

Designation: F1551 – 09 (Reapproved 2017)

Standard Test Methods for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials¹

This standard is issued under the fixed designation F1551; 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 These test methods establish a recommended list from which suitable test methods shall be selected for the identification of physical property characteristics and comparison of the performance properties of synthetic turf systems or components for athletic and recreational uses, or both.

1.2 Some of the test procedures are suitable only for the laboratory characterization of either components or the complete system; others are suitable for tests on installed sports fields; and some tests may be applied in both the laboratory and the field.

1.3 The test procedures included in these test methods apply as a group to the description of synthetic turf playing surfaces.

1.4 Some of the test procedures are specific for components of the synthetic turf system, and others apply to the complete synthetic turf playing surface.

1.5 Reference to the methods for testing the synthetic turf playing surface and its components contained herein should state specifically the particular test or tests desired and not necessarily refer to these test methods as a whole.

1.6 This is a physical property characterization standard, and it shall not be construed as a safety standard.

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

1.8 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.

1.9 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:²
- 2.1.1 Pile Fiber:
- D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D1577 Test Methods for Linear Density of Textile Fibers
- D1907 Test Method for Linear Density of Yarn (Yarn Number) by the Skein Method
- D2256 Test Method for Tensile Properties of Yarns by the Single-Strand Method
- D3218 Specification for Polyolefin Monofilaments
- D7138 Test Method to Determine Melting Temperature of Synthetic Fibers
- 2.1.2 *Fabric*:
- D1335 Test Method for Tuft Bind of Pile Yarn Floor Coverings
- D1776 Practice for Conditioning and Testing Textiles
- D2859 Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials
- D4158 Guide for Abrasion Resistance of Textile Fabrics (Uniform Abrasion)
- D5034 Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)
- D5251 Practice for the Operation of the Tetrapod Walker Drum Tester (Withdrawn 2014)³
- D5793 Test Method for Binding Sites per Unit Length or Width of Pile Yarn Floor Coverings
- D5823 Test Method for Tuft Height of Pile Floor Coverings
- D5848 Test Method for Mass Per Unit Area of Pile Yarn Floor Coverings
- E648 Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy SourceF1015 Test Method for Relative Abrasiveness of Synthetic

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

¹ These test methods are under the jurisdiction of ASTM Committee F08 on Sports Equipment, Playing Surfaces, and Facilities and are the direct responsibility of Subcommittee F08.65 on Artificial Turf Surfaces and Systems.

Current edition approved Dec. 1, 2017. Published December 2017. Originally approved in 1994. Last previous edition approved in 2009 as F1551-09. DOI: 10.1520/F1551-09R17.

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 The last approved version of this historical standard is referenced on www.astm.org.

∰ F1551 – 09 (2017)

Turf Playing Surfaces

2.1.3 Shock Absorbing Cushion Underlayment:

D395 Test Methods for Rubber Property—Compression Set

- D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- D624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
- D1667 Specification for Flexible Cellular Materials—Poly (Vinyl Chloride) Foam (Closed-Cell)
- D1876 Test Method for Peel Resistance of Adhesives (T-Peel Test)
- D2126 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
- D3574 Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams
- D3575 Test Methods for Flexible Cellular Materials Made From Olefin Polymers
- D3936 Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Covering
- F355 Test Method for Impact Attenuation of Playing Surface Systems, Other Protective Sport Systems, and Materials Used for Athletics, Recreation and Play

2.1.4 Turf Systems:

- D1667 Specification for Flexible Cellular Materials—Poly (Vinyl Chloride) Foam (Closed-Cell)
- F355 Test Method for Impact Attenuation of Playing Surface Systems, Other Protective Sport Systems, and Materials Used for Athletics, Recreation and Play
- F1015 Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
- F1936 Specification for Impact Attenuation of Turf Playing Systems as Measured in the Field
- F2117 Test Method for Vertical Rebound Characteristics of Sports Surface/Ball Systems; Acoustical Measurement
- F2333 Test Method for Traction Characteristics of the Athletic Shoe-Sports Surface Interface
- 2.1.4 Infill Materials:
- D5644 Test Methods for Rubber Compounding Materials— Determination of Particle Size Distribution of Recycled Vulcanizate Particulate Rubber
- F1632 Test Method for Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sports Field Rootzone Mixes

2.2 Other Standards:

AT-030 Sports Shoe Traction

NOTE 1—AstroTurf[®] Industries internal test procedure is suitable as a basis for new ASTM test methods.

- DIN 18-035 Part 6—Water Permeability of Synthetic Turf Systems and Permeable Bases
- EN 12234 Surfaces for Sports Areas Determination of Ball Roll
- EN 12616 Surfaces for Sports Areas Determination of Infiltration Rate
- EN 14808 Surfaces for Sports Areas- Determination of Force Reduction
- EN 14809 Surfaces for Sports Areas Determination of Vertical Deformation

prEN 15301-1 Surfaces for Sports Areas- Part 1. Determination of Rotational Resistance

3. Terminology

3.1 *Definitions*—Terms are as defined in the referenced ASTM procedures comprising these test methods.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *fabric construction*—the method of assembly of pile ribbon and backing yarns that produces the fabric, usually tufting, knitting, or weaving.

3.2.2 *infilled turf system*—field system having a long pile height and either one or more substances in the face of the fabric to provide the desired playing properties. Infill substances can be either sand, rubber or other substances or a combination of items.

3.2.3 *lengthwise direction*, *n*—*in textiles*, the direction in a machine-made fabric parallel to the direction of movement the fabric followed in the manufacturing machine.

3.2.4 *matting*—the extent of change of the apparent synthetic turf pile thickness from the original value due to permanent compression of the pile from sports use.

3.2.5 *pile*, *n*—*for pile fiber turf surfacing*, surface texture composed of many individual thin strands or groups of strands bound to a backing fabric in a repetitive array.

3.2.6 *pile lay*—the direction in which most of the pile fibers lean in the original, uncrushed fabric.

3.2.7 *secondary backing*—a material adhered to the backing side of a pile turf fabric.

3.2.8 *sports shoe traction*—a measure of the static or sliding coefficient of friction between a weighted sports shoe and the turf pile surface, horizontal motion.

3.2.9 synthetic turf field system—composite of synthetic contact surface material, any fill material used in the contact surface, energy absorbing material, fabric layers, adhesives, if any, and other constructed layers (as applicable to the individual system construction).

3.2.10 synthetic turf system components—the separate components such as turf fabric, shock-absorbing pad, and adhesives that comprise the synthetic turf playing surface when assembled; the subcomponents such as pile yarns and backing yarns that comprise the turf fabric.

3.2.11 *texture*—the detailed configuration of loops, cut pile ends, and individual fibers in the pile layer.

3.2.11.1 *Discussion*—Texture is the detailed appearance of the pile that changes by matting, crushing, flattening, fuzzing, untwisting, etc. during exposure to service. The texture should be distinguished from the construction, that is, the specifications of kinds of yarns, yarn sizes, and the mode of combination.

3.2.12 *water permeability*—the rate at which water of a specified head flows vertically through synthetic turf or other components of the system.

🕼 F1551 – 09 (2017)

TABLE 1 Performance Test Methods for Synthetic Turf Surfaces

	Test Method	Section	Item Tested
Pile Fiber			
D792	density (specific gravity)	9	synthetic yarn
D1577	linear density of textile fibers (denier)	10	pile of yarn on mfg. turf fabric
D1907	linear density of yarn (denier - skein method)	11	bobbin of yarn
D2256	breaking strength and elongation	12	bobbin of yarn
D3218	yarn thickness	13	synthetic yarn
D7138	melting point (Fisher-John method or DSC	14	synthetic yarn
	method)		, ,
Fabric			
D1335	resistance to tuft pullout	15	synthetic turf fabric
D2859	flammability of pile floor covering (methenamine tablet)	17	synthetic turf fabric
D4158	abrasion resistance (uniform abrasion method)	18	non-infilled turf
D5034	grab tear strength	19	synthetic turf fabric
D5251	resistance to matting (tetrapod method)	20	non-infilled turf
D5793	binding sites per unit	21	synthetic turf fabric
D5823	pile height	22	synthetic turf fabric
D5848	pile fiber, mass per unit	23	synthetic turf fabric
E648	flammability of synthetic turf (flooring radiant panel test)	24	synthetic turf fabric
F1015	relative abrasiveness of synthetic turf surfaces	25	synthetic turf fabric
	Shock Absorbing Pad Component		
D395	compression set under constant load	26	shock-absorbing pad
D412	Dogbone tensile & elongation (Die A)	27	shock-absorbing pad
D624	tear resistance (Die C)	28	shock-absorbing pad
D1667	compression resistance	29	shock-absorbing pad
D1876	T-peel strength of secondary pad	30	synthetic turf and pad
D2126	hydrolytic stability	31	shock-absorbing pad
D3574	tensile and elongation urethane foams	32	shock-absorbing pad
D3575	water absorption (% weight gain)	33	shock-absorbing pad
D3936	delamination strength of secondary backing	34	synthetic turf and reinforce- ment fabric
F355	shock absorbency of playing surface systems	35	shock-absorbing pad
Turf Systems			
D1667	compression resistance (modified method)	29	synthetic turf system
F355	shock absorbency of playing surface systems	35	synthetic turf system
	and materials		
F1015	relative abrasiveness of synthetic turf surfaces	25	synthetic turf or system
F1936	shock absorbency of playing surface systems	36	synthetic turf system
	in the field		
F2117	vertical rebound (acoustical measurement)	37	synthetic turf system
F2333	athletic shoe traction	38	synthetic turf or system
	Other Standards – Turf Systems		* *
AT-030	sports shoe traction	41	synthetic turf or system
DIN 18-035	water permeability of synthetic turf system	42	synthetic turf or system
EN 12234	ball roll	43	synthetic turf system
EN 12616	infiltration rate	44	synthetic turf or system
EN 14808	force reduction	45	synthetic turf system
EN 14809	vertical deformation	46	synthetic turf system
Infill Material			
D5644	particle size distribution of recycled rubber	40	ground rubber
F1632	particle size analysis and sand shape grading	39	sand

4. Summary of Test Methods

4.1 The purpose of these test methods is to provide a comprehensive characterization of synthetic turf playing surfaces.

4.2 Specific conditions of the referenced procedures are recommended to encourage uniform application of these test methods.

4.3 Table 1 is an index of the test methods listed herein.

5. Significance and Use

5.1 These test methods constitute a standard for obtaining data in research and development, quality control, acceptance and rejection under specifications, and for special purposes.

5.2 The data obtained from use of these test methods are applicable to the system and its components under conditions of the particular test procedures and are not necessarily the same as the data that might be obtained in other environments or use conditions.

5.3 The selection of test methods or tests should be limited to those appropriate to the system or material(s) being evaluated.

6. Conditioning of Materials

6.1 Conduct laboratory tests under known conditions of temperature and humidity as specified in the individual test procedures. In the absence of specified conditions, tests must be conducted under the standard laboratory conditions of 23 \pm

This is a preview. Click here to purchase the full publication.