Designation: E985 – 24

Standard Specification for Permanent Metal Railing Systems and Rails for Buildings[1]

This standard is issued under the fixed designation E985; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification[2] covers permanent metal railing systems (guard, stair, and ramp-rail systems) and rails (hand, wall, grab, and transfer rails) installed in and for agricultural, assembly, commercial, educational, industrial, institutional, recreational, and residential buildings. However, this standard does not cover metal railing systems installed in and for industrial, commercial, and other non-residential workplace occupancies where normally only adults will be present or have access, and for which guardrail or handrail requirements are specified by occupational safety and health safety regulations and standards. This standard does not cover ballasted railing systems.

1.2 This specification is intended to be applied to permanent metal railing systems for buildings and to such railing systems and rails having major structural components made of metal, with their secondary components made of metal or other materials such as wood, plastics, and glass.

1.3 This specification considers that today's and tomorrow's overall outlook is based on the health and safety of all potential users of buildings. The criteria incorporated in this specification provide for normal and anticipated building uses, but not for abuses for which the building and its components are not designed.

1.4 This specification establishes basic minimum requirements and criteria that lead to satisfactory products under normal use conditions and does not give consideration to design criteria for specific field conditions, the establishment of which is the prerogative and responsibility of the designer, specification writer, and code agencies.

1.5 Sources of supportive information are listed in the Reference section (**1-28**).[3]

1.6 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[4]

E631 Terminology of Building Constructions

E894 Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings

E935 Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings

E1481 Terminology of Railing Systems and Rails for Buildings

3. Terminology

3.1 *Definitions*—For definitions of terms covering railing systems and rails for buildings, see Terminology E631 and Terminology E1481.

4. Design Requirements

4.1 *Railing Height:*

4.1.1 *Guardrail Systems:*

4.1.1.1 The fabricated height of a guardrail system, measured from its top surface to the finished floor level, shall be a minimum of 1.07 m (42 in.). When variations in the evenness of the finished floor will result in individual height measurements of the installed guardrail system to be less than 1.04 m

[1] This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.56 on Performance of Railing Systems and Glass for Floors and Stairs.

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[2] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:E06-1000.

[3] The boldfaced numbers in parentheses refer to the list of references at the end of this specification.

[4] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

(41 in.), the fabricated height of the guardrail system shall be increased accordingly.

4.1.1.2 Within an individual dwelling unit, the required railing height is reduced.

(a) Where the vertical distance between adjacent finished floor levels is less than 1.83 m (72 in.), the height shall be a minimum of 0.81 m (32 in.). When variations in the evenness of the finished floor will result in individual height measurements of the installed guardrail system to be less than 0.79 m (31 in.), the fabricated height of the guardrail system shall be increased accordingly.

(b) Where the vertical distance between adjacent finished floor levels is a minimum of 1.83 m (72 in.), the height shall be a minimum of 0.86 m (34 in.). When variations in the evenness of the finished floor will result in individual height measurements of the installed guardrail system to be less than 0.84 m (33 in.), the fabricated height of the guardrail system shall be increased accordingly.

4.1.1.3 In public assembly, elementary school, and multiple-family occupanies where the vertical distance between stair and adjacent levels is more than 4.1 m (20 ft), the required railing height shall be increased beyond that given in 4.1.1.1.

4.1.1.4 For balconies in public-assembly occupancies, the required railing height in front of the first row of fixed seats shall be reduced to 0.66 m (26 in.) provided adequate safety is established by the designer and approved by the authority having jurisdiction; however, it shall be a minimum of 0.91 m (36 in.) at aisle ends and a minimum of 1.07 m (42 in.) where aisle steps occur.

4.1.2 *Handrails and Stair-Rail Systems:*

4.1.2.1 In corridors, ramps, walkways, and enclosed stairways having a slope of at least 1 in 20, the height of the handrail of the stair-rail systems, measured from its top surface to the finished floor level or tread-nose line, shall be not less than 0.86 m (34 in.) nor more than 0.97 m (38 in.). When a stair-rail system is higher than 0.97 m (38 in.), a separate handrail shall be installed at a height of not less than 0.86 m (34 in.) nor more than 0.97 m (38 in.).

4.1.2.2 Where required and in childcare and educational facilities serving children under the age of 12 years, a second separate handrail shall be permitted to be installed at a mounting height of 24 in. to 28 in. (610 mm to 710 mm). The vertical clearance between the handrails shall be at least 9 in. (230 mm).

4.1.3 *Transfer Rail Systems*—Where transfer rail systems are to be installed, such as in toilets and bathrooms, the required height, measured from its top surface to the finished floor level, shall not be less than 0.76 m (30 in.) nor more than 0.86 m (34 in.).

4.2 *Railing System Penetration:*

4.2.1 The various members of the railing system shall be arranged such that a sphere, 140 mm (5½ in.) in diameter, cannot be passed through any opening in the system except as noted in 4.2.2. The members shall be arranged to discourage climbing.

4.2.2 In areas protected by a railing system where children five years of age or less will be present or have access and require protection from passing through the railing system, the various members of the railing system, such as balusters, screens, wire mesh, or scrolls, shall be arranged in such a way that a sphere, 102 mm (4 in.) in diameter cannot be passed through any opening in the system up to a height of 0.66 m (26 in.) above the top surface of the adjacent finished floor.

4.2.3 In industrial, commercial, and other nonresidential occupancies, where only adults normally will be present or have access, and in areas where access by the users is infrequent, the diameter of the sphere may be increased to 533 mm (21 in.) unless other conditions warrant a smaller diameter.

4.2.4 Toe boards shall be provided in areas where tools and other objects could be dislodged and fall on occupants below. The top of the toe board shall not be less than 102 mm (4 in.) and the bottom not more than 13 mm (½ in.) above the average finished level at the line of the vertical supports of the railing system.

4.3 *Handrail Design:*

4.3.1 Handrails shall be designed to permit continuous sliding of hands. The hardware chosen for attaching handrails to balusters or walls shall be such that projecting lugs, devices, or other construction elements shall have no sharp edges or dangerous protrusions.

4.3.2 Handrail ends shall be returned to supporting walls or otherwise arranged to avoid projecting rail ends. Wall handrails at stairs and ramps and other handrails that are not continuous shall be extended horizontally for a distance of at least 305 mm (12 in.) beyond the intersection of the finish line (plane of thread nose lines) of the stair or ramp and the landings, unless interference limits such an extension.

4.3.3 The clearance between the handrail and the mounting surface or any protrusions from this surface shall be 38 mm (1½ in.). The handrail shall project no more than 89 mm (3½ in.) into the required minimum egress width. The vertical clearance in a recess shall be in accordance with the provision in 4.4.5.

4.3.4 The hand-grip portion of the handrail shall be not less than 32 mm (1¼ in.) nor more than 51 mm (2 in.) in outside diameter.

4.4 *Transfer Rail Design:*

4.4.1 Transfer rails shall be designed to permit continuous sliding of the arm and hand supporting the body weight during transfer. The hardware chosen for attaching the transfer rails shall be such that projecting lugs, devices, or other construction elements shall not interrupt the continuous sliding of arm or hand or catch loose clothing. The transfer rails, including their fasteners, shall have no sharp edges or dangerous protrusions. The transfer rail top surface shall not be abrasive.

4.4.2 Transfer rails shall be returned to supporting walls or otherwise arranged to avoid projecting rail ends.

4.4.3 The clearance between the face of the transfer rail and that of the mounting surface or any protrusions from this surface shall be 38 mm (1½ in.).

4.4.4 The hand-grip portion of the transfer rail shall have a perimeter of not less than 102 mm (4 in.) nor more than 165 mm (6½ in.), and a maximum to minimum cross-sectional dimension ratio of not more than two.