



Standard Guide for ASTM Standards on Playground Surfacing¹

This standard is issued under the fixed designation F2223; 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 guide covers standards for selecting and specifying surface systems under and around playground equipment.

1.2 This guide describes how to apply existing ASTM standards to evaluate the impact attenuation, accessibility characteristics and product characteristics when selecting surfacing systems for use under and around playground equipment.

1.3 This guide does not imply that an injury cannot be incurred when the surface system complies with standards referred to in this guide.

1.4 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.

1.5 **Warning**—Mercury has been designated by EPA and many state agencies as a hazardous material that can cause central nervous system, kidney, and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury-containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website (<http://www.epa.gov/mercury/faq.htm>) for additional information. Users should be aware that selling mercury or mercury-containing products, or both, in your state may be prohibited by state law.

1.6 *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.*

¹ This guide is under the jurisdiction of ASTM Committee F08 on Sports Equipment and Facilities and is the direct responsibility of Subcommittee F08.63 on Playground Surfacing Systems.

Current edition approved Oct. 1, 2010. Published November 2010. Originally approved in 2003. Last previous edition approved in 2009 as F2223 – 09. DOI: 10.1520/F2223-10.

2. Referenced Documents

2.1 ASTM Standards:²

F963 Consumer Safety Specification for Toy Safety

F1292 Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment

F1487 Consumer Safety Performance Specification for Playground Equipment for Public Use

F1918 Safety Performance Specification for Soft Contained Play Equipment

F1951 Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment

F2075 Specification for Engineered Wood Fiber for Use as a Playground Safety Surface Under and Around Playground Equipment

F2479 Guide for Specification, Purchase, Installation and Maintenance of Poured-In-Place Playground Surfacing

2.2 Canadian Standard:

CSA Z614 Children's Playspaces and Equipment³

2.3 Government Publications:

CPSC (US Consumer Product Safety Commission) Handbook for Public Playground Safety, Pub. No. 325⁴

US Code of Federal Regulations Part 3, 36 CFR Part 1191 Americans with Disabilities Act Accessibility Guidelines: Play Areas: (Final Rule)

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *acceleration*—the time rate of change of velocity.

3.1.2 *critical height*—the maximum height in full feet for a surfacing system that, when tested in accordance with Specification F1292, no value shall exceed 200 g-max or 1000 HIC.

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 Canadian Standards Association (CSA), 178 Rexdale Blvd., Toronto, ON Canada M9W1R3.

⁴ Available from the Consumer Product Safety Commission, Washington, DC 20207, website: www.cpsc.gov.

3.1.3 *deceleration*—the time rate of reduction of velocity.

3.1.4 *drop height*—the distance from which the instrumented headform is released to the surface.

3.1.5 *fall height*—the vertical distance between a designated play surface of the play equipment and the protective surfacing beneath it. In the case of swings, the vertical distance from the pivot point for the swinging element to the protective surface beneath it. The playground standard that has relevant jurisdiction should be consulted with relation to specific play structures.

3.1.6 *g*—acceleration due to gravity at the earth’s surface at sea level (32 ft/s² (9.8 m/s²)).

3.1.7 *g-max*—the multiple of *g* that represents a maximum deceleration experienced during an initial impact.

3.1.8 *headform*—the striking part of testing apparatus.

3.1.9 *head injury criteria (HIC)*—a measure of impact severity that considers the duration over which the most critical section of the deceleration pulse persists as well as the peak level of deceleration.

3.1.10 *impact attenuation*—the ability of a surface to reduce and dissipate the energy of an impacting body.

3.1.11 *impact velocity*—the velocity of a falling body immediately prior to striking the surface.

3.1.12 *loose fill system*—a surface system consisting of small independent, moveable components such as sand, gravel, wood chips, engineered wood fiber, rubber particles, and like materials.

3.1.13 *surface system*—all materials that contribute to the impact absorption of force to minimize the likelihood of a life threatening head injury under and around a piece of playground equipment.

3.1.14 *theoretical drop height*—equates the measured velocity of the headform to a height that would generate the same velocity if the test were performed at sea level and there was no friction to retard the headform during a drop from that height.

3.1.15 *unitary system*—a surface system consisting of one or more components bound together, such as foam composites, urethane/rubber systems such as prefabricated blocks, tiles, or mats or as poured in place, and like materials.

4. Significance and Use

4.1 This guide is to be used to assist the playground owner/operator, specifier, designer, etc., in determining the properties that can be considered with regard to the protective surfacing in the playground. It is the intent to outline the requirements associated with design, installation, and maintenance of the surface. This is not a technical document and technical information must be found in the various standards.

5. Background and Rationale

5.1 Since 1986, ASTM has been involved in the ongoing development and publishing of a standard specification for the impact attenuation of the surface systems installed under and around playground equipment. This is the work of the F08.63 subcommittee on playground surfaces. This subcommittee

consists of a broad spectrum of members including testing laboratory personnel, scientists, engineers, manufacturers, safety experts, and owner/operators of playgrounds.

5.2 In 1986, Subcommittee F08.63 was given the responsibility to respond to the need for a standard for the impact-attenuating surface under and around playground equipment. Specification **F1292** was first published in 1991. Since then, the specification has been revised five times in '93, '94, '95, '96, and '99.

5.3 In 1998, the subcommittee published a provisional standard specification (PS 83) for determination of accessibility for wheelchair access of surface systems under and around playground equipment. The standard was elevated to a full standard (see Specification **F1951**) in 1999.

6. Factors to Consider in the Selection and Specification of Surface Systems

6.1 *Types of Material*—Every surface system is unique in material, formulation, composition, and source of raw materials and should be tested to confirm conformance with the ASTM specifications as identified within this guide (Specifications **F1292**, **F1951**, and **F2075**).

7. Impact Attenuation

7.1 The initial work of Subcommittee F08.63 was especially important since injuries sustained from falls to the surface were determined to be 60 % of all playground injuries.

7.2 There are two measurements considered in the guide. The first is the *g-max* and the second is the HIC or Head Injury Criteria. It should be recognized that serious injuries (for example, long bone injuries and so forth) might occur even though the playground surfacing system meets the requirements of Specification **F1292**. Lower values of *g-max* and HIC signify better performance for impact absorption.

7.3 *The g-max*—The *g-max* is the measurement of the peak deceleration of an instrumented metal headform when it impacts the surface. When the object falls from the same height onto a hard surface such as concrete, the impact duration will be very short and therefore the peak deceleration (*g-max*) will be high, but an impact on a resilient surface that yields and deforms with the force, results in a longer impact and a lower peak deceleration (*g-max*).

7.4 *Head Injury Criteria (HIC)*—A measure of impact severity that considers the duration over which the most critical section of the deceleration pulse persists as well as the peak level of the deceleration.

7.5 *Critical Height*—The maximum height from which the instrumented metal headform, upon impact, yields either a *g-max* that does not exceed 200 *g*'s or HIC exceeding 1000, when tested in accordance with the procedure described in Specification **F1292**. The United States Consumer Product Safety Commission states that “critical height—the fall height below which a life-threatening head injury would not be expected to occur.”

7.5.1 The surfacing material used under and around a particular piece of playground equipment should have a critical