

524 CMR: BOARD OF ELEVATOR REGULATIONS

524 CMR 22.00: MOVING STAIRWAYS (FOR INSTALLATIONS MADE PRIOR TO JULY 1, 1989)

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22.01: Construction: Protection of Floor Openings

- (1) Floor openings for moving stairways not constituting required means of egress shall be protected as follows:
- (2) Floor openings shall be provided with enclosures as required for stairways, or
- (3) 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 (524 CMR 22.01(4)); Rolling Shutter method 524 CMR 22.01(5); or Spray Nozzle method (524 CMR 22.01(6)); 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.
- (4) 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 300 feet per minute under normal conditions for a period of not less than 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 FPM 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 FPM 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.

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- (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, at least 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 door opening and reaching from the ceiling to the floor.
- (5) 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 100 lbs. on any one square foot of area, and not less resistant to fire or heat than 24 gauge steel.
  - (c) The shutter shall operate at a speed of not greater than 30' 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 inches upon the application of a force of at least 20 lbs. 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.
- (6) 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 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 60° 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 25 lbs. 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 20" to 30" 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.

22.02: Angle of Inclination

The angle of inclination of a moving stairway shall not exceed 30° from the horizontal.

22.03: Width

The width between moving stairway balustrade shall be at least 22" and not more than 48", measured on the incline at a height of 27" vertically above the nose line of the steps. In no case shall such width exceed the width of the steps by more than 13".

22.04: Balustrading and Hand Rails

- (1) 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 ¼" and properly beveled may be used to cover joints of panels.
- (2) Where glass panels are used in balustrading, they shall be of laminated type glass.
- (3) The clearance between the step treads and the balustrading curtain guard shall not exceed ⅛".
- (4) There shall be no abrupt change in the width between the balustrades. Any change shall be not more than 8% 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 15° from the line of travel.
- (5) Each balustrading shall be equipped with a moving handrail traveling 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 12" beyond the line of the comb-plate teeth at the upper and lower landing.
- (6) Hand or finger guards shall be provided at the point where the handrail enters the balustrading.
- (7) Where the intersection of the outside balustrade or deck board and the ceiling or soffit is within 24" 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 14" 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.

22.05: Step Frames and Treads

- (1) Step frames and treads shall be of noncombustible material. Step treads shall be horizontal and of a material and design affording a secure foothold.
- (2) The depth of any step tread in the direction of travel shall not be less than 15¾", and the rise between treads shall not exceed 8½". In no case shall the width of a step tread be less than 16".
- (3) The maximum clearance between treads on the horizontal run shall be ⅛".
- (4) 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 ¼" wide and not less than ⅜" deep, and the distance from center to center of adjoining slots shall be not more than ⅜".
- (5) 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.

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- (6) Comb-plates shall be adjustable in both the horizontal and vertical directions.
- (7) Sections forming the comb-plate teeth shall be so arranged as to be readily replaceable.

22.06: Design of Trusses or Girders

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.

22.07: Track Arrangement

The track arrangement shall be designed to prevent displacement of the steps and running gear if a step chain breaks.

22.08: Capacity and Loading

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 30" vertically above the nose line of the steps, and A the horizontally projected distance in feet between the upper and lower comb-plate teeth.

22.09: Factors of Safety

The factors of safety to be used in the design of moving stairways shall be at least the following, based on the static loads:

- (1) For trusses and all structural members, including tracks, five.
- (2) For moving stairway driving machines -- for wrought iron or wrought steel, eight; for cast iron, cast steel, or other materials, ten.
- (3) For power transmission members, ten, other than step chains composed of cast steel links which shall be thoroughly annealed, in which case the factor of safety shall be at least 20.

22.10: Safety Requirements

- (1) Limits of Speed. The rate of travel of the steps measured along the angle of inclination shall not exceed 125 feet per minute.
- (2) Application of Power.
  - (a) Each moving stairway shall be driven by an individual motor.
  - (b) The driving machine shall be connected to the main drive shaft by tooth gearing, a coupling, or chain.
  - (c) Where a means other than a solid shaft, coupling, or tooth gearing connects the motor to the gear reducer, the electrically released, mechanically applied brake must be located on the gear reducer or main drive shaft.
  - (d) If the drive motor is attached to a gear reducer by means other than a solid shaft, coupling or tooth gearing, a device shall be provided that will cause the application of the electrically released, mechanically applied brake if the motor becomes disconnected from the gear reducer or if escalator overspeeds or underspeeds.
- (3) Safety Devices. The following safety devices shall be provided:
  - (a) All existing escalators shall have emergency stop buttons conforming to the requirements of Rule 805.3a (1) (Reference A17.1-1996). Existing escalators shall be compliant by January 1, 2003. The new emergency stop buttons shall not be combined with key operated start switches and shall be mounted on the right side facing the escalator.

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- (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 40% in excess of the normal running speed. The speed governor is not required where an alternating current squirrel cage induction motor is used.
- (d) Each moving stairway shall be provided with a broken step switch and broken chain switch which will cause interruption of power to the moving stair and shall be of the manual reset type. 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.
- (h) Skirt Obstruction Device. Wherever the basic design of the panels will permit its addition, means shall be provided to cause the opening of the power circuit to the moving stair driving machine motor and brake, should an object become wedged between the step and the skirt panel as the step approaches the upper and lower combplates.
- (i) Upthrust track switches shall be provided and shall be of the manual reset type.
- (j) Handrail brush switches shall be installed.

(4) Lights and Access.

- (a) There shall be an electric light (ten candlepower) and a 110 volt outlet in every moving stairway machine room and pit access area which can be lit without passing over or reaching over any part of the machinery.
- (b) Free access to the moving stairway, machine room, pit access areas and inspection doors shall be provided for inspection and maintenance and shall be electrically contacted.

22.11: Tests

All escalators will be tested in accordance with 524 CMR 8.01 (10), (11) and (12).

- (1) Speed Test. The application of the over speed safety device shall be obtained by causing the moving stairway to travel at governor tripping speed.
- (2) Broken Step Chain. The broken step chain device shall be tested by operating the actuating device by hand.
- (3) Broken Drive Chain. The broken drive chain device, where a drive chain is provided, shall be tested by operating the actuating device by hand.
- (4) Stop Buttons. The emergency stop buttons shall be tested by operating these buttons when the moving stairway is operated in each direction of travel.
- (5) Stop Switches in Machinery Spaces. A stop switch shall be provided in each machinery space where means of access to the space is provided. The switch, when open, shall cause the electric power to be removed from the moving stairway driving machine motor and brake. The stop switch shall:

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- (a) be of the manually opened type
- (b) be conspicuously and permanently marked "STOP"
- (c) be positively opened mechanically and the opening shall not be solely dependent on springs.

(6) Reverse Phase Relays. Each power driven moving stairway 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) if there is a failure in any phase.

NOTE: 524 CMR 22.00 does not apply to AC motors used to drive motor generator sets.

(7) Disconnect Means. An enclosed fused disconnect switch or circuit breaker arranged to disconnect the power supply to the moving stairway shall be installed in the space where the controller is located or shall be mounted on the controller. Disconnect switches or circuit breakers shall be of the manually closed multi-voltage type.

REGULATORY AUTHORITY

524 CMR 22.00: M.G.L. c. 143, § 69.