



Designation: E935 – 21

# Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings<sup>1</sup>

This standard is issued under the fixed designation E935; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 These test methods cover procedures to be followed in testing the performance of permanent metal railing systems (guard, stair, and ramp-rail systems), including components such as rails (hand, wall, grab, and transfer rails) and swing gates or other forms of required guardrail opening protection, installed in and for agricultural, assembly, commercial, educational, industrial, institutional, recreational, and residential buildings and other structures, such as towers or elevated platforms.

1.2 These test methods are applicable to such railing systems and rails having major structural components made of metal, with their secondary components, including swing gates or other forms of guardrail opening protection, made of metal or other materials such as wood, plastic, and glass.

1.3 These test methods can be used to determine whether permanent metal railing systems and rails,<sup>2</sup> including components, comply with requirements of the applicable performance specifications, such as building codes, or performance standards such as those described in Specification E985, ANSI/ASSE A1264.1, and OSHA 1910.23.

1.4 Specifically, these test methods cover procedures for determining the static strength of metal railing systems, rails and components as structural elements when installed and fastened to concrete, masonry, wood, and metal, as well as related products.

1.5 No consideration is given in these test methods to any possible deterioration of metal railing systems, rails, and connections, resulting from adverse environmental conditions. The performance of special tests covering this aspect may be desirable.

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee E06 on Performance of Buildings and are the direct responsibility of Subcommittee E06.56 on Performance of Railing Systems and Glass for Floors and Stairs.

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<sup>2</sup> “Field Testing Device for Railing Systems and Rails,” *Journal of Testing and Evaluation*, Vol. 16, No. 6, ID JTE11274J, Online, Available: <http://www.astm.org>, 01 November 1988.

1.6 These test methods are limited to the application of the loads described herein.

1.7 Should computations make it possible to provide the needed information, testing can be employed for verification.

1.8 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.9 *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. For specific hazard statements, see 11.2.*

1.10 *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:*<sup>3</sup>

E4 Practices for Force Calibration and Verification of Testing Machines

E575 Practice for Reporting Data from Structural Tests of Building Constructions, Elements, Connections, and Assemblies

E631 Terminology of Building Constructions

E985 Specification for Permanent Metal Railing Systems and Rails for Buildings (Withdrawn 2015)<sup>4</sup>

E1481 Terminology of Railing Systems and Rails for Buildings

<sup>3</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

<sup>4</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

## 2.2 Other Standards:

**ANSI/ASSE A1264.1 Safety Requirements for Workplace Walking/Working Surfaces and Their Access**<sup>5</sup>  
**OSHA 1910.23 Guarding floor and wall openings and holes**<sup>6</sup>

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in these test methods, see Terminology **E631** and Terminology **E1481**.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *failure*—the loss of load carrying capacity or the inability to meet the required load carrying capacity specified in the applicable performance standard, depending on the purpose of the test.

3.2.2 *guardrail opening protection*—swing gates or other form of barrier to prevent unintended egress or fall through guardrail openings.

## 4. Significance and Use

4.1 These test methods are intended to provide information from which applicable design and performance data can be derived for the performance of metal railing systems and rails installed and fastened to structural elements of concrete, masonry, wood, and metal as well as related products.

4.2 These test methods may be used to determine whether railing systems comply with requirements of the applicable performance specifications.

4.3 These test methods are intended for use in the buying and selling of railing systems and components according to performance specifications, for use in product development research, for use in quality assurance and manufacturing process control, for use in developing performance standards, and for use in field and laboratory compliance determination. Typical floor-mounted railings are shown in **Fig. 1**.

## 5. Apparatus

5.1 *Testing Machine*—Any testing machine or loading device, capable of imposing forces accurate to within  $\pm 1\%$  when calibrated in accordance with Practices **E4**, is suitable and may be used provided the requirements of specified rate of loading are met. The testing device shall be of sufficient capacity to prevent yielding of its various components and shall insure that the applied load remains essentially parallel to the relevant axis of the assembly during testing.

5.2 *Test System*—Attach the loading device to the assembly by means of pins or a swivel connector to prevent the direct transfer of any flexural forces through the connection. Load contact points against the test specimen shall be a maximum width of 2 in. (51 mm), unless otherwise specified by the applicable performance specification or required for the purpose of the test and applied such that the centerline of the load contact point is located at the position indicated by the test method.

<sup>5</sup> Available from American Society of Safety Engineers (ASSE), 520 N. Northwest Hwy., Park Ridge, IL 60068, <http://www.asse.org>.

<sup>6</sup> Available from Occupational Safety and Health Administration (OSHA), 200 Constitution Ave., Washington, DC 20210, <http://www.osha.gov/law-regs.html>.

5.3 *Deflection Measurements*—Unless otherwise specified by the applicable performance specification, dial gages, having a smallest division of not more than 0.01 in. (0.25 mm), or any suitable measurement devices or calibrated sensors of at least comparable accuracy and sensitivity shall be used to measure the horizontal displacements of the top of the railing system or rail relative to its original location at each loading point prior to load application. These devices shall have sufficient measurement capability to indicate the displacement throughout the test range.

## 6. Test Selection

6.1 The only tests that need to be performed are those that are necessary to provide information required by the requesting party, testing agency, and regulatory body involved or those that are specified by, or otherwise required to provide information related to, applicable performance specifications.

## 7. Installation

7.1 Install the railing system, rail or component being tested in accordance with the manufacturer's or designer's specifications.

## 8. Sampling

8.1 A sampling plan appropriate for the purposes of the test shall be used.

8.1.1 If a sampling plan is specified by the applicable performance specification, that plan shall be used for compliance testing.

## 9. Test Specimens

9.1 *Specimen Definition*—The guard and handrail test specimen shall be defined as two vertical posts at maximum center-to-center spacing, and all components, and all connections used in the guard and handrail system, including the vertical post bases.

9.1.1 A guardrail opening protection specimen such as a swing gate shall be defined as a single example of the guardrail opening protection, at maximum span if adjustable, all connections used in attachment to the guardrail system, the two vertical posts that define the opening, and sufficient installation of the guardrail system to permit installation of the guardrail opening protection according to the manufacturer's instructions with adequate structural support by the guardrail system. If the purpose of the test is to determine compliance or performance as installed in a specific field example, the span of the gate should be as in the field installation.

9.2 *Specimen Assembly*—Test specimens may be assembled using the actual post base anchors to be installed to a representative substrate of the completed installation, or test specimens may be assembled using post base anchors consistent with the size and location of anchors to be installed in the completed installation, connected to a rigid support, installed according to the manufacturer's recommendations and as specified by the applicable performance standard or as required for the purposes of the test. If adhesive anchors are used, cure adhesive according to the manufacturer's recommendations to