

PART V

DUMBWAITERS, SPECIAL TYPES OF
ELEVATORS AND ESCALATORS

SECTION I. DUMBWAITERS.

Order 479.—Dumbwaiters.

1. New and Existing Installations.

(a) The hoistway openings of every electric dumbwaiter shall be provided with landing doors, so arranged that the dumbwaiter cannot be started unless all doors are closed. Where a fire-resistive hoistway is required, all landing doors shall be fire-resistive (see Orders 410-412).

(b) Every dumbwaiter hoistway opening at the floor level shall be protected by a gate in compliance with Orders 437 and 438. Every other dumbwaiter hoistway shall be enclosed on the loading side to a height of at least 30 inches above each floor.

(c) A dumbwaiter shall not have a platform area greater than 9 square feet and not more than 4 feet in height, shall have a solid cover over the full area of the car, and a carrying capacity of not more than 500 pounds.

Note: Dumbwaiters installed before August 12, 1926, where the platform is greater than 9 square feet and the height is more than 4 feet, will be accepted provided all the other dumbwaiter requirements of August 12, 1926, are complied with.

2. New Installations.

(a) No power dumbwaiter hereafter installed shall be controlled or operated by cable control.

(b) Power dumbwaiters shall be equipped with brakes which are automatically applied when the power is cut off the motor.

Exception: Hydraulic dumbwaiters.

(c) Power dumbwaiters having a travel of more than 30 feet, and a capacity of more than 100 pounds and operated by winding-drum machines shall be provided with a

slack-cable device which will cut off the power and stop the car if the car is obstructed in its descent.

(d) Power dumbwaiters shall be provided at each terminal with means independent of manual operation to automatically stop the car, within the limits of overtravel.

(e) Every hoistway landing door or gate, on a power dumbwaiter hereafter installed, shall be equipped with electric contacts and approved locks or interlocks.

(f) Dumbwaiter cars shall be of such strength and stiffness that they will not deform appreciably if the load leans or falls against the sides of the car.

(1) Cars shall be made of wood or metal and of solid construction.

(2) Cars for power dumbwaiters shall be reinforced with metal from the bottom of the car to the point of suspension.

(3) Metal cars shall be of metal sections rigidly riveted, welded or bolted together.

(g) Dumbwaiter cars, machines and hoisting cables shall be capable of sustaining the loads given in the following table:

MINIMUM ALLOWABLE DUMBWAITER CAPACITIES CORRESPONDING TO EFFECTIVE PLATFORM AREA

Horizontal Area in Sq. Ft.	Structural Capacity in Lb.
4	100
5	150
6.25	300
9	500

(h) Power dumbwaiters, except those of the direct-plunger type, shall be provided with one or more iron or steel hoisting cables, chains or tapes. Where cables are exposed to corrosion, they may be covered with marline or other equivalent protective covering.

(1) The factor of safety for car and counterweight cables based on static loads shall be not less than the values corresponding to the contract speed of the car as outlined in the following table:

FACTORS OF SAFETY FOR DUMBWAITER CABLES

Factor of Safety	Car Speed (Ft. per Min.)
5.4	50
5.7	100
6	150
6.3	200
6.6	250
6.9	300
7.2	350
7.5	400
7.7	450
8	500

(2) The safety factor for tapes shall not be less than 25 per cent greater than given in the above table.

(3) The safety factor for chain shall not be less than 100 per cent greater than given in the above table.

(4) The number and size of the cables, chains or tapes are determined by using the factor of safety in the above table and the rated ultimate strength of the cable, chains or tape. The computed load on the cable, chains or tape shall be the weight of the car plus the contract load, plus the weight of hoisting cables, chains or tapes and compensation.

(i) Guide rails shall be securely fastened to the hoistway, and the joints shall be tongued and grooved, doweled, or fitted with splice plates.

(j) Sections of counterweight for dumbwaiters having a capacity exceeding 100 pounds or having a speed exceeding 100 feet per minute shall be secured by at least 2 tie rods passing through holes in all sections, unless suitable

frames or boxes are provided. The tie rods shall have lock nuts at each end and secured by cotter pins.

(k) There shall be no thoroughfare under the hoistway of a dumbwaiter or its counterweight unless there is a structure under the hoistway sufficiently strong to withstand without failure the impact of the car with contract load, or the impact of the counterweights, when either is dropped freely in its guides from the upper limits of over-travel; provided that for cars or counterweights equipped with governor-operated safeties, the impact shall be computed for governor-tripping speed. When broken rope safeties are used, the impact of the car or counterweight shall be computed for a free drop of the car or counterweight from $\frac{1}{3}$ its travel.

SECTION II. SIDEWALK ELEVATORS.

Order 480.—Sidewalk Elevators.

Note: Sidewalk elevators are not recommended since their use involves accident hazards which cannot easily be eliminated.

1. *New and Existing Installations.*

(a) Every sidewalk elevator shall be covered at the top with hinged or vertically lifting type covers which shall when closed be capable of sustaining a live load of 300 pounds per square foot. The limitations of the sidewalk opening, except for existing installations, shall in no case exceed 5 feet at right angles to the curb and 7 feet parallel to the curb. The surface of the covers shall be rough and no part of them shall project above the sidewalk when closed.

Hinged hatch covers may be used on sidewalk elevators hereafter installed only if the elevator car has a clear platform area of not more than 35 square feet. Hinges of hatch covers shall be of sufficient strength and be securely fastened to withstand the service of normal operation.

(b) Every power sidewalk elevator shall be provided with one of the following requirements:

(1) A device to prevent its operation until the hatch covers over the top of the hoistway are open, or

(2) Flat metal tops or arched bows of sufficient strength to open the hatch covers.

(c) When hatch covers are left open, a full guard not less than 30 inches in height shall be provided in each side of the sidewalk opening not fully protected by the hatch covers. This guard shall be so fastened that it cannot be pushed into the sidewalk opening.

(d) Beveled toe-guards shall be provided under the edges of the sidewalk and under other projections, if any, as required by Order 415.

(1) If the platform of an existing sidewalk elevator rises above the sidewalk, similar toe-guards shall be provided under the platform on all exposed sides.

(2) If the platform of a sidewalk elevator hereafter installed rises above the sidewalk, aprons shall be attached to the under side of the platform fully protecting all exposed sides (see Order 487-(g)).

(e) Every existing power sidewalk elevator traveling not more than 15 feet, or more than one story, shall comply with the following orders: Orders 400, 402, 405, 406, 407, 412-(a), 415, 418-(a), 436-(c), and Orders 437 and 438 (as applied to the lower landing), 473-(e), (f)-(2), (g), (h), (i), (j), (p), 474, 476-(b), 478-(a).

Every existing power sidewalk elevator traveling more than 15 feet shall, in addition to the above orders, comply with Order 465-(b).

Hydraulic sidewalk elevators shall be subject to such paragraphs of Orders 485, 486, 487 and 488 as may reasonably be applicable to sidewalk elevators.

(f) Every hand chain hoist elevator shall comply with Orders 412-(a), 437 and 438 (as applied to lower landing), 478-(a), 480-(a) and 480-(c).

(g) Every hand or existing power sidewalk elevator car platform shall be enclosed to a height of one foot on the sides not used for entrance.

2. New Installations.

(a) The contract speed of every power sidewalk elevator shall not exceed 20 feet per minute.

(b) Electric sidewalk elevators having a winding-drum machine shall have normal terminal stopping devices on the machine.

(c) The car enclosure on every power sidewalk elevator shall comply with Order 434-(a).

(d) A sidewalk elevator having a travel of 30 feet or more shall comply with the requirements of power freight elevators.

(e) A hatch cover of the hinged type may be arranged to open against the building or may be used as a thoroughfare only when there is a space of at least 18 inches between the fully opened covers and any obstruction in the direction of opening.

(f) Guide shoes for sidewalk elevators (except plunger elevators) shall be at least 24 inches long unless two sets of shoes are used, spaced 18 inches between center.

(1) If vertical lift covers are used (except plunger elevators), the spacing of guide shoes or the length of a single guide shoe remaining on the guide rail when the car platform is level with the sidewalk, shall be at least $\frac{1}{3}$ of the height of the hatch cover stanchions.

(2) If single guide shoes not less than 24 inches long are used, 6 inches of the shoe may be off the rail when the platform is level with the top landing.

Order 481.—Freight Elevators of the Sidewalk Type.

(a) Every elevator of the sidewalk type hereafter installed within a building and traveling one story or more, shall comply with all the orders which apply to freight elevators.

Exception: Order 458; counterweights are not required.

(b) The overhead clearance for elevators of a sidewalk type hereafter installed shall be not less than given in Order 417(a).

SECTION III. HAND ELEVATORS, HAND HOSPITAL ELEVATORS,
AND HAND INVALID LIFTS.

Order 482.—Special Requirements.

(a) The following orders of this code are applicable to hand elevators: Orders 400, 401, 402, 405, 406, 407, 408, 410, 412, 413, 414, 415, 416, 417-(a)-(b), 418 where lower landing is basement landing; 420-(b), 422-(a)-(c)-(d) where a penthouse is provided; 424-(a), 426-(c), 427-(d), 434-(a)-(b)-(c), 435, 437, 438, 441, 442, 443, 444-(a), 445, 446-(d), 451, 453, 454, 456-(b), 459, 460-(f)-(j)-(k), 461, 464-(a), 465-(c)-(d), 476, 478.

(b) Where the lower landing of a hand elevator terminates at the first floor the wall and floor of the pit shall be substantially constructed and may be of wood.

(c) The minimum carrying capacity of a hand invalid lift and of a hand hospital elevator shall be not less than 35 pounds per square foot of platform area inside the car enclosure. (See Order 419-(a) for car buffers.)

SECTION IV. STAGE ELEVATORS.

Order 483.—Stage Elevators.

1. Existing Installations.

(a) Every elevator located below a stage and traveling one story only, shall have the opening on the stage floor equipped with a flush hatchway cover which, when the elevator is down, shall be closed, forming part of the stage floor.

The opening in the stage floor shall be protected by toeguards as required in Order 415. The hoistway in the basement shall be enclosed with guards as described in Order 412, and a swinging door equipped with a lock shall be provided at each entrance. The speed of any elevator installed in such a manner shall not exceed 50 feet per minute. The carrying capacity of the car platform shall be as required in Order 427-(a).

2. New Installations.

(a) Every stage elevator hereafter installed shall be operated from one point only, from which point the operator

shall be able to see the hoistway opening in the stage floor from at or above the stage floor level.

The hoistway entrances on elevators hereafter installed shall be equipped with gates or doors provided with electric contacts and approved door locks or interlocks.

SECTION V. HYDRAULIC ELEVATORS.

Order 485.—Construction and General Requirements. New Installations.

(a) Every piston rod of tension-type hydraulic elevators shall have a factor of safety of not less than 8, based on the cross-sectional area at the root of the thread. A true bearing shall be maintained under the nut at each end of the piston rod to prevent eccentric loading on the rod.

(b) Every hydraulic elevator machine, 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. A stop 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.

(c) The traveling sheaves for vertical hydraulic elevators shall be guided. The guide rails and guide shoes shall be of metal. The side frames of traveling sheaves for vertical hydraulic elevators shall be made of structural steel or of forged steel.

(d) Pressure tanks shall be made and tested in accordance with the requirements of the Boiler Code issued by the Industrial Commission.

(e) Every pressure tank that may be subjected to vacuum shall be provided with one or more vacuum valves to prevent collapse of the tank.

(f) Every pressure tank shall be so located and supported that inspection may be made of the entire exterior.

(g) Where a booster pump is used to operate a hydraulic elevator the operating device on the car must be so arranged that full control of the elevator in either direction is maintained.

(h) The outlet of each pressure tank shall be so located as to prevent the entrance of air or other gas into the elevator cylinder.

(i) Automatic stop valves shall be packed with cup leather, or other means shall be used to prevent sticking of the valve stems.

(j) Each pump connected to the pressure tank of a hydraulic elevator 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 tank. The relief valve shall be piped to discharge into the discharge tank or into the pump suction. Two or more relief valves may be used to obtain the capacity.

(k) Every elevator pump, unless equipped with a pressure regulator which controls the motive power, shall be equipped with an automatic by-pass.

(l) Every hydraulic elevator 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. For limitations in use see Order 460.

Order 486.—Safety Equipment. New and Existing Installations.

(a) The hand cable on every hydraulic elevator shall be equipped with a limit stop to prevent damage to the valve mechanism.

(b) Every tank for a hydraulic elevator shall be fitted with a $\frac{1}{4}$ inch pipe connection for attaching a test gauge when the tank is in service so that the accuracy of the pressure gauge can be ascertained.

(c) Every pressure tank shall be equipped with a water gauge glass to indicate the height of the water in the tank. Pet cocks may be used where pressure is obtained by steam, air, or other gas.

(d) Each pressure tank shall be equipped with a pressure gauge which correctly indicates pressure to at least

1½ times the normal working pressure of the tank. This gauge shall be connected to the tank by a brass or other non-corrodible pipe in such a manner that the gauge cannot be shut off from the tank except by a cock with a "T" or lever handle. (The "T" or lever must be set in line with the direction of the flow.) The cock shall be in the pipe near the gauge.

(e) The cylinders of hydraulic elevator machines, except plunger type machines, shall be provided with means for releasing air or other gas.

(f) Every hydraulic elevator hereafter installed shall be provided with an independent automatic means of gradually stopping the car at the terminal landings.

(g) Where a booster pump is used to operate a hydraulic elevator, means shall be provided so that full control of the elevator in either direction is maintained at all times by the operating device.

Order 487.—Plunger Type Elevators. New Installations.

(a) The piping system of plunger elevators shall be provided with proper means to eliminate or prevent water hammer in both directions of travel.

(b) The sections of the piston shall be rigidly joined, and the bottom section shall be so designed and installed that it cannot leave the cylinder.

(c) A cast iron plunger shall not be used in any case where the elevator travel is more than 50 feet.

(d) Every plunger type elevator operating on greater than 150 pounds pressure shall have extra heavy pressure fittings throughout.

(e) There shall be no lead piping in the water line between the plunger cylinder and the operating valve.

(f) The construction of the operating valve shall be such that the opening and closing of the valve will gradually stop the flow of water to and from the cylinder.

(g) No sidewalk elevator of the plunger type with sliding extended car guide rails shall rise more than 4 feet above any sidewalk.

Order 488.—Maintenance.

(a) The piston rods of hydraulic elevator machines, except plunger type machines, shall be exposed for inspection at least once every two years. The preparation for such inspections shall be made by the owners or parties using the elevators.

(b) The discharge tank and the pressure tank of every hydraulic elevator shall be cleaned at least once every two years. The water level in the pressure tank of a hydraulic elevator shall be maintained at about two-thirds of the capacity of the tank.

(c) Each pump connected to the pressure tank of a hydraulic elevator shall be equipped with a relief valve so installed that it cannot 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.

Order 489.—Recabing Hydraulic Elevators.

Where more than one vertical hydraulic cylinder is placed in the same hoistway, or where the horizontal cylinders are placed in duplex or triplex, the operation of all such connected elevators shall be stopped by closing the main water supply valve before recabing any one of the elevators.

SECTION VI. ESCALATORS.

Order 490.—Construction of Escalators.

(a) Angle of Inclination. The angle of inclination of an escalator shall not be in excess of 30 degrees from the horizontal.

(b) Width of Escalators. Escalators shall not be less than 24 inches nor more than 48 inches wide and shall have a horizontal tread formation.

The width of an escalator shall be measured between the balustrading at a vertical height of 24 inches above the nose line of the treads.

(c) Balustrading. Escalators shall be provided on each side with solid balustrading. On the escalator side the balustrading shall be smooth, without depressed or raised pan-

eling or molding. Glass panels in balustrading are prohibited.

There shall be no abrupt changes in the width between the balustrading on the two sides of the escalator. Should any change in width be necessary, the change shall not be more than 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 not be more than 15 degrees from the line of the escalator travel.

Each balustrading shall be equipped with a hand rail moving at the same speed and in the same direction as the escalator.

(d) Treads and Landings. Escalator treads and landings shall be of material and design affording secure foothold such as wood or material used for safety treads. If the landing is of concrete, it shall have edge insertions of metal, wood, or other anti-slip material.

(e) Strength of Trusses or Girders. The factor of safety to be used in the design of escalator trusses or girders shall be not less than 5, based on the static loads.

The escalator truss or girder shall be so designed that it will safely retain the steps and running gear in case of failure of the track system to retain the running gear in its guides.

(f) Track Arrangement. The track arrangement shall be designed to prevent displacement of the treads and running gear if a tread chain breaks.

(g) Capacity and Loading: The contract load on an escalator shall be computed by the following formula:

$$\text{Contract Load} = 4.6 W A$$

In this formula W is the width of the escalator in inches and A the horizontally projected length in feet of the exposed treads. The contract load is expressed in pounds.

Order 491.—Safety Requirements For Escalators.

(a) Limits of Speed. The speed of an escalator measured along the angle of inclination shall not exceed 125 feet per minute, except that if the line of entrance and exit is

not in the vertical plane of travel, the speed shall not exceed 100 feet per minute.

(b) Application of Power. Escalators shall be driven by individual electric motors.

(c) Chains. All chains shall have a factor of safety of not less than 10, except where the chain is composed of cast-steel links which shall be thoroughly annealed, in which case the factor of safety shall be not less than 20.

(d) Stop Buttons. An emergency stop button or other type of switch accessible to the public shall be conspicuously located at the top and bottom of each escalator landing.

The operation of either of these buttons or switches shall cause the interruption of power to the escalator.

It shall be impossible to start an escalator by means of these buttons or switches.

These buttons or switches shall be marked "Escalator Stop Button" or "Escalator Stop Switch".

(e) Starting Buttons. If starting buttons or switches are accessible to the public, they shall be either of the key operated type or be enclosed in a box provided with a lock and key.

(f) Interruption of Power. Escalators shall be equipped with means to cause the interruption of power to the escalator in case of accidental reversal of travel of the escalator traveling in the ascending direction.

(g) Speed Governor. Escalators shall be provided with a speed governor which will cause the interruption of power to the escalator in case the speed exceeds a predetermined value which shall be not more than 40 per cent in excess of the normal running speed.

(h) Broken Chain Device. Escalators shall be provided with a broken chain device that will cause the interruption of power to an escalator in case a tread chain breaks.

(i) Tension Weights. Where escalators are equipped with tightening devices operating by means of tension weights, provision shall be made to retain these weights in the escalator truss in case the weight should fall.

(j) Safety Brake. Each escalator shall be provided with an electrically released and mechanically applied safety brake of sufficient power to stop the fully loaded escalator, mounted on the main drive shaft of the escalator.

This safety brake shall automatically stop the escalator when operating or tending to operate in the descending direction in case any of the above safety devices function, except that if the escalator drive machine is equipped with an electrically released, mechanically applied brake of sufficient power to stop the fully loaded escalator, then the above safety devices may apply this brake in place of the safety brake, provided that a device is furnished which will apply the safety brake in case the connection between the escalator drive machine and the main drive shaft parts.

(k) Machine Room Lighting. There shall be a suitable light in every escalator machine room, which can be lighted without passing over or reaching over any part of the machinery.

(l) Access to Interior of Escalator. Reasonable access to the interior of the escalator shall be provided for inspection and maintenance.

Order 492.—Escalator Tests.

New escalator installations before being placed in service shall be tested as follows:

- (1) Speed Tests. The application of the over-speed safety device shall be obtained by causing the escalator to travel at the governor tripping speed, as specified in Order 491-(g). With escalators driven by alternating current motors the governor may be tripped by hand with the escalator traveling at its normal rate of speed.
- (2) Reversal Test. The accidental reversal device called for in Order 491-(f) shall be made to function by manually operating or attempting to operate the escalator in the reverse direction.

- (3) Broken Chain. The application of the broken chain safety device as called for in Order 491-(h), shall be obtained by operating the device by hand.
- (4) Stop Button. Test of the escalator emergency stop buttons or switches shall be made to determine whether they function properly.
- (5) Safety Brake. The device, called for in some cases by Order 491-(j), which applies the safety brake in case the connection between the escalator drive machine and the main drive shaft fails, shall be tested by operating the device by hand.