



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 of amusement rides and devices and major modifications to amusement rides and devices which the designer/engineer identifies as outside the purview of other ASTM F24 design standards.

1.1.1 Prior to designating an amusement ride or device as outside the purview of other ASTM F24 standards and subject to Practice F1159, the designer/engineer shall perform a review of all standards under the jurisdiction of the ASTM Committee F24 addressing amusement ride and device design and determine that Practice F1159 is appropriate and more applicable to the amusement ride or device than other ASTM Committee F24 practices addressing amusement ride and device design.

1.1.2 In making such a determination, the designer/engineer shall consider the following:

1.1.2.1 The general nature of the amusement ride or device;

1.1.2.2 The absence of relevant specific requirements or features addressed by other ASTM Committee F24 practices.

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

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 Nov. 1, 2015. Published November 2015. Originally approved in 1988. Last previous edition approved in 2015 as F1159 – 15a. DOI: 10.1520/F1159-15B.

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.

2.2 *Federal Document:*³

OSHA 29 CFR Fall Protection Systems Criteria and Practices Part 1926.502 (d)

3. Significance and Use

3.1 This practice provides designers/engineers of amusement rides and devices not addressed in the other ASTM Committee F24 standards with design references and criteria to use in 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. Patron Restraint, Clearance Envelope, and Containment Design Criteria

5.1 For rides and devices having a ride vehicle or passenger carrier, the patron restraint, clearance envelope, and containment design criteria shall be in accordance with Section 6 of Practice **F2291**, to the extent that these requirements are applicable as determined by the ride analysis and patron restraint and containment analysis.

5.2 For devices lacking a ride vehicle or passenger carrier, consideration shall be given to measures that prevent or mitigate injuries potentially caused by collisions as determined by the ride analysis and patron restraint and containment analysis.

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

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

6.1 Structures shall be designed in accordance with the provisions of Practice **F2291**, Section 8.

6.2 *Welding*—Welding and welding procedures shall be in accordance with the provisions of Practice **F2291**, Section 15.

6.3 *Fasteners*—Fasteners shall be designed in accordance with the provisions of Practice **F2291**, Section 16.

6.4 *Mechanical Systems and Components*—Mechanical systems and components shall be designed in accordance with the provisions of Practice **F2291**, Section 13.

6.5 *Fixed Air-Supported Structures*—Where applicable, fixed air-supported structures shall be designed and manufactured with flame-resistant materials that meet or exceed a 2-s flame-out standard.

6.5.1 Fixed air-supported structures shall be designed and operated in accordance with the provisions of Practice **F2374**, subsections 5.4.1, 5.4.2, 6.1.11, 6.1.11.1, and 6.5.6.

6.5.2 Enclosed structures shall have within 100 ft of the normal point of egress adequately lighted emergency exits.

6.5.3 Power failure or failure of an inflation means shall be detected and result in an alarm, shall not result in loss of structural integrity of the inflatable device, and shall not substantially increase the risk of injury to anyone on or in the device.

6.6 *Fall Protection*—The manufacturer of an amusement ride or device shall provide appropriate anchorage points for attachment of personal fall arrest systems that may be used during routine assembly, disassembly, maintenance, and inspection. Personal fall arrest systems shall meet the minimum design requirements specified in OSHA 29 CFR PART 1926.502 (d).

6.7 *Adhesive Bonding*—When adhesive/chemical bonding is used, designer/engineer shall only use in accordance with the manufacturer's instructions and Material Data Safety Sheet.

6.8 *Coatings*—When material coatings are used, designer/engineer shall design for any degradation that may occur due to the environmental conditions.

6.8.1 Designer/engineer shall use material coatings in accordance with the manufacturer's instructions and Material Data Safety Sheet.

7. Electrical Components

7.1 Electrical components shall be designed in accordance with the provisions of Practice **F2291**, Section 12.

8. Hydraulic Components

8.1 Hydraulic components and systems shall be designed in accordance with the provisions of Practice **F2291**, Section 9.

9. Pneumatics

9.1 Pneumatics shall be designed in accordance with the provisions of Practice **F2291**, Section 10.

10. Operator Controls

10.1 Operator controls shall be designed in accordance with the provisions of Practice **F2291**, Section 17.

11. Brakes

11.1 When used, brakes shall be designed in accordance with Practice **F2291**, subsection 13.7.

11.1.1 For the purposes of this practice, Practice **F2291** subsection 13.7 shall not be interpreted to require a Safety Related Control System, or prevent the use of manually operated brakes, nor limit the application of said brakes to operator or patron use.

12. Machine Guards

12.1 Machine guards shall be designed in accordance with the provisions of Practice **F2291**, Subsection 13.5.

13. Fencing for Amusement Rides and Devices Subject to this Standard

13.1 Fences shall be designed in accordance with the provisions of Practice **F2291**, Section 14.

14. Safety Related Control Systems

14.1 Safety related control systems shall be designed in accordance with the provisions of Practice **F2291**, Section 11.

15. Sanitation/Disinfection

15.1 The atmosphere, material composition and configuration of surfaces, the nature of patron contact, potential for biological growth, disinfection techniques and frequencies, and the information in the disinfectant agent(s) associated Material Safety Data Sheets shall all be considered in the ride analysis.

16. Acceleration Limits

16.1 For equipment that meets the passenger containment requirements of Practice **F2291**, amusement rides and devices shall be designed such that ride dynamics are in accordance with Practice **F2291**, subsection 7.1.4.7.

16.2 For equipment that does not meet the passenger containment requirements of Practice **F2291** or does not pertain to the general case of a vehicle with a seating or passenger positioning system, the following subsections in Practice **F2291** are not applicable: 7.1.4, 7.1.5, 7.1.6, and 7.1.7.

16.2.1 For amusement rides and devices that fall into the categories outlined in **16.2**, the ride analysis must include a review by a biodynamic expert.

17. Keywords

17.1 amusement rides and devices; design; manufacture