Designation: E1551 – 16

Standard Specification for a Size 4.00-8 Smooth Tread Friction Test Tire[1]

This standard is issued under the fixed designation E1551; 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 specification covers the general requirements for a special purpose, smooth-tread standard tire for measuring tire-pavement friction forces. The tire is utilized on fixed braking slip continuous friction measuring equipment such as the Runway Friction Tester, Surface Friction Tester, or BV-11 Skiddometer Trailer.

1.2 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.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D297 Test Methods for Rubber Products—Chemical Analysis

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D1054 Test Method for Rubber Property—Resilience Using a Goodyear-Healey Rebound Pendulum (Withdrawn 2010)[3]

D1765 Classification System for Carbon Blacks Used in Rubber Products

D2240 Test Method for Rubber Property—Durometer Hardness

D3182 Practice for Rubber—Materials, Equipment, and Procedures for Mixing Standard Compounds and Preparing Standard Vulcanized Sheets

2.2 *Other Documents:*

BV-11 Skiddometer Trailer—Instruction and Servicing Manual

DOT/FAA/AS-90-1 Reliability and Performance of Friction Measuring Tires and Friction Equipment Correlation[4]

Advisory Circular 150/5320-12 —"Measurement, Construction and Maintenance of Skid Resistant Airport Pavement Surfaces"[5]

3. Materials and Manufacture

3.1 The individual standard tires shall conform to the design standards of Section 5. Dimensions, weights, and permissible variations are also given in Section 5 and in Fig. 1 and Fig. 2.

3.2 Tread compounding, fabric processing, and all steps in tire manufacturing shall be certified to ensure that the specifications are met (see Section 7).

3.3 The markings on the tire as shown in Fig. 1 shall be molded on both sides of the tire.[6]

3.4 Fig. 1 shows a view of the tread surface and a side view of the standard, special purpose, smooth tread tire and Fig. 2 is a typical tire cross section with critical dimensions identified.

3.5 Tire should be mounted so that it is rotated in the direction of the arrow on the side of the tire. See Fig. 1.

4. Material Requirements

4.1 The compounding requirements for the tread compound are given in Table 1.

4.2 The fabric shall be nylon, 1260/2 Denier.

NOTE 1—Certain proprietary products have been specified since exact duplication of properties of the finished tire may not be achieved with other similar products. This inclusion does not in any way comprise a recommendation for these proprietary products nor against similar products of other manufacturers, nor does it imply any superiority over any such similar products.

[1] This specification is under the jurisdiction of ASTM Committee E17 on Vehicle - Pavement Systems and is the direct responsibility of Subcommittee E17.24 on Tire and Slider Characteristics.

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[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.

[4] Available from National Technical Information Service (NTIS), 5285 Port Royal Rd., Springfield, VA 22161, http://www.ntis.gov.

[5] Available from U.S. Department of Transportation Federal Aviation Administration, 800 Independence Ave., S.W., Washington, DC 20591.

[6] Specified tire is available from Specialty Tires of America, Inc., P.O. Box 749, 1600 Washington St., Indiana, PA 15701. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

Suggested Marking on Tire
ASTM Test Tire E1551
4.00 – 8 NHS
6 Ply Rating
Tube Type
Manufacturer's Name or Trademark

FIG. 1 Test Tire

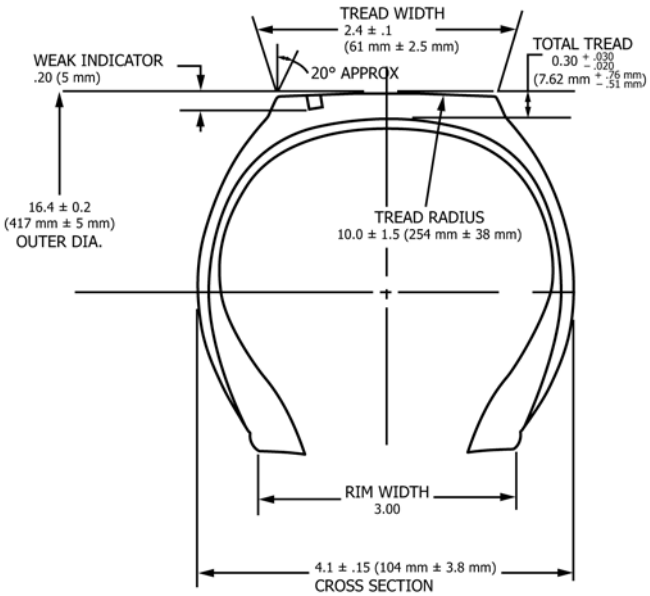

FIG. 2 Tire Section, Including Inflated Dimensions

TABLE 1 Compounding of Tread Rubber[A]

Material	PPHR
SBR 1712[B]	89.38
BR 1208[C]	35.00
Zinc oxide	3.00
Stearic acid	2.00
Paraffin wax	2.00
N339[D]	75.00
6PPD[E]	2.00
High aromatic oil	22.12
TBBS[F]	1.10
DPG[G]	0.10
Sulfur	1.80

[A] See Practice D3182.
[B] Styrene-butadiene rubber (23.5 % styrene) 37.5 parts of high-aromatic oil.
[C] High cis-polybutadiene.
[D] N339 Carbon Black, see Classification D1765.
[E] Dimethyl butylphenyl phenylenediamine.
[F] Butyl benzothiazole sulfenamide.
[G] Diphenyl guanidine.

5. Construction, Dimensions, and Permissible Variations

5.1 *Construction*—The tire shall be a size 4.00-8, tube type, four plies, Nylon cord, and bias construction.

5.2 *Dimensions*—Tread width shall be 2.4 ± 0.1 in. (61 ± 2.5 mm), the tread radius shall be 10.0 ± 1.5 in. (254 ± 38 mm), the cross-sectional width shall be 4.1 ± 0.15 in. (104 ± 3.8 mm), and the outside diameter at the tread centerline shall be 16.4 ± 0.2 in. (417 ± 5 mm) when measured on an 8 by 3.00D rim at 30 ± 0.5 psi (207 ± 2 kPa) inflation pressure. See Fig. 2 which shows inflated dimensions of the new tire.

5.3 *Tread*—The tread surface shall be smooth (blank) without any ribs or grooves. The tread shall have a thickness of 0.16 in. (4.1 mm) and an under skid thickness of 0.14 ± 0.03 in. (3.56 ± 0.76 mm).

5.4 *Wear Indicators*—There will be four holes molded into the tire 0.16 in. (4.1 mm) deep and 0.125 in. (3.18 mm) diameter. These four wear indicators will alternate from one side of the tread centerline to the other and be spaced 90° apart.

6. Workmanship

6.1 Tires shall be free of defects in workmanship and material.

7. Test Methods

7.1 *Tensile Sheet Cure*—Practice D3182.

7.2 *Modulus (300 %)*—Test Methods D412.

7.3 *Tensile Sheet Durometer*—Test Method D2240, using a Type A Shore Durometer.

7.4 *Restored Energy (Rebound or Resilience)*—Test Method D1054.

7.5 *Specific Gravity*—Test Methods D297.

7.6 *Tensile Strength*—Test Methods D412.

7.7 *Elongation*—Test Methods D412.

7.8 *Tire Tread Durometer*—Test Method D2240, in addition to the following specific procedures:

7.8.1 Use a Type A Durometer. A0.5-in. (12.7-mm) diameter presser foot, Shore, code XAHAF is recommended.

7.8.2 The durometer shall be calibrated at a reading of 60 hardness.

7.8.3 Condition the tire and durometer to equilibrium at 73.4 ± 3.6°F (23 ± 2°C) before determining tread hardness.

7.8.4 The tire tread hardness is to be determined by averaging at least one set of six readings. A set should consist of readings taken at equally spaced intervals across the tread. It is recommended that additional sets of readings be taken around the tread circumference.

7.8.5 Apply presser foot to the tire tread as rapidly as possible without shock, keeping the foot parallel to the tread surface. Apply just sufficient pressure to obtain firm contact between presser foot and tire tread surface. Read the durometer scale within 1 s after presser foot is in contact with the tire tread, but after initial maximum transient which may occur immediately after contact is made.

8. Physical Requirements

8.1 The physical and mechanical test requirements are given in Table 2.

9. Certification

9.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been tested and inspected as directed in this specification, verifying that all requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

10. Packaging and Preservation

10.1 The tires should be stored in a dry area, at a temperature not exceeding 90°F (32.2°C) and in subdued light. Tires must not be stored near electric motors, welders, or other ozone generating equipment. The tire is not to be used as a standard test tire after more than one year storage by the consumer nor if it has been stored at more than 85°F (29.4°C) for more than 60 days.

11. Recommendations for Tire Use and Operational Requirements

11.1 The tire is for measuring tire-pavement friction forces only and is not designed for general highway service.

11.2 A new tire break-in sufficient to only remove the glossy tread surface is recommended before using the tire for testing. This break-in time will vary with pavement surface condition, speed, and test tire operating mode.

11.3 The tire shall be operated on fixed slip devices such as the Runway Friction Tester, the Surface Friction Tester, and the BV-11 Skiddometer Trailer. The inflation pressure used in the friction tire shall be 30 ± 0.5 psi (207 ± 3 kPa) measured at ambient temperature (cold).

11.4 The recommended static test load on the friction tire shall be 200 ± 2 lbf (890 ± 9 N) with loading to a maximum of 320 ± 3 lbf (1423 ± 14 N) permissible, at 30 ± 0.5 psi (207 ± 3 kPa) inflation pressure.

11.5 When any irregular wear or damage results from testing or when the wear indicators are no longer visible, the use of the friction tire as a standard test friction tire shall be discontinued.

TABLE 2 Physical Properties of Tread Compound

Tensile Sheet Cure, min. at 302°F (150°C)	30
300 % modulus, psi (Test Methods D412)	1000 ± 200
Specific gravity (Test Methods D297)	1.13 ± 0.02
Tensile strength, min psi (Test Methods D412)	2000
Elongation, min % (Test Methods D412)	500
Tire tread durometer (Test Method D2240)	58 ± 2