

Regulations PS 45.0 – Staircases, Handrails, Ladders & Balconies

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Regulation PS-45.0: Staircases, Handrails, Ladders & Balconies

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45.1 Staircases

- 45.1.1 All the building types that has more than one floor, and whose floor area below 450 square meter or 1400 square meter for the total floor area, shall provide a minimum of one main staircase. Regarding every additional area, from 450 to 950 square meters per floor or from 1400 to 2800 square meter per floor, an additional staircase shall be provided.
- 45.1.2 The clear width of the stair landing shall not be less than the clear width of the stair, and shall not be less than 1.10 meter for the residential and office buildings, and 1.5 meter for the public buildings. The minimum clear vertical height from the bottom margin of the landing structure to the pedestrian passageway shall be 2.4 meter.
- 45.1.3 The maximum number of steps in one single staircase or in one direction shall be less 14 steps. All the steps shall be identical in height and width.
- 45.1.4 Normal staircase is $2R+T = 0.6m$, R= riser and T= tread,
1. maximum R shall be 0.19 meter
 2. minimum T shall be 0.25 meter
- 45.1.5 The minimum door inward swinging clearance shall be 0.9 meter from first step.
- 45.1.6 Head room over stairs and landings should not be less than 2000mm measured vertically above the pitch line. Additionally, there should be a



minimum clearance measured at right angles to the pitch line of at least 1500 mm.

- 45.1.7 A single step is likely to cause a trip and should not be placed across a circulation route. If a single step is used, it should be well lit and be prominently marked by contrasting Colour.
- 45.1.8 Stairs and landings should be provided with protection against falling over the edge of the treads. Guarding height should be no less than 900 mm above the pitch line of the stairs and not less than 1100mm above landings, with the maximum clearance among the vertical rods of the stair railing shall be 0.125 meter.
- 45.1.9 In addition to guarding, every step with two or more rises should have a continuous handrail to provide guidance and support to those using the stair. Handrails are required to be beside the bottom two steps in a stairway if the stairway is in a public building or is intended for use by disabled people. Handrails should help an individual to regain balance in the event of a fall, and thus reduce the severity of injuries that may result.
- 45.1.10 Treads and landings should have a surface (including the nosing) that does not become slippery in use. Slip resistant strips or inserts should be



fitted, they should be fitted as close as possible to the leading edge of the tread and should be of contrasting Colour or brightness.

- 45.1.11 Adequate artificial lighting should be provided on staircase, users should be able to distinguish clearly each step, especially the first and last steps in each flight and wherever changes in direction occur. Two way switching should be provided at the top and bottom of stairs at each floor.

45.2 Handrails

Handrails should be:

- A. rigid and strong enough to provide adequate support for users
- B. Comfortable to grip and without sharp projections yet able to provide adequate resistance to hand slippage
- C. A poor conductor of heat if exposure to heat is likely.
- D. Stairs and landings should be provided with protection against falling over the edge of the treads. Guarding height should be no less than 900 mm above the pitch line of the stairs and not less than 1100mm above landings, with the maximum clearance among the vertical rods of the stair railing shall be 0.125 meter. Handrails should be provided on both sides of the stairwell. Where people





are likely to be ascending and descending the stair at the same time, e.g., on stairs with a width of 1000mm or more, it is essential to have a handrail on both sides.

- E. Where public or assembly stairs have a stair width greater than 1800mm, the stair width should be divided by handrails into two or more channels so that all persons using the stair are within reach of a handrail.

45.3 Ladders

45.3.1 General Design Considerations

- 45.3.1.1 The minimum design live load shall be a single concentrated load of 200 pounds.
- 45.3.1.2 The number and position of additional concentrated live-load units of 200 pounds each as determined from anticipated usage of the ladder shall be considered in the design.
- 45.3.1.3 The live loads imposed by persons occupying the ladder shall be considered to be concentrated at such points as will cause the maximum stress in the structural member being considered.
- 45.3.1.4 The weight of the ladder and attached appurtenances together with the live load shall be considered in the design of rails and fastenings.



- 45.3.1.5 Metal ladders and appurtenances shall be painted or otherwise treated to resist corrosion and rusting when location demands. Ladders formed by individual metal rungs imbedded in concrete, which serve as access to pits and to other areas under floors, are frequently located in an atmosphere that causes corrosion and rusting. To increase rung life in such atmosphere, individual metal rungs shall have a minimum diameter of 1 inch or shall be painted or otherwise treated to resist corrosion and rusting.
- 45.3.1.6 When different types of materials are used in the construction of a ladder, the materials used shall be so treated as to have no deleterious effect one upon the other.
- 45.3.1.7 The distance from the centreline of rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be not less than 7 inches, except that when unavoidable obstructions are encountered.
- 45.3.1.8 The distance from the centreline of the grab bar to the nearest permanent object in back of the grab bars shall be not less than 4 inches. Grab bars shall not protrude on the climbing side beyond the rungs of the ladder which they serve.

45.3.2 Rungs, Cleats, Strings, landings

- 45.3.2.1 All rungs shall have a minimum diameter of three-fourths inch for metal ladders, and a minimum diameter of 1 1/8 inches for wood ladders.
- 45.3.2.2 The distance between rungs, cleats, and steps shall not exceed 12 inches and shall be uniform throughout the length of the ladder.
- 45.3.2.3 Rungs, cleats, and steps shall be free of splinters, sharp edges, burrs, or projections which may be a hazard.
- 45.3.2.4 Rungs should be designed to withstand a concentrated load of 1.5 kN placed in any position and should be fixed securely.
- 45.3.2.5 The rungs of an individual-rung ladder shall be so designed that the foot cannot slide off the end.
- 45.3.2.6 The top rung of a ladder should be replaced at the same level as the floor or platform to which access is provided.
- 45.3.2.7 The step-across distance from the nearest edge of ladder to the nearest edge of equipment or structure shall be not more than 12 inches, or less than 2 1/2 inches.



45.3.2.8 Strings should be robust enough to minimize flexing of the ladder and should be supported from the structure at adequate intervals.

45.3.2.9 Handrails which may be an extension of the string, should extend upwards at the same angle as the ladder to a height of not less than 1100 mm above the upper platform and be securely fastened at their extremities.

45.3.2.10 Above platform level the clear width between strings should be less than 600 mm and not more than 700 mm.

45.3.2.11 It is essential to make all rises in a flight uniform and the top surface the top rung should be level with the platform or landing. The minimum rise should be 225 mm and the maximum rise should be 255 mm.

45.3.2.12 Landings should not be less than 850 mm square and should have toe plates and handrails around all open sides. Toe plates should be provided around all open sides of platform and walkways and beneath the first step of any open riser **stair**.



45.3.3 General Requirements:

- 45.3.3.1 Fixed ladders should have equal rises in successive flights wherever practicable.
- 45.3.3.2 Access points to the head ladders from platforms and walkways should be protected by self closing gates.
- 45.3.3.3 No part of the ladder should project onto the passageway.
- 45.3.3.4 When ladders are used to ascend to heights exceeding 20 feet (except on chimneys), landing platforms shall be provided for each 30 feet of height or fraction thereof, except that, where no cage, well, or ladder safety device is provided, landing platforms shall be provided for each 20 feet of height or fraction thereof.
- 45.3.3.5 Each ladder section shall be offset from adjacent sections. Where installation conditions (even for a short, unbroken length) require that adjacent sections be offset, landing platforms shall be provided at each offset.
- 45.3.3.6 Where a man has to step a distance greater than 12 inches from the centerline of the rung of a ladder to the nearest edge of structure or equipment, a landing platform shall be provided.
- 45.3.3.7 The minimum step-across distance shall be 2 1/2 inches.



- 45.3.3.8 All landing platforms shall be equipped with standard railings and toe-boards, so arranged as to give safe access to the ladder. Platforms shall be not less than 24 inches in width and 30 inches in length.
- 45.3.3.9 There should be not less than two rails in the same vertical plane, the lower rail being positioned midway between the top rail and the platform / stair pitch line or the top of the toe plate.
- 45.3.3.10 Handrails should be continuous and follow the line of the nosing. Side rails which might be used as a climbing aid shall be of such cross sections as to afford adequate gripping surface without sharp edges, splinters, or burrs.
- 45.3.3.11 To avoid injury or damage, rails should terminate in a returned end, either to the wall or to the knee-rail, or return to the newel post.
- 45.3.3.12 Potentially hazardous areas, such as the gap in handrails at the head of a ladder, should be protected by a self-closing gate, which should gently close but securely and should be designed to swing only into the landing.



45.3.3.13 Hold open devices should never be fitted. Adequate means shall be employed to protect dissimilar metals from electrolytic action when such metals are joined.

45.3.3.14 All ladders shall be maintained in a safe condition.

45.3.3.15 All ladders shall be inspected regularly, with the intervals between inspections being determined by use and exposure.

45.3.4 Cages

45.3.4.1 If a user could fall from more than 3 meters or come into contact with dangerous equipment, the ladders should be fitted with safety equipment (cage).

45.3.4.2 Cages should be constructed of components robust enough to minimize flexing.

45.3.4.3 The hoops of any safety cage should be placed at equal intervals not more than 900 mm apart.

45.3.4.4 The top hoop should be in line with the top guard rail on the platform.

45.3.4.5 Cages shall extend a minimum of 42 inches above the top of landing, unless other acceptable protection is provided.



- 45.3.4.6 Cages shall extend down the ladder to a point not less than 7 feet nor more than 8 feet above the base of the ladder, with bottom flared not less than 4 inches, or portion of cage opposite ladder shall be carried to the base.
- 45.3.4.7 Cages shall not extend less than 27 nor more than 28 inches from the centerline of the rungs of the ladder.
- 45.3.4.8 Cage shall not be less than 27 inches in width. The inside shall be clear of projections. Vertical bars shall be located at a maximum spacing of 40 degrees around the circumference of the cage; this will give a maximum spacing of approximately 9 1/2 inches, centre to centre.

45.4 Balconies

45.4.1 Balcony- Railings/ balustrades/ Parapet wall

- 45.4.1.1 These regulations and guidelines shall cover Balconies,
- 45.4.1.2 The top of the railing must at least 1.1 meter (1100mm) from the ground/ finished floor level.
(Up stand near the railings will be considered as the finished floor level.



45.4.1.3 Any opening must not permit a 100mm sphere to pass through it. So the vertical balusters must not be more than 100 mm.

45.4.1.4 For balcony floors more than 4meters off the surface there must not be any horizontal or near horizontal elements 760mm above the floor that facilitate climbing.

45.4.2 Windows:

As an additional safety requirement for windows, child resistant safety catch that limits the opening to less than 100 mm should be fitted to all windows above first floor level. Any restrictor fitted should be capable of being opened in case of fire, via a child resistant catch. Key operated catches should therefore be avoided.