Designation: F2493 – 14

Standard Specification for P225/60R16 97S Radial Standard Reference Test Tire[1]

This standard is issued under the fixed designation F2493; 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 the P225/60R16 97S radial standard reference test tire. The tire covered by this specification is primarily for use as a reference tire for braking traction, snow traction, and wear performance evaluations, but may also be used for other evaluations, such as pavement roughness, noise, or other tests that require a reference tire.

1.1.1 Other standard reference test tires are also used for these purposes and are referenced in Section 2.

1.2 This specification provides a rim code diameter of 16 standard tire design and construction, standard dimensions, and specifies the conditions of storage.

1.3 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.

1.4 *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:*[2]

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

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

E867 Terminology Relating to Vehicle-Pavement Systems

E1136 Specification for P195/75R14 Radial Standard Reference Test Tire

F538 Terminology Relating to the Characteristics and Performance of Tires

F2870 Specification for 315/70R22.5 154/150L Radial Truck Standard Reference Test Tire

F2871 Specification for 245/70R19.5 136/134M Radial Truck Standard Reference Test Tire

F2872 Specification for 225/75R16C 116/114S M+S Radial Light Truck Standard Reference Test Tire

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this specification, refer to Terminology F538.

3.1.2 *all-season tread, n*—tread design providing dry, wet, and snow traction performance for an optimized balance for year-round performance and which may meet the Rubber Manufacturers Association (RMA) definition for an M&S, M+S, M/S, MS, etc. marked tire (see RMA "Snow Tire Definitions for Passenger and Light Truck (LT) Tires").[3]

3.1.3 *pavement characteristic, n*—physical feature or property of a pavement surface such as type, roughness, texture, and skid resistance. **E867**

3.1.4 *pitch, n*—unit of tread pattern elements used in various combinations to obtain optimum noise levels.

3.1.5 *standard reference test tire, SRTT, n*—tire that is used as a control tire or surface-monitoring tire (for example, Specification E1136, F2870, F2871, and F2872 tires.)

4. Design and Construction

4.1 The P225/60R16 standard reference test tire shall feature the steel-belted radial technology, and an all-season silica content tread design, see Figs. 1 and 2, with technology as described in Section 3 and Sections 5 – 7.

[1] This specification is under the jurisdiction of ASTM Committee F09 on Tires and is the direct responsibility of Subcommittee F09.20 on Vehicular Testing.

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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] Available from the Rubber Manufacturers Association, 1400 K Street, N.W. Washington, D.C. 20005.

FIG. 1 Front View of the P225/60R16 97S Radial Standard Reference Test Tire

FIG. 2 Side View of the P225/60R16 97S Radial Standard Reference Test Tire

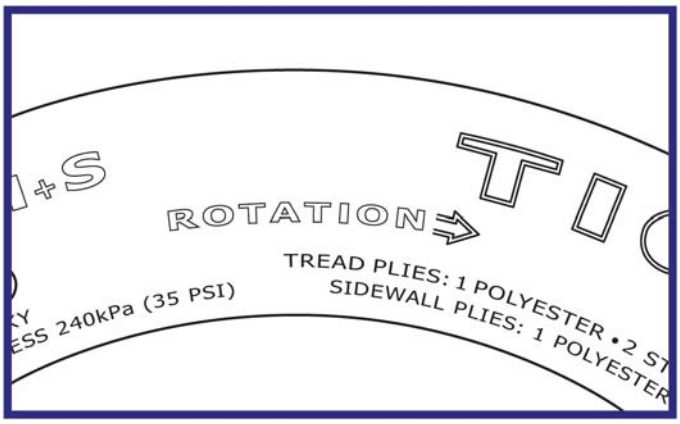

FIG. 3 Example of Rotation Arrow

4.2 The tire shall be designed to conform with the Tire and Rim Association, Inc. (TRA) standard nominal dimensions and tolerances for cross section and overall diameter found in the current TRA Yearbook.[4]

[4] Available from the Tire and Rim Association, Inc., 175 Montrose West Ave., Suite 150, Copley, OH 44321.

TABLE 1 Physical Properties of Tread Compound

Tensile sheet cure, min at 320°F (160°C)	15.0 min
Stress at 300 % elongation, psi (MPa)	705 ± 64 psi (4.9 ± 0.4 MPa)
Tensile strength, min psi (MPa)	2250 psi (15.5 MPa)
Elongation, min %	650 % min
Durometer hardness[A]	64 ± 2 Type A

[A] Measured on tire tread.

4.3 The tire used for this specification is produced by Michelin Passenger and Light Truck Tire Manufacturing.[5] The tire is stamped on the sidewall with the words: "Standard Reference Test Tire" and ECE (Economic Commission for Europe) and DOT (Department of Transportation) certification marks.

4.4 Beginning in 2014, the tire is marked with an arrow which provides a rotational orientation for those testers who choose to reference it. (See Fig. 3.)

5. Materials and Manufacture

5.1 The individual standard reference test tires shall conform to the manufacturer's design standards.

5.2 Tread compound, fabric processing, and all the steps in tire manufacturing shall be controlled to ensure minimum variability between tires.

5.3 The standard reference test tire shall be as originally molded without any tread grinding or repairs.

5.4 Since the formulation for tread compounds are proprietary, they shall be controlled by means of their physical properties given in Table 1.

5.5 Dimensions, weights, and permissible variations are given in Section 7.

5.6 The tire shall be of the following construction:

5.6.1 One-ply sidewall construction (polyester).

5.6.2 A three-ply tread construction (one-ply polyester and two steel belts).

5.6.3 Black sidewall.

5.6.4 Ventless tread molding.

6. Physical Properties

6.1 The physical properties of the tread compound are listed in Table 1.

7. Dimensions, Weights, and Permissible Variations

7.1 Details of dimensions are listed as follows and are shown in Fig. 4. When tolerances are not specified, tire dimensions are subject to manufacturer's normal tolerances.

7.2 *Inflated Dimensions and Cured Cord Angles:*

[5] The sole source of supply of the standard reference tire known to the committee at this time is Michelin Passenger and Light Truck Tire Manufacturing, 1101 Michelin Road, Ardmore, OK 73401 (specify P225/60R16 97S SRTT Uniroyal Tiger Paw AWP). 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.

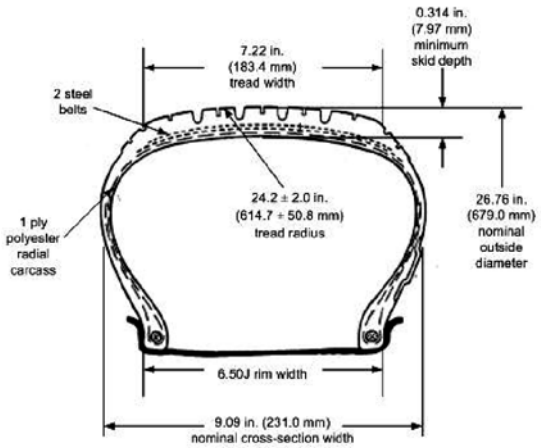

FIG. 4 Tire Cross Section

7.2.1 The tread width shall be 7.22 in. (183.4 mm), and the cross-sectional tread radius shall be 24.2 ± 2.0 in. (614.7 ± 50.8 mm).

7.2.2 The tread radius is measured using the three-point drop method (see Fig. 5 for an example of how the measurement is taken).

7.2.3 The tire shall have a nominal cross-section width of 9.09 in. (231.0 mm), and a nominal outside diameter of 26.76 in. (679.0 mm) when mounted on a TRA measuring rim width (16 × 6.5 J).

7.2.4 The cured cord angles shall be 90 ± 2° for the carcass and 21.0 ± 2° for the belts.

7.3 *Ribs*—The tire shall have five ribs.

7.4 *Grooves*—The tire shall have four circumferential grooves having a minimum groove depth of 0.314 in. (7.97 mm).

7.5 *Tread Design:*

7.5.1 *Groove (Void) Area Fraction*—37 %.

7.5.2 *Number of Pitches*—81.

7.5.3 *Footprint Size*—7.99 in. long by 6.97 in. wide (203 by 177 mm).

7.6 *Tread Wear Indicators*—The tire shall have indicators in each groove, laterally across the tread width, in six locations spaced uniformly around the tire circumference. The height of the wear indicators in the grooves shall be 0.0625 in. (1.6 mm).

NOTE 1—Groove depth is not to be measured at these wear indicators.

FIG. 5 Measuring the Tread Radius Using the Three-Point Drop

8. Workmanship

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

9. Test Methods

9.1 Preparation of tensile sheet cure shall be in accordance with Practice D3182.

9.2 Stress at 300 % elongation shall be in accordance with Test Methods D412.

9.3 Tensile strength shall be in accordance with Test Methods D412.

9.4 Elongation shall be in accordance with Test Methods D412.

9.5 Tire tread hardness shall be in accordance with Test Method D2240 in addition to the following:

9.5.1 Use a Type A durometer that has the center of the presser foot at a minimum of 0.24 in. (6.0 mm) from any edge of the foot.

9.5.2 Check the durometer operation and the state of calibration of the durometer with the rubber reference block(s).

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

9.5.4 Determine the tire tread hardness by averaging at least four readings. Take these readings in the center of each rib, excluding the center rib. It is recommended that additional sets of readings be taken around the tread circumference.

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

10. Certification

10.1 The tires are manufactured throughout the year in specific campaign quantities, that is, batches, that are identified by a tread area marking.

10.2 Upon request, the manufacturer shall furnish to the purchaser certification that the test tire meets this specification.

10.3 All tires under certification shall be subject to the manufacturer's normal variation.

10.4 For purposes of certification, it is noted that these tires do not contain aromatic oils.

11. Storage and Preservation

11.1 The tires shall be stored under constant relative humidity conditions at a temperature not to exceed 70°F (21°C) and above freezing. The ozone level in the storage area shall not exceed 5 parts/10^8 (or 5 MPa partial pressure), and no tires shall be stored within 30 ft (9.1 m) of electrical motors or other ozone-generating equipment. Storage of the tires shall be in subdued light, with the tires stacked unbundled, no more than eight tires high on a pallet.

12. Recommendations for Tire Use and Operational Requirements

12.1 It is recommended that the tire be used as a reference for performance evaluations (that is, traction, noise, pavement characteristics, and the like).

12.2 The tire shall be mounted on a 6.50 ± 0.5-in. (1.651 ± 12.7-mm) wide rim (16 × 6.5 J wheel is recommended).

12.3 When irregular wear or damage results from tests, or when wear influences the test results, the use of the tire shall be discontinued.

12.4 **Warning—**Test results, such as measured friction force, may be influenced by tire groove depth or tread hardness or both. The magnitude of this dependence is a function of the water depth, pavement characteristics, test speed, tire aging effects, and break-in.

13. Keywords

13.1 airport runway friction; F09; fixed slip; SRTT; standard reference test tire; tire pavement friction; traction; treadwear