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# Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems<sup>1</sup>

This standard is issued under the fixed designation F2772; 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 This specification establishes levels for athletic performance properties of multi-purpose indoor sports floor ~~systems;~~systems excluding turf and materials specific to running tracks and tennis courts.

1.2 The methods described are applicable in both the laboratory and field unless otherwise stated.

~~1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.~~

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

1.4 *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:*<sup>2</sup>

E303 [Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester](#)

F2117 [Test Method for Vertical Rebound Characteristics of Sports Surface/Ball Systems; Acoustical Measurement](#)

F2157 [Specification for Synthetic Surfaced Running Tracks](#)

F2569 [Test Method for Evaluating the Force Reduction Properties of Surfaces for Athletic Use](#)

2.2 *Other Standards:*<sup>3</sup>

~~EN 12235/C1~~[Determination of Vertical Ball Rebound Behavior](#) EN 13036-4 [Road and Airfield Surface Characteristics. Test Methods. Method for Measurement of Slip/Skid Resistance of a Surface. Part 4: The Pendulum Test.](#)

ISO 48 [Rubber Vulcanized or Thermoplastic—Determination of Hardness \(hardness between 10 IRHD and 100 IRHD\)](#)

ISO 4662 [Rubber Vulcanized or Thermoplastic—Determination of Rebound Resilience](#)

## 3. Terminology

3.1 *Definitions:*

~~3.2 *point-elastic* area-elastic, *adj*—describes sports floors which are only comprised of an elastic layer or layers. (for example, surfaces such as poured urethanes, vinyl or rubber sheet goods).—describes sports floors having a rigid upper layer (for example, wood) supported by resilient components.~~

3.3 *combination-elastic, adj*—describes sports floors having a point elastic upper layer in combination with a rigid structural layer (for example, wood, high-density composites, poured non-resilient materials) and resilient support components (for example, elastic pads, foam blanket, or poured urethane).

~~3.4 *area-elastic* point-elastic, *adj*—describes sports floors having a rigid upper layer (for example, wood) supported by resilient components.—describes sports floors that are only comprised of an elastic layer or layers (for example, surfaces such as poured urethanes, vinyl, or rubber sheet goods).~~

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee F08 on Sports Equipment and Facilities and is the direct responsibility of Subcommittee F08.52 on Miscellaneous Playing Surfaces.

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<sup>2</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>3</sup> Available from <http://www.global.ihc.com/>.~~

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

#### 4. Summary of Test Methods

4.1 *Force Reduction*—Test Method F2569 provides a non-destructive means for evaluating the force reduction properties of the surface in both laboratory and field settings. Force Reduction is a characteristic of sports surfaces indicating the degree of force attenuation provided or caused by the surface in certain movement situations. It is principally related to the give of the surface upon impact. The higher the force reduction, the greater the absorptive effect. The referenced test method is more closely associated with impacts generated by lower extremities, and is not an indication of the ability of the test surface to prevent head trauma.

Classification  
4.1 Compliance with the properties contained in this specification shall be determined based on the values designated in Section 4 of this specification.

4.1.1 The field test shall clearly indicate the average and maximum and minimum values for general comparison to performance of laboratory samples.

4.2 *Force Reduction*—In the case of force reduction, two parameters are required:

4.2.1 *Performance Level*—For laboratory samples, the average performance of all test points shall achieve a level as indicated in Table 1. If no performance level is met, the result stated in the report shall be “No Performance Level Achieved.”

4.2.2 *Uniformity*—Laboratory samples shall be such that the force reduction value of every individual test point falls within a spread of  $\pm 5.0$  percentage points of the average of all test point values. The report shall be marked “Noncompliant” if any individual test point does not meet this requirement.

4.3 *Ball Rebound*—EN 12235/C1 provides a non-destructive means that can be used both in the laboratory and in the field by which to identify the ball rebound height of various balls used for indoor sports activities. Ball Rebound is an optional consideration for certain activities commonly associated with indoor sports surfaces. Ball rebound values on particular surfaces indicate whether those floors provide suitable or desired values in relation to the preferred activity in the sports hall.—In the case of ball rebound, two parameters are required:

4.3.1 *Performance Level*—For laboratory samples, the average performance of all test points shall achieve a minimum of 90 % as indicated in Table 2. If the performance level is not met, the result stated in the report shall be “Performance Level Not Achieved.”

4.3.2 *Uniformity*—Laboratory samples shall be such that the ball rebound value of every individual test point falls within a spread of  $\pm 3.0$  percentage points of the average of all test point values. The report shall be marked “Noncompliant” if any individual test point does not meet this requirement.

4.4 *Vertical Deformation*—In the case of vertical deformation, two parameters are required:

4.4.1 *Performance Level*—For laboratory samples, the average performance of all test points shall achieve a level as indicated in Table 3. If no performance level is met, the result stated in the report shall be “No Performance Level Achieved.”

4.4.2 *Uniformity*—Laboratory samples shall be such that the vertical deformation value of every individual test point falls within a spread of  $\pm 0.03$  in. ( $\pm 0.7$  mm) of the average of all test point values. The report shall be marked “Noncompliant” if any individual test point does not meet this requirement.

4.5 *Surface Finish Effect*—In the case of surface effect, two parameters are required:

4.5.1 *Performance Level*—Laboratory or field testing shall achieve an average value between 80 and 110.

4.5.2 *Uniformity Level*—For laboratory or field testing, individual tests shall vary no more than  $\pm 4$  points from average value.

#### 5. Specimen Preparation

5.1 Testing in the laboratory shall be performed at a temperature of  $23 \pm 2^\circ\text{C}$  ( $73 \pm 4/-3^\circ\text{F}$ ) unless otherwise specified with test sections acclimated to the test temperature for no less than 24h prior to evaluation.

5.2 Field testing shall be conducted in the environmental range associated with the facility on ambient temperature of the surface, and with air temperature and humidity measured 0.76 m  $\pm$  100 mm ( $30 \pm 4$  in.) above the playing surface with all temperature and humidity readings recorded in the test report. It is noted that temperature and humidity can affect the performance characteristics of floor components and the results of on-site testing as compared to results recorded in controlled laboratory conditions. Test reports shall be recorded as ‘Outside Standard Indoor Temperature’ or ‘Humidity,’ or both, when such conditions prevail.

**TABLE 1 Force Reduction Requirements for Laboratory Samples**

	Performance Level Classification				
	1	2	3	4	5
Average	$\geq 10\%$	$\geq 22\%$	$\geq 34\%$	$\geq 46\%$	$\geq 58\%$
Force and Reduction	$\leq 21\%$	$\leq 33\%$	$\leq 45\%$	$\leq 57\%$	
Force Reduction Uniformity	No individual test point result shall differ from the average value by more than $\pm 5.0$ percentage points.				
Force Reduction Uniformity	No individual test point shall differ from the average value by more than $\pm 5.0$ percentage points.				

**TABLE 2 Ball Rebound Requirements for Laboratory Samples**

Performance Level	
Average Ball Rebound	The average rebound height of all test points taken shall be $\geq 90.0\%$ of the average rebound height on concrete.
Ball Rebound Uniformity	No individual test point result shall differ from the average value by more than $\pm 3.0$ percentage points.

**TABLE 3 Vertical Deformation for Laboratory Samples**

	Performance Level Classification		
	Point Elastic	Area Elastic	Combination
Average Vertical Deformation	$< 0.138$ in. $< 3.5$ mm	Class A: $0.071$ - $0.197$ in. ( $1.8$ - $5.0$ mm) (inclusive) Class B: $< 0.071$ in. ( $< 1.8$ mm) (exclusive)	$0.071$ - $0.197$ in. ( $1.8$ - $5.0$ mm) (inclusive) $> 0.020 < 0.079$ in. ( $> 0.5 < 2.0$ mm) (point elastic surface)
Vertical Deformation Uniformity	No individual test point shall differ from the average value by more than $0.03$ in. ( $0.7$ mm).		

5.1 Force Reduction—Test Method F2569 provides a nondestructive means for evaluating the force reduction properties of the surface in both laboratory and field settings. Force reduction is a characteristic of sports surfaces indicating the degree of force attenuation provided or caused by the surface in certain movement situations. It is principally related to the give of the surface upon impact. The higher the force reduction, the greater the absorptive effect. The referenced test method is more closely associated with impacts generated by lower extremities and is not an indication of the ability of the test surface to prevent head trauma.

5.2 Ball Rebound—Test Method F2117 provides a nondestructive means that can be used both in the laboratory and the field by which to identify the ball rebound height of various balls used for indoor sports activities. Ball rebound is an optional consideration for certain activities commonly associated with indoor sports surfaces. Ball rebound values on particular surfaces indicate whether those floors provide suitable or desired values in relation to the preferred activity in the sports hall.

5.3 Vertical Deformation—Test Method F2157 provides a nondestructive means that can be used both in the laboratory and the field by which to identify vertical deformation as the ability of the surface to deform under load. Too high a deformation can affect the safety of the athlete through instability of the foot, while the inability of the surface to deform can cause injuries as a result of impact forces.

5.4 Surface Finish Effect—Test Method E303 provides a nondestructive test for determining the surface finish effect using the British pendulum skid resistance tester. This tester is suited for laboratory and field testing.

## 6. Dimensions, Mass, and Permissible Variations

6.1 Laboratory Test—Test specimens shall be constructed per the system design and include structural elements such as seams and end joints.

6.1.1 Point-elastic floors require test specimens measuring a minimum of ~~1-03.25~~ by ~~1-0m~~ (~~3-25-3.25~~ ft (~~1.0~~ by ~~3-25~~ ft); ~~1.0~~ m). The test specimen shall be placed over a substrate typically required by the manufacturer. Non-free floating floors shall be soundly held to the substrate (for example, double-sided tape).

6.1.2 Combination-elastic floors require test specimens in which the upper elastic surface measures a minimum of ~~1-03.25~~ by ~~1-0m~~ (~~3-25-3.25~~ ft (~~1.0~~ by ~~3-25~~ ft); ~~1.0~~ m) in combination with the lower ~~sub-floors~~subfloor construction ~~which that~~ measures a minimum of ~~3-511.5~~ by ~~3-5m~~ (~~11-5-11.5~~ ft (~~3.5~~ by ~~11-5~~ ft); ~~3.5~~ m). The test specimen shall be placed over a substrate typically required by the manufacturer. Non-free floating upper elastic surfaces shall be attached to the structural layer by typical means according to the manufacturer or soundly held to the structural layer by other suitable methods (for example, double-sided tape). Non-free floating lower sub-floors require attachment to the substrate as per the manufacturer's design.

6.1.3 Area-elastic floors require test specimens measuring a minimum of ~~3-511.5~~ by ~~3-5m~~ (~~11-5-11.5~~ ft (~~3.5~~ by ~~11-5~~ ft); ~~Test 3-5~~ m). The test specimen shall be placed over a substrate typically required by the manufacturer. Non-free floating lower sub-floors require attachment to the substrate as per the manufacturer's design.

6.1.4 Individual testing of the surface finish effect requires test specimens of a minimum 12 by 12 in. (305 by 305 mm).

6.2 Site Test—No minimum size has been established.

## 7. Test Methods

~~7.1 Force Reduction~~—The conditioned specimen shall be tested according to Test Method F2569, using the specimen