



Designation: **F1159—14 F1159 – 15**

Standard Practice for Design of Amusement Rides and Devices that are Outside the Purview of Other F24 Design Standards¹

This standard is issued under the fixed designation F1159; 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 practice establishes information and procedures for the design and manufacture of patron directed amusement rides or devices (for example, go karts, bumper cars, bumper boats), artificial climbing walls, dry slides, coin operated rides, and amusement rides and devices that involve the purposeful immersion of the patron's body partially or totally in the water and involve more than incidental patron contact (for example, pools, water slides, lazy rivers, interactive aquatic play devices), and air-supported structures.

1.2 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

[F1193 Practice for Quality, Manufacture, and Construction of Amusement Rides and Devices](#)

[F2291 Practice for Design of Amusement Rides and Devices](#)

[F2374 Practice for Design, Manufacture, Operation, and Maintenance of Inflatable Amusement Devices](#)

2.2 Federal Documents: Document:³

[Dept. of Health, Education, and Welfare Pediatric Growth Development Chart, 1983](#)

[OSHA 29 CFR Fall Protection Systems Criteria and Practices Part 1926.502 \(d\)](#)

[USDA Agricultural Handbook 72, Rev. 0—The Wood Handbook, by the U.S. Dept. of Agricultural Forest Products Laboratory](#)

2.3 Society of Automotive Engineers Standards:⁴

[SAE J 833 Recommended Practice for USA Human Physical Dimensions](#)

[SAE Hydraulic Fluid Standards](#)

[SAE J 10 Pneumatic Storage Tanks](#)

[SAE Pneumatic Tubing Standards](#)

2.4 American Society of Mechanical Engineers Documents:⁵

[ASME Boiler and Pressure Vessel Code, Section VIII, Division 1](#)

[ASME Welding Standards](#)

2.5 American Institute of Steel Construction Document:⁶

[AISC Manual on Steel Construction](#)

2.6 American Welding Society Standard:⁷

[ANSI/AWS D1.1 Structural Welding Code](#)

2.7 National Fire Protection Association Standard:⁸

[National Electrical Code](#)

2.8 ANSI Standard:⁹

[ANSI \(NFPA/JIC\) T2.24.1—1991 Hydraulic Fluid Power Systems Standard for Stationary Industrial Machinery,⁹](#)

¹ This practice is under the jurisdiction of ASTM Committee F24 on Amusement Rides and Devices and is the direct responsibility of Subcommittee F24.24 on Design and Manufacture.

Current edition approved Oct. 1, 2014; Jan. 15, 2015. Published November 2014; February 2015. Originally approved in 1988. Last previous edition approved in 2014 as F1159—H-F1159—14. DOI: 10.1520/F1159-14.10.1520/F1159-15.

² 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.

³ Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

3. Significance and Use

3.1 This practice provides designers and manufacturers of patron directed designers/engineers of amusement rides or devices (for example, go karts, bumper cars, bumper boats), artificial climbing walls, dry slides, coin operated rides, water amusement rides or devices (involve the purposeful immersion of the patron's body partially or totally in the water and involve more than incidental patron contact (for example, pools, water slides, lazy rivers, interactive aquatic play devices)), and air-supported structures and devices not addressed in the other ASTM Committee F24 standards with design references and criteria to use in designing and manufacturing of patron directed amusement rides or devices, artificial climbing walls, dry slides, coin operated rides, purposeful immersion water amusement rides or devices, and air-supported structures. design development.

4. General Design Requirements

4.1 *Design and Calculations*—Basic documentation and engineering analysis shall be in accordance with Practice **F2291**.

4.2 *Drawings and Records*—Records shall be kept in accordance with Practice **F2291**.

4.3 *Testing*—Document and record the testing performance of amusement rides and devices in accordance with the tests given in Practice **F1193**.

DESIGN PROCEDURES

5. Designing in Accordance with Passenger Weights

5.1 The weight assigned to an adult passenger, for design purposes, shall be 170 lb (77 kg) or 12 lb/in. (5.4 kg/25.4 mm) of hip width at the seat, whichever is greater. Reference SAE J 833 on USA Human Physical Dimensions, using the “medium man” for passenger weight.

5.2 The weight assigned to a 12-year-old child passenger, for design purposes, shall be 90 lb (41 kg) or 9 lb/in. (4.1 kg/25.4 mm) of hip width at the seat, whichever is greater. Reference U.S. Department of Health, Education, and Welfare Pediatric Growth Development Chart 1983.

5. Passenger Carrying Devices

5.1 *Design of Seats*—Design passenger seating to provide adequate support padding and containment for the passenger's body during operation, and to be consistent with the design intent of the ride.

5.2 *Methods of Restraint*—Where appropriate, base the passenger restraint on the design intent of the ride or device with consideration given, but not limited to, the height, speed, and forces on passengers.

5.3 *Passenger Clearance*—Design clearance to minimize the opportunity for contact between a contained passenger and any object where said contact is likely to cause injury during operation of a ride or device.

6. Amusement Ride and Device Structures Fastening, Mechanical Systems and Components, Fall Protection, Adhesive Bonding, and Coatings

6.1 *Metal Structures*—Where applicable, design metal structures—Structures shall be designed in accordance with the AISC provisions Manual of Steel Practice **F2291** Construction, as applicable. Section 8.

7.1.1 Allowable loads or stresses as indicated in the AISC *Manual of Steel Construction* shall be reduced as deemed adequate by the manufacturer/designer, to allow for special combinations of conditions which may include, but are not limited to, stress concentrations, shock, dynamics, load cycles, degree of risk, and environment.

7.2 *Timber Structures*—Design timber structures in accordance with USDA Agricultural Handbook 72, Revision 0, *The Wood Handbook*.

7.2.1 Allowable loads or stresses as indicated by the above data shall be reduced as deemed adequate by the manufacturer/designer to allow for special combinations of conditions that may include, but are not limited to, stress concentrations, shock, dynamics, load cycles, degree of risk, and environment.

6.2 *Welding*—Welding and welding procedures shall be in accordance with American Welding Society (ANSI/AWS D1.1) or American Society of Mechanical the provisions of Practice **F2291** Engineers, or other equivalent standards, and be performed by appropriately certified or qualified welders as required by the standard., Section 15.

6.3 *Bolting Specifications—Fasteners*—All threaded fasteners used on an amusement ride or device in connecting components shall meet accepted engineering standards for each application in the system, and grade Fasteners shall de designed in accordance with the provisions of Practice **F2291** shall be identified where appropriate., Section 16.

6.4 *Chain and Wire Rope—Mechanical Systems and Components*—Chain and wire rope used in ride systems shall meet existing industrial ratings considering the loads, conditions, dynamics. Mechanical systems and components shall be designed in accordance with the provisions of Practice **F2291** and potential fatigue involved., Section 13.