-travel.

32.08 No car or counterweight wire rope shall be lengthened or repaired by splicing.

32.09 The winding drum end of car and counterweight wire ropes shall be secured by clamps on the inside of the drum, or by one of the methods specified in 32.10 below for fastening wire ropes to car or counterweight.

32.10 The car or counterweight ends of wire ropes shall be fastened by return loop, by properly made individual tapered babbitted sockets or by spliced eye.

32.11 A metal tag shall be placed on all wire rope fastenings, or be permanently fixed on the car frame, upon which shall be stamped the size, material and manufacturer's rated ultimate strength of the rope and the name of person or company installing the ropes and the date of installation or renewal.

33.00 EMERGENCY SIGNAL

33.01 An emergency signal shall be provided operative from the car. This signal shall be audible outside the hoistway and may be a telephone connected to a central exchange.

34.00 MAINTENANCE OF ELEVATORS

34.01 In order to insure the safe operation of elevators installed in broadcasting towers and cement towers subject to extreme weather conditions, and before being placed in service, they shall conform to the following requirements:

(a) Lubrication.

All parts of the machinery and equipment requiring lubrication shall be lubricated at regular intervals with lubricants of a grade as recommended by the manufacturer.

35.00 GUIDE RAILS

35.01 Except those of elevators equipped with roller or other type guiding members not requiring lubrication, guide rails should be kept well lubricated.

1. Rails on which a lubricant is used shall be cleaned down at least once a year.

2. Rust-preventive compounds such as paint mixtures or other anti-rust coatings shall not be used as they may interfere with the proper operation of the car safety.

36.00 CAR SAFETY MECHANISMS

36.01 All moving parts of car safety mechanisms shall be kept clean and free of rust and dirt and shall be lubricated at frequent intervals. This is especially important where the safety mechanism is exposed to water, corrosive vapors, or freezing conditions, as corrosion or rusting of the parts may prevent operation of the safety.

37.00 MACHINE AND BRAKE

37.01 Machine lubricant subject to freezing conditions shall be specified by the manufacturer. Transformer oil with low pour point and low viscosity shall be used in all brake pots where brake coils and magnets are submerged.

1. All fulcrum pins operating in brake levers shall be of non-ferrous metal or the liners bushed with non-ferrous bushings.

2. The heads of all rivets fastening brake linings and all metal in contact shall be sealed to avoid freezing to brake pulley.

38.00 INSTRUCTIONS

38.01 Elevator subject to extreme weather conditions should make a trial trip without personnel on the car to make sure the operating mechanism is in good order.

ELV - 2

PART 13

TEMPORARY WORKMEN'S ELEVATORS

FOR

BUILDING CONSTRUCTION

PART 13 - TEMPORARY WORKMEN'S ELEVATORS FOR BUILDING CONSTRUCTION

10.00 - SCOPE, APPLICATION AND REQUIREMENTS

10.01 - This section of the Code applies only to -

(a) passenger elevators installed in or outside of buildings during construction, alteration or demolition, and used primarily to raise and lower workmen only during the construction, alteration or demolition of the building, and

(b) temporary use of permanent elevators for carrying workmen or materials.

10.02 - Workmen's elevators may also be used for carrying materials, provided they are designed and installed for the type of loading to be used, as specified in Rule 33.03, Part 2, ELV-2.

10.03 - Elevator hoistways shall conform to the requirements of Section 11.00 of this part. All other equipment shall conform to Part 2, ELV-2, Elevator, Dumbwaiter and Escalator Regulations, except as may be hereinafter excepted.

11.00 - HOISTWAY ENCLOSURES, GENERAL

11.01 - Hoistways shall not be located, either partially or wholly, over sidewalks or passageways to which the public or workmen have access.

Exception: Installations conforming to Section 16.00, Part 2, ELV-2.

11.02 - The hoistway construction forming the supports for the elevator machinery and guide rails shall conform to the requirements of Section 12.00 of this part, and to Rules 61.06, 61.07, 61.08, 61.09, Part 2, ELV-2.

11.03 - Hoistways shall be enclosed throughout their height.

11.04 - Hoistway enclosures shall be constructed of solid or openwork material conforming to the following requirements:

(a) If of openwork material, they shall reject a ball one and one-half inches ($1\frac{1}{2}$") in diameter, and if of metal shall be made of wire at least No. 16 steel wire gage or of expanded metal at least No. 16 U. S. gage.

11.04 (contd.)

(b) If made of wood, they shall be installed without openings.

(c) Openwork enclosure inside the building shall, where a counterweight is provided, be covered on the counterweight side with a steel wire netting having a mesh not greater than one-half inch (1/2") and made of steel wire not smaller than No. 20 steel wire gage. The covering shall extend the width of the counterweight plus one foot (1') on each side thereof.

(d) Be so supported and braced that when subjected to a pressure of one hundred (100) pounds applied horizontally at any point, the deflection shall not exceed one inch (1") and shall not reduce the running clearance below the minimum required by Rule 14.02 of this part.

(e) If of openwork, be provided on all sides within the building or structure with an unperforated kick plate extending not less than twelve inches (12") above the level of each floor above the lowest, and a guard rail forty-two inches (42") high, not less than eighteen inches (18") outside the hoistway, constructed of one-inch by six-inch (1" x 6") board.

(f) If of openwork material, they shall be enclosed solid to a height of six feet six inches (6'6") on the hoistway door side.

12.00 - MACHINE ROOM, SHEAVE ROOM AND SECONDARY LEVELS

12.01 - Overhead beams and foundations for the direct support of the elevator machinery and/or sheaves shall conform to the requirements of Sections 12.12 through 12.14 of Part 2, ELV-2.

12.02 - A solid floor or metal grating shall be provided at the top of the hoistway where necessary to provide safe access to the overhead machinery, control equipment or sheaves for lubrication, inspection and maintenance. Floors may be of wood, metal or concrete. Metal gratings shall be of a design which will reject a ball three-quarters (3/4) of an inch in diameter, or if of perforated sheet metal shall reject a ball one inch (1") in diameter. Floors or gratings shall be designed and constructed to sustain a concentrated load of three hundred (300) pounds on any four (4) square inches of thin area. It is not required that the floor sustain the load specified on every four (4) square inches of its area simultaneously.

12.03 - Machinery and control equipment shall be protected from the weather and from access by unauthorized persons. Spaces containing elevator driving machines and control equipment shall be provided with electric lighting.

12.04 - Access shall be provided to the machinery and control spaces to permit proper lubrication and maintenance of the equipment.

14.00 - CLEARANCE AND PITS

14.01 - The top and bottom clearances and run-bys for cars and counterweights shall conform to Rules 14.02, 14.03, Part 2, ELV-2.

14.02 - Horizontal clearances in the hoistway shall conform to Rule 14.01, Part 2, ELV-2.

17.00 - PIPES AND WIRING

17.01 - Electrical wiring shall conform to Section 17.00, Part 2, ELV-2.

Exceptions:

1 - Elevator travelling cable without encasement may be used for the hoistway wiring provided it is securely fastened to the hoistway construction, and where exposed to weather, as in open shafts outside the building, is of the weather-proof type.

2 - Temporary feeders for the elevator may be run inside the hoistway provided Rule 17.08, Part 2, ELV-2 is fully complied with.

17.02 - Where the hoistway is exposed to the weather, as in open shafts outside the building, the electrical fittings, fixtures and switches shall be of the weather-proof type.

20.00 - HOISTWAY DOORS

21.00 - GENERAL

21.01 - Hoistway doors shall be not less than six feet six inches (6'6") high. Solid doors shall be provided with a vision-panel opening covered with wire mesh conforming to Rule 11.04, paragraph c, of this code.

21.02 - Hoistway doors shall be provided with electrical interlocking devices specified in Rule 24.00, Part 2, ELV-2, or they may be provided with an electro-mechanical lock so that they cannot be opened from the landing side. Locking devices shall be so located as to be inaccessible from outside the hoistway, and of a type which can be released only by a person in the elevator car or by a cam attached to the car.

Exception: The door at the lowest terminal landing shall be provided with means to unlock it from the landing side to permit access to the car. The means provided shall be accessible only to authorized persons.

30.00 - CARS

31.00 - CAR CONSTRUCTION

31.01 - Cars shall be constructed in accordance with Section 31.00, Part 2, ELV-2.

Exception: Car platforms shall not be required to be protected on the underside against fire.

32.00 - CAR ENCLOSURES

32.01 - Car enclosures shall conform with Section 32.00, Part 2, ELV-2.

Exception: Car enclosure sides may be of untreated wood without sheet metal outer covering and the car top shall consist of not less than two-inch (2") thick wood or material of equivalant strength.

32.02 - All entrances to the car shall be protected by doors or gates conforming to the requirements of Section 32.04, Part 2, ELV-2, provided that they are not required -

(a) To be more than six feet (6') high.

ct a ball less than four and one-half inches
diameter.

to Section 32.04(a), Part 2, ELV-2 provided
ally sliding gates or doors may be used
Section 32.03 of this part.

ding doors and vertically sliding gates,
conform to the following:

32.03 (contd.)

(a) They shall be of the balanced counterweighted type which slide in the up direction to open, operating in guides.

(b) They shall reject a ball two inches (2") in diameter.

(c) They may be manually operated.

(d) They shall have their counterweights enclosed in conformity with Section 32.06(f), Part 2, ELV-2.

32.04 - Doors and gates shall be provided with car-door or gate-electric contacts conforming to Section 32.07, Part 2, ELV-2.

34.00 - CAR AND COUNTERWEIGHT SAFETIES AND SPEED GOVERNORS

34.01 - Car and counterweight safeties and speed governors shall conform to Section 34.00, Part 2, ELV-2.

Exception: Instantaneous type car safeties may be used for rated car speeds up to and including two hundred feet (200') per minute.

37.00 - CONTRACT LOAD AND TEST

37.01 - The capacity and loading shall conform to Sections 33.01 and 33.02, Part 2, ELV-2.

37.02 - The elevator shall not be used to carry workmen until it has been inspected and tested as required by Section 37.00, Part 2, ELV-2, inclusive, and until a temporary operating permit therefor has been issued by the enforcing authority and posted in a conspicuous place in the elevator car.

37.03 - The travel of the elevator may be increased or the location of the driving machine changed without conforming to the requirements of ELV-2, Page 1 - Material Changes C and D. When the travel of the elevator is increased, the installation shall be reinspected and approved by the enforcing authority before it is again placed in normal service. Additional tests are not required, except when considered necessary by the enforcing authority.

37.04 - The elevator shall be subject to periodic and maintenance tests as required by Chapter 143, General Laws, Sections 63, 64 and 65.

37.05 - All parts of the elevator equipment shall be maintained in a safe operating condition in accordance with the requirements of Massachusetts Elevator Code Regulations.

40.00 - MACHINES AND MACHINE SAFETIES

41.00 - MACHINES AND MACHINERY

41.01 - Driving machines shall be of the electric type and shall conform to Section 41.00, Part 2, ELV-2. Winding-drum machines shall have grooved drums and only one (1) layer of rope shall be permitted on the drum.

50.00 - WIRE ROPES

51.00 - HOISTING ROPES

51.01 - Power elevators shall be provided with iron or steel wire hoist and counterweight ropes conforming to Section 50.00, Part 2, ELV-2.

60.00 - GUIDE RAILS, BUFFERS AND COUNTERWEIGHTS

61.00 - GUIDE RAILS

61.01 - Guide rails shall conform to Section 61.00, Part 2, ELV-2.

Exception: Clamps may be used for fastening guide brackets or supports to the building construction. Finished surfaces are required only for the guide rail guiding surfaces which come in contact with the car safety mechanism.

61.02 - Car and counterweight buffers shall conform to Section 62.00, Part 2, ELV-2.

Exception: Spring-type car and counterweight buffers may be used for rated speeds not exceeding three hundred feet (300') per minute provided that for rated speeds of more than two hundred feet (200') per minute the buffer stroke shall be not less than:

a) 201-60-250 feet per minute = $6\frac{1}{4}$"
b) 251-60-300 feet per minute = 9"

61.03 - Counterweights shall conform to Section 63.00, Part 2, ELV-2.

70.00 - CONTROL AND OPERATING DEVICES AND SYSTEMS

71.00 - GENERAL

71.01 - Control and operating devices and systems shall conform

71.01 (contd.)

to Sections 71.00, 72.00 and 73.00, Part 2, ELV-2, and to Sections 70.02 and 70.03 of this part.

Exceptions:

1 - The stop switch in the pit and on top of the car shall not be required.

2 - Operation of the elevator shall be only by means of a car switch or by continuous pressure-type switches located in the car.

3 - Elevators used to carry workmen shall be operated only from inside the car by a competent designated operator.

71.02 - Where the primary source of power consists of a direct current generator driven by gasoline motor, means shall be provided on each elevator controller to absorb the energy regenerated by a direct-current elevator motor under overhauling load conditions.

71.03 - Where a nonrotating or other type rectifying unit, which is incapable by itself of absorbing the energy generated by the elevator driving-machine motor as a result of overhauling loads, is used to transform alternating current to direct current for the operation of a direct-current elevator motor or motors, means shall be provided on each elevator controller to absorb a sufficient amount of the energy regenerated by the elevator motor under overhauling load conditions to prevent the elevator from attaining at any time a speed of more than one hundred and twenty-five per cent (125%) of the speed in the up direction with rated load in the car.

80.00 - TEMPORARY USE OF PERMANENT ELEVATORS FOR CARRYING WORKMEN OR MATERIALS

80.01 - Passenger or freight elevators being installed in buildings for permanent use may be used prior to their completion during construction of the building for carrying workmen or materials, provided they are specifically approved for such use and a temporary permit therefor issued by the enforcing authority.

80.02 - Workmen and materials shall not be carried at the same time.

Exception: Elevators may be used by the minimum number of persons for accompanying and handling the materials.

80.03 - Requirements for Issuing Limited Operating Permits.

Limited operating permits shall be issued providing the following requirements are conformed to:

(a) The hoistway has been enclosed with permanent enclosures and doors conforming to Section 11.00, Part 2, ELV-2, or with temporary enclosures and doors conforming to Sections 11.03, 11.04 and 20.00 of this part.

Exception: Where permanent enclosures conforming to Section 11.00, Part 2, ELV-2 are in place, temporary hoistway doors and door-locking devices conforming to Section 20.00 of this part may be used.

(b) The elevator car has been enclosed with permanent car enclosures and doors or gates conforming to Section 32.01 through 32.04, Part 2, ELV-2, or with temporary enclosures, doors or gates conforming to Section 32.00 of this part and car doors or gates are provided with electric contacts conforming to Section 32.07, Part 2, ELV-2.

Where the hoistway is not fully enclosed with solid material on all sides throughout its height, a temporary wood car enclosure conforming to Section 30.00 of this part shall be provided;

(a) If the car is arranged so that it can be operated from inside the car only and a competent designated operator is in charge.

Exception: Where the permanent hoistway doors and door-locking devices conforming to Section 20.00 to 24.00, inclusive, Part 2, ELV-2 are in place, automatic operation or continuous pressure operation elevators may be operated from the car and from the landing operating devices without the services of a regular operator in the car, subject to the approval of the enforcing authority.

(b) If the elevator has been subjected to the following tests:

1 - A running test with rated load, making stops at each landing. On this test the rated speed shall not exceed that specified on the erection permit approved by the enforcing authority.

80.03 (contd.)

2 - A test of the normal and final terminal stopping devices with no load in the up direction and rated load in the down direction has been made which indicates compliance with Section 74.00, Part 2, ELV-2.

3 - A test of the car safety device and speed governor has been made in accordance with the requirements of Section 37.00, Part 2, ELV-2.

80.04 - Permits shall be posted in a conspicuous location in the elevator car. In addition, a notice bearing the information that the elevator has not been finally approved by the enforcing authority shall be conspicuously posted on, near, or visible from each entrance to such elevators.

ELV-2

PART 14

STAGE, ORCHESTRA, AND ORGAN CONSOLE ELEVATORS

PART 14 - ELV-2

STAGE, ORCHESTRA, AND ORGAN CONSOLE ELEVATORS

SHAFTWAY CONSTRUCTION

The shaftways of Orchestra and Organ console elevators shall be of two (2) hour fire resistive construction immediately below the top landing.

The complete surface of the shaftway within the limits of travel shall be of smooth finish, devoid of surface roughness, and without any projections or recesses except for landing entrances, guides, and guide brackets, vertical slots where required for concealed guides, junction boxes and conduit or wiring. All projections or recesses at landing entrances shall be bevelled on the under side or shall be guarded with metal plates. The angle of such bevels or guard plates shall not be less than seventy-five (75) degrees from the horizontal.

CLEARANCE AND PITS

A pit shall be provided at the bottom of every shaftway of such depth that when the platform is at its lowest limit of travel the distance between the lowest point of the under side of the platform framing shall be in accordance with the following: A.-The clear vertical distance between the under side of the car platform or between the under side of any equipment attached thereto, exclusive of the car frame channels, car safety blocks, guide shoes and any aprons or guards attached to the car sill, and the pit-floor when the car rests on the fully compressed buffer shall not be less than two (2) feet. In measuring this clearance, the depth of any trenches or depressions in the pit shall not be included. (See definition for car aprons).

SHAFTWAY DOORS

The bottom landing openings of shaftways shall be protected by sliding or swinging doors of one and one-half hour ($1\frac{1}{2}$ hour) fire resistive construction.

RAILINGS AND TOE BOARDS

Railings and toe boards shall be provided at floor levels of orchestra and organ console elevators. (See definition).

GUIDE RAILS

Steel guide rails shall be used for guides of stage and organ console elevators.

DOOR INTERLOCKS

All shaftway landing doors shall be equipped with interlocks as described in Reg. 24.00, Paragraphs 24.01 through 24.09, Part 2 of ELV-2.

LIFTING CAPACITY

The lifting capacity of an orchestra or console elevator shall be equal to a live load of not less than 25 pounds per square foot of floor area of the platform. All railings, aprons, wiring conduits, etc., shall be considered as part of moveable platforms.

STAGE ELEVATORS

The lifting capacity of a stage elevator shall be equal to a live load of not less than 75 pounds per square foot of floor area of the platform.

CONTROL APPARATUS FOR ORCHESTRA AND ORGAN CONSOLE ELEVATORS

Operating switches shall be provided in a suitable location on the platform of orchestra and console elevators.

An emergency stop switch, which will cut off the sources of power, shall be provided in the car adjacent to the operating device for all of the above elevators and shall be identified by the distinctive color of Red.

Emergency stop switches may be operated by buttons or levers but shall be of the manually opened and closed type so installed that when opened gravity will not tend to close the switch.

An emergency stop switch shall be installed in the pit of every orchestra and console elevator.

A manually operated multiple disconnecting switch shall be installed in the main line of each electric orchestra or console elevator or motor generator set machine.

The disconnect switch shall be located adjacent to and visible from the elevator machine or motor generator set to which it is connected and shall, where practicable, be located in the machine room at the lock jam side of the entrance door.

DRIVING MACHINES

Where elevating screws are used they shall be of the direct connected type, either worm or bevelled gears, and all gears shall be enclosed in a protective housing.

Where a stage, orchestra or console elevator is not supported or operated by either screws, plungers or similar means, car safeties shall be provided under the platform capable of stopping and holding the platform with full rated load at any point of its travel.

CONTROL AND OPERATING DEVICES AND SYSTEMS

MOTOR CONTROLLER -

A suitable lighted room shall be provided outside of the shaftway for the motor controller and brake unless the motor and controller

and brake are located in the pit in which case masonry piers or columns shall be provided of sufficient strength to take the impact of a full loaded car.

LOCATION OF MOTOR AND CONTROLLER

Where the motor and controller are located in a shaftway pit or in a pit adjacent to the lifting platform, access to same shall be provided by means of a door entirely below the bottom of the platform when the platform is at its lowest limit of travel.

This door shall be of sufficient width and height to make the entrance readily accessible.

TERMINAL LIMIT SWITCHES

Enclosed terminal limit switches located in the shaftway shall be provided and arranged to automatically bring the car platform to rest as it approaches either terminal landing.

FINAL LIMIT SWITCHES

Enclosed final limit switches shall be provided at the top and bottom of the shaftway arranged to cut off the current and stop the platform if it should travel beyond the terminal limit switch. Electric power elevators having winding drum machines shall have the stopping switches on the machines and also in the shaftway operated by the movement of the car.

FACTOR OF SAFETY

ELEVATOR PLATFORM CONSTRUCTION

The platform of stage, orchestra, organ console elevators shall be of steel frame construction designed with a safety factor of not less than six (6) based on the rated load, uniformly distributed.

All other parts of the equipment shall have a safety factor as required by the elevator regulations outlined in ELV-2.

INSTALLATIONS IN THE SAME SHAFTWAY

When orchestra and organ console elevators are installed in the same shaftway the adjacent sides shall be provided with solid dividing wall partitions with not less than three quarter (3/4) hour fire resistive construction.

When the travel of a stage, orchestra or organ console elevator extends above the top of the shaftway enclosure, aprons of substantial construction shall be provided on the platform of sufficient depth to enclose the space between the top of the shaftway enclosure and the under side of the platform plus three inches (3") when the platform is at its limit of travel.

The lower edge of the aprons shall be bevelled at an angle of not less than 75 degrees with the horizontal.

DEFINITIONS

STAGE ELEVATORS

A stage elevator shall mean a platform consisting of a section of the stage arranged to be raised and lowered to or above and below the stage level in a vertical direction at a speed not exceeding fifteen (15) feet per minute.

ORCHESTRA ELEVATOR

An orchestra elevator shall mean the platform for raising and lowering musicians of an orchestra in a substantially vertical direction at a speed not exceeding fifteen (15) feet per minute.

ORGAN CONSOLE ELEVATOR

An organ console elevator shall mean a platform for raising and lowering an organ console including the organist, in a substantially vertical direction at a speed not exceeding fifteen (15) feet per minute.

STANDARD RAILING

A standard railing shall mean a railing not less than forty-two (42) inches in height with an additional rail between the top rail and the floor.

TOE BOARDS

Toe boards shall mean a board not less than six (6) inches in height placed at right angles with floor or platform to prevent objects from falling from the floor or platform to the spaces below.

CAR APRONS

Car aprons shall mean an enclosure of solid construction to enclose the space between the top of the shaftway enclosure and the underside of the platform when the platform extends above the top of the shaftway enclosure.

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Approved as to matters of form:

Edward A. Brooke
Attorney General

by: John J. Grigalus
Assistant Attorney General

Received Feb. 25, 1964 in
accordance with the provisions
of G. L., Chapter 143, Section
69, as amended.

CLAYTON L. HAVEY
Acting Commissioner of Public Safety

A true copy, attest:

Edward T. Sullivan
Clerk of Board

Deposited with the Secretary of
the Commonwealth February 27, 1964
in accordance with the provisions
of G. L., Chapter 143, Section 69,
as amended.

CLAYTON L. HAVEY
Acting Commissioner of Public Safety

APPENDIX A
LOADING CLASSIFICATIONS

CAR FRAME UPRIGHTS (STILES). The total stress in each car frame upright, due to tension and bending and the slenderness ratio of each upright and its moment of inertia, shall be determined in accordance with the following formulas:

A. Stress Due to Bending and Tension:

$$\text{Total Stress} = \frac{KL}{4HZ_u} \quad \not{} \quad \frac{G}{2A}$$

Where $\frac{KL}{4HZ_u}$ is the bending stress in each upright in the plane of the frame due to the live load W on the platform for the class of loading A, B or C for which the elevator is to be used (See Part 2, Section 33.03) K is determined by the following formulas:

1. For Class A freight loading or passenger loading: $K = \frac{WE}{8}$
2. For Class B freight loading: $K = W\left(\frac{E}{2} - 48\right)$
3. For Class C freight loading: $K = \frac{WE}{4}$, and $\frac{G}{2A}$ is the tensil stress in each upright.

B. Slenderness Ratio:

The slenderness ratio L/R for uprights subject to compressions other than those resulting from safety and buffer action shall not exceed one hundred and twenty (120).

C. Moment of Inertia:

The moment of inertia of each upright shall be not less than determined by the following formula:

$$I = \frac{K(L)^3}{54 \times (10)^7 H}$$

FREIGHT ELEVATOR PLATFORM FRAMES. The calculation of the stresses in the platform frame at the entrance of freight elevators, due to loading and unloading at the landings, shall be based on the following:

A. For Class A loading: One-quarter (1/4) of the rated load shall be considered as being concentrated on the mid-point of the frame member

I L L U S T R A T I O N

Turning Moment Based on Class of Loading.

B. For Class B loading: Seventy-five (75) per cent of the rated load shall be considered as being concentrated on the frame member supported at two points five (5) feet apart, symmetrically located with respect to the mid-point of the member.

C. For Class C loading: Eighty (80) per cent of the rated load shall be considered as being concentrated on the frame member supported at two points two (2) feet six (6) inches apart, symmetrically located with raspect to the mid-point of the member.

FORMULA SYMBOLS

The symbols used in the formulas in this section shall have the following meanings:

W = Rated load in pounds.
C = Net weight in pounds of complete elevator car.
G = Load in pounds supported by crosshead with rated load in car at rest at top terminal landing.
K = Turning moment in inch-pounds as determined by class of loading.
D = Distance in inches between guide rails.
E = Inside clear width of car in inches.
H = Vertical center distance between upper and lower guide shoes (or rollers) in inches.
L = Free length of uprights in inches (distance from lowest fastening in crosshead to top fastening in plank).
A = Net area of section in $(\text{inches})^2$.
R = Least radius of gyration of section in inches.
I = Moment of inertia of member, gross section in $(\text{inches})^4$.
Z = Combined section moduli of plank members, gross section, $(\text{inches})^3$.
Z_u = Section modulus of one upright, gross section, $(\text{inches})^3$.

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