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IS 4591 (1968): Code of Practice for Installation and Maintenance of Escalators [ETD 25: Lift and Escalators]

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Indian Standard

CODE OF PRACTICE FOR INSTALLATION AND MAINTENANCE OF ESCALATORS

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BUREAU OF INDIAN STANDARDS MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG NEW DELHI 110002

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Indian Standard CODE OF PRACTICE FOR INSTALLATION AND MAINTENANCE OF ESCALATORS

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Indian Standard

CODE OF PRACTICE FOR INSTALLATION AND MAINTENANCE OF ESCALATORS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 29 April 1968, after the draft finalized by the Lifts and Escalators Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 Escalator industry is gradually growing in the country and already escalators have been installed in many buildings. Need was, therefore, felt to prepare this code to regulate the installation and maintenance and for safe working of escalators and the associated machinery and apparatus.

0.3 In the preparation of this code, assistance has been derived from the following:

The West Bengal Escalators Rules, 1962.

A17.1-1965 American Standard safety code for elevators, dumbwaiters, escalators and moving walks. American Society of Mechanical Engineers.

0.4 This standard is one of a series of Indian Standards on lifts and escalators. Other standards published in this series are:

- IS: 1860-1968 Code of practice for installation, operation and maintenance of electric passenger and goods lifts (revised)
- IS: 3534-1966 Outline dimensions for electric lifts

IS: 4666-1968 Specification for electric passenger and goods lifts

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS: 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This code applies to the design, installation and maintenance of escalators in buildings.

^{*}Rules for rounding off numerical values (revised).

2. TERMINOLOGY´

2.0 For the purpose of this code, the following definitions shall apply.

2.1 Escalator — A power-driven, inclined, continuous starway used for raising or lowering passengers.

2.1.1 Escalator Installation — It includes the escalator, the track, the trusses or girders, the balustrading, the step-treads and landings and all chains, wires and plant directly connected with the operation of the escalator.

2.1.2 Escalator Machine — The mechanism and other equipment in connection therewith used for moving the escalator.

2.2 Baluster - A short pillar slender above and bulging below.

2.2.1 Balustrade — A row of balusters meant for supporting moving handrails.

2.3 Combplete — A pronged plate that forms part of an escalator landing and engages with the cleats of the steps at the limits of travel.

2.4 Emergency Step Push or Switch — A push button or switch designed to open a circuit and cut off power supply to the escalator machine so as to cause the escalator to stop.

2.5 Landing — The portion of the building or structure which is used to receive or discharge passengers into or from an escalator.

2.6 Travel (Rise)—The vertical distance between the bottom terminal landing and the top terminal landing of an escalator.

2.7 Overspeed Governor — An automatic device which causes the power supply to the escalator to be interrupted in the event of the speed exceeding the predetermined value of the normal running speed.

2.8 Rated Load — The load which the escalator is designed and installed to lift at the rated speed.

2.9 Rated Speed — The speed at which the escalator is designed to operate. It is the rate of travel of the steps, measured along the angle of inclination, with rated load on the steps or carriage.

3. CONSTRUCTION, INSTALLATION, PROTECTION, OPERATION AND MAINTENANCE OF ESCALATORS

3.1 Every escalator and every part thereof shall be of sound material and good construction and of sufficient mechanical strength for the purpose for which it is intended and so far as is practicable, shall be installed, protected, worked and maintained in such a manner so as to prevent danger. 3.2 All materials shall be in accordance with the latest Indian Standard specifications wherever available.

4. CONSTRUCTIONAL REQUIREMENTS

4.1 Angle of Inclination — It shall not be in excess of 30 degrees from the horizontal excepting that with an escalator having a vertical rise not exceeding 6 metres an angle up to 35 degrees may be permitted.

4.2 Width — The width between balustrades shall be measured on the incline at a point 68.5 cm vertically above the nose line of the steps, and shall not be less than the width of the step. It shall not exceed the width of the step by more than 33 cm with a maximum of 16.5 cm on either side of the escalator.

4.3 Balustrading — Escalators shall be provided on each side with solid balustrading. On the step side the balustrading shall be smooth and substantially flush except for protective mouldings parallel to the run of the steps and properly bevelled vertical mouldings projecting not more than 6.5 mm, that cover joints of panels.

4.3.1 Use of Glass in Balustrades — Glass panels shall not be used unless they conform to IS: 2553-1964*.

4.3.2 Change in Width Between Balustrades — There shall be no abrupt changes in the width between the balustrading on the two sides of the escalator. Where a change in width is unavoidable, such change shall not exceed 8 percent of the greatest width. In changing the direction of the balustrading resulting from a reduction in width the maximum allowable angle of change in the balustrading shall not exceed 15 degrees from the line of the escalator travel.

4.3.3 Clearance Between Balustrades and Steps — The clearance on either side of the steps between the steps and the adjacent skirt guard shall be not more than 5 mm and the sum of the clearances on both sides shall be not more than 6 mm.

4.3.4 Guards at Ceiling Intersection -- A solid guard shall be provided in the intersecting angle of the outside balustrade (deck board) and the ceiling or soffitt except where the intersection of the outside balustrade (deck board) and the ceiling or soffitt is more than 60 cm from the centre line of the handrail.

The vertical face of the guard shall project at least 36 cm horizontally from the apex of the angle.

The exposed edge of the guard shall be rounded to eliminate shear hazard. Guards may be shatterproof glass.

^{*}Specification for safety glass (revised). (Since revised).

4.4 Handrails

4.4.1 Each balustrade shall be provided with a handrail moving in the same direction and at substantially the same speed as the steps.

4.4.2 Extension Beyond Combplates — Each moving handrail shall extend at normal handrail height not less than 30 cm beyond the line of points of the combplate teeth at the upper and lower landings.

4.4.3 Guards — Hand or finger guards shall be provided at the point where the handrail enters the balustrade.

4.4.4 Distance Between Handrails — The horizontal distance between the centre lines of the two handrails, measured on the incline, shall not exceed the width between the balustrades (see 4.2) by more than 15 cm, with a maximum of 7.5 cm on either side of the escalator (see Fig. 1).



4.5 Steps Treads

4.5.1 Material and Type — Step frames shall be made of incombustible material. Step treads shall be horizontal and made of incombustible material and shall afford a secure foothold.

4.5.2 Dimensions of Steps — The depth of any step tread in the direction of travel shall be not less than 40 cm and the rise between treads shall be not more than 22 cm. The width of a step tread shall be not less than 40 cm nor more than 102 cm.

4.5.3 Clearance Between Steps — The maximum clearance between step treads on the horizontal run shall be 4 mm.

4.5.4 Slotting of Step Treads — 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 6.5 mm wide and not less than 9.5 mm deep; and the distance from centre to centre of adjoining slots shall be not more than 9.5 mm.

4.6 Landings

4.6.1 Landings shall be of material and design affording secure foothold.

4.6.2 If the landing is of concrete, it shall have edge insertions of metal, wood or other antislip material.

4.7 Combplates

4.7.1 There shall be a combplate at the entrance and at the exit of every escalator.

4.7.2 Design of Combplates — The combplate teeth shall be meshed with and set into the slots in the tread surface so that the points of the teeth are always below the upper surface of the treads.

Combplates shall be adjustable vertically.

4.8 Trusses or Girders

4.8.1 The truss or girder shall be designed to safely sustain the steps and running gear in operation. In the event of failure of the track system it shall retain the running gear in its guides.

4.8.2 Where tightening devices are operated by means of tension weights, provision shall be made to retain these weights in the truss if they should be released.

4.9 Step Wheel Tracks

4.9.1 Step wheel tracks shall be so designed as to prevent displacement of the steps and running gear if a step chain breaks.

4.10 Rated Load

4.10.1 The rated load in kilograms on an escalator shall be computed by the following formula:

Rated load =
$$2.7 WA$$

7

where

- W = the width in cm between the balustrades (see 4.2), and
- A = the horizontal distance between the upper and lower combplate teeth in metres.

4.11 The rated speed of the escalator shall not be more than 38 metres per minute.

4.12 Design Factors of Safety

4.12.1 The factors of safety, based on the static loads, shall be at least the following:

- a) For trusses and all structural members including tracks-five (5);
- b) For driving machine parts:
 - 1) where made of steel or bronze eight (8);
 - 2) where made of cast iron or other materials ten (10);
- c) For power-transmission members ten (10).

Step chains composed of cast-steel links which, if thoroughly annealed, shall be permitted with a factor of safety of at least twenty (20).

5. DRIVING MACHINE, MOTOR AND BRAKE

5.1 Connection Between Driving Machine and Main Drive Shaft — The driving machine shall be connected to the main drive shaft by toothed gearing, a coupling, or a chain.

5.2 Driving Motor — An electric motor shall not drive more than one escalator.

5.3 Brake — Each escalator shall be provided with an electrically released, mechanically applied brake capable of stopping the up or down travelling escalator with any load up to rated load. This brake shall be located either on the driving machine or on the main drive shaft.

Where a chain is used to connect the driving machine to the main drive shaft, a brake shall be provided on this shaft. It is not required that this brake be of the electrically released type if an electrically released brake is provided on the driving machine.

6. OPERATING AND SAFETY DEVICES

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6.0 Operating and safety devices shall be provided conforming to the following requirements.

6.1 Starting Switch — Starting switches shall be of the key-operated type and shall be located within sight of the escalator steps.

6.1.1 Where starting pushes or switches are within reach of the public they shall be either of the key-operated type or be enclosed in a box provided with a lock and key.

6.2 Emergency Stop Buttons — Emergency stop buttons or other type of manually operated switches having red buttons or handles and conspicuously marked STOP PUSH or STOP SWITCH shall be accessibly located at or near the top and bottom landings of each escalator, and shall be protected against accidental operation. An escalator stop button with an unlocked cover over which it can readily be lifted or pushed aside shall be considered accessible. The operation of either of these buttons or switches shall interrupt the power to the driving machine. It shall not be possible to start the driving machine by these buttons or switches.

6.3 Speed Governor — A speed governor shall be provided, the operation of which shall cause the interruption of power to the driving machine should the speed of the steps exceed a predetermined value which shall be not more than 40 percent above the rated speed.

EXCEPTION: The overspeed governor is not required where a low slip alternating current squirrel cage induction motor is used and the motor is directly connected to the driving machine.

6.4 Broken Step-Chain Device — A broken step-chain device shall be provided which shall cause the interruption of power to the driving machine if a step-chain breaks, and, where no automatic chain tension device is provided, if excessive sag occurs in either step-chain.

6.5 Broken Drive-Chain Device — Where the driving machine is connected to the main drive shaft by a chain, a device shall be provided to cause the application of the brake on the main drive shaft if the drive-chain parts.

6.6 Stop Switch in Machinery Spaces — A stop switch shall be provided in each machinery space where means of access to the space is provided. This switch, when opened, shall cause electric power to be removed from the escalator driving machine motor and brake. The stop switches shall be:

- a) of the manually opened and closed type;
- b) conspicuously and permanently marked, 'STOP'; and
- c) positively opened mechanically and their opening shall not be solely dependent on springs.

6.7 Application of an Electrically Released Brake — An electrically released brake shall automatically stop the escalator when any of the safety devices required by 6.2 to 6.5 function.

7. MACHINE ROOM

7.1 A machine room of suitable size and construction shall be provided for the housing of the escalator machine or machines, and associated apparatus and equipment.

7.2 Construction — The machine room shall be of sound construction, weather-proof and dry and shall be properly ventilated to prevent any undue rise in temperature inside the room. Where necessary means shall also be provided to maintain a reasonable temperature in the machine room. The floors of the machine rooms shall be capable of carrying the load of the escalator machinery and other equipment housed therein.

7.3 Access

7.3.1 The machine room shall be arranged to allow reasonable access to and the removal of the equipments therein or of any part thereof. The height of the machine room shall be sufficient to allow any part of the equipment to be accessible and removable for repairs and replacement.

7.3.2 Safe and convenient access to machine room entrances shall be provided with access doors opening outwards.

7.4 The machine room shall not be used as store room or for any other purpose other than housing the escalator machine and associated apparatus and equipment. No inflammable or explosive material shall be kept in machine room.

8. LIGHTING, ACCESS AND ELECTRICAL WORK

8.1 Lighting of Machine Room — The machine room shall be provided with permanent and adequate artificial lighting of an approved type and whenever available electric lighting shall be provided by at least one fixed light point and one plug socket for every two or less machines. The light switch shall be fixed near the machine room entrance. The lighting switch shall be so located that it can be operated without passing over or reaching over any part of the machinery.

8.2 Lighting of Step Treads — Step treads shall be illuminated throughout their run. The light intensity on the tread surfaces shall be not less than 20 lux.

NOTE — It is desirable that the illumination be of uniform intensity and that it should not contrast materially with that of the surrounding area.

8.3 Electrical Wiring and Apparatus

8.3.1 All electrical wiring and apparatus in connection with the escalator installation, shall conform to the Indian Electricity Rules and to the relevant Indian Standard and also to other regulations, if any, relating to fire insurance of the building in which the escalator is installed.

8.3.2 All cables and other wiring in connection with the escalator installation shall conform to the relevant Indian Standard for the voltage at which these are intended to be worked and if metallic covering is used it shall be efficiently earthed. **8.3.3** No bare conductor shall be used in any escalator as may cause danger to persons.

8.3.4 Electrical conductors shall be encased in rigid conduits, electrical tubings or wireways which shall be securely fastened to the supporting structure.

8.3.5 All electric supply lines and apparatus in the escalator shall be of suitable construction and shall be so installed, protected, worked and maintained that there is no danger to persons from them.

8.3.5.1 All metal casings or metallic coverings containing or protecting any electric supply line or apparatus shall be efficiently connected with earth.

8.3.6 Disconnect Switch — An enclosed, fused disconnect switch or a circuit breaker shall be installed and shall be connected into the power supply line to the driving machine motor. Disconnect switches or circuit breakers shall be of the manually closed multi-pole type. The switch shall be so placed that it is close to and visible from the escalator machine to which the supply is controlled.

8.3.6.1 With dc power supplies the main disconnecting switch and any circuit breaker shall be so arranged and connected that the circuit of brake magnet coil is opened at the same time that the main circuit is opened.

8.3.7 Enclosure of Electrical Parts — All electric safety switches and controllers shall be enclosed to protect against accidental contact.

8.3.8 Caution Notice — Suitable 'CAUTION' notice shall be affixed near every motor or other apparatus in which energy is used at a pressure exceeding 250 volts.

8.3.9 Insulation — The electrical parts of starting and stopping devices, other operating and similar devices, controllers and similar other parts shall be efficiently insulated and the insulation shall be capable of withstanding for a period of one minute, the continuous application of a test voltage of alternating current equal to ten times the voltage at which these electrical parts are energised, subject to a maximum voltage of 2 000 volts when the test voltage is applied between contacts or similar parts in the open position, and between such contacts and earthed parts.

8.3.10 Voltage Limitations — under consideration.

8.4 Access to Interior — Reasonable access to the interior of the escalator shall be provided for inspection and maintenance.

9. ADDITIONAL PRECAUTIONS AND REQUIREMENTS

9.1 The escalator machine room shall be provided with a suitable fireextinguisher.

9.2 Explosive or other inflammable materials shall not be carried in the escalator as may endanger the safety of persons.

9.3 Where an escalator is under examination or repairs suitable steps shall be taken to ensure that the escalator is not operated inadvertently by any person in such a manner which may endanger the safety of persons working in the escalator.

9.4 Escalator Pit Pans — Escalator pit pans should be periodically cleaned of oil and refuse. The frequency of cleaning will depend on the service, but should be such as to reduce to a minimum the hazard resulting from accidental or spontaneous ignition.

9.5 Lubrication — All parts of the machinery and equipment requiring lubrication should be lubricated at regular periodic intervals with lubricants of a grade as recommended by the manufacturer. The use of excessive amounts of lubricant should be avoided.

10. PROTECTION OF TRUSSES AND MACHINE SPACES AGAINST FIRE

10.1 Protection Required — The sides and undersides of escalator trusses and machinery spaces shall be enclosed in fire-resistive materials. Means may be provided for adequate ventilation of the driving and driven machine and control spaces.

11. PROTECTION OF FLOOR OPENINGS

11.1 Protection Required — Floor openings for escalators shall be protected against the passage of flame, smoke or gases in the event of fire.

11.2 Escalators Accredited as a Required Means of Egress — Escalators accredited as a required means of egress shall be fully enclosed in accordance with the requirements of local laws and ordinances pertaining to interior stairways.

11.3 Escalator Not Accredited as a Required Means of Egress — Escalators not accredited as a required means of egress shall have the floor openings protected by any one of the following generally recognized methods or by other methods which may be established as adequate by competent agencies:

- a) Full enclosures as specified in 11.2;
- b) Sprinkler method (only where the building area is fully protected by a supervised automatic sprinkler system) consisting of individually operating sprinklers so spaced as to protect the exposed sides of the opening. A heat apron shall be provided to bank heat around the sprinkler heads adjacent to the opening. The lower

edge of the apron shall be not less than 15 cm below the bottom of the sprinkler heads (see also IS: 1648 - 1961*);

- c) Kiosks;
- d) Automatic rolling shutters [see IS: 3614 (Part I) 1966[†]]; or
- e) Spray nozzles (only where building area is fully protected by a supervised automatic sprinkler system).

12. TESTS

12.1 Site Tests of Escalators

12.1.1 Each type and size of escalator shall be tested for the rated load that it is designed to carry. Such tests may be made, at the option of the manufacturer, in his plant or in the field on the first escalator of that type and size installed in a building.

Where a type and size of escalator has previously been tested and approved in one jurisdiction, certified copies of such test may be accepted in lieu of an actual test at the option of the enforcing authority.

12.1.2 If the rise for a given type and width to be installed is more than 1.5 metres higher than the rise for which that type and width has been tested, a new type test shall be made for the higher rise.

12.1.3 Escalator operating and safety devices required shall be tested with no-load on the escalator in accordance with the following:

- a) Speed Governor Test Where a speed governor is required by 6.3, the governor shall be tested by operating it by hand.
- b) Broken Step-Chain Device Operation of the broken step-chain device, required by 6.4, shall be tested by operating the actuating device by hand.
- c) Broken Drive-Chain Device Operation of the broken drive-chain device required by 6.5, where a drive chain is used, shall be tested by operating the actuating device by hand.
- d) Stop Buttons The emergency stop buttons, required by 6.2, shall be tested by operating them when the escalator is operated in each direction of travel.

[•]Code of practice for fire safety of buildings (general): Fire fighting equipment and its maintenance including construction and installation of fireproof doors.

[†]Specification for fire-check doors : Part I Plate, metal covered and rolling type.