



Designation: F1806 – 21

Standard Practice for Tire Testing Operations—Basic Concepts and Terminology for Reference Tire Use¹

This standard is issued under the fixed designation F1806; 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 practice presents some basic concepts for tire testing and a standard set of terms relating to the use of reference tires frequently used for comprehensive tire testing programs. The tests may be conducted in a laboratory on various dynamometer wheels or other apparatus as well as at outdoor proving ground facilities. The overall objective of this practice is to develop some elementary principles for such testing and standardize the terms used in these operations. This will improve communication among those conducting these tests as well as those using the results of such testing.

1.2 In addition to the basic concepts and terminology, a statistical model for tire testing operations is also presented in [Annex A1](#). This serves as a mathematical and conceptual foundation for the terms and other testing concepts; it will improve understanding. The annex can also serve for future consultation as this practice is expanded to address additional aspects of the testing process.

1.3 This overall topic requires a comprehensive treatment with a sequential or hierarchical development of terms with substantial background discussion. This cannot be accommodated in Terminology [F538](#).

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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.*

¹ This practice is under the jurisdiction of Committee [F09](#) on Tires and is the direct responsibility of Subcommittee [F09.94](#) on Terminology.

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2. Referenced Documents

2.1 *ASTM Standards:*²

[D4483](#) Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries

[E1136](#) Specification for P195/75R14 Radial Standard Reference Test Tire

[F538](#) Terminology Relating to Characteristics and Performance of Tires

[F1650](#) Practice for Evaluating Tire Traction Performance Data Under Varying Test Conditions

[F2493](#) Specification for P225/60R16 97S Radial Standard Reference Test Tire

[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. Significance and Use

3.1 Tire testing operations usually consist of a sequence of tests that involve special “reference” tires in addition to the candidate tires being evaluated for their performance characteristics. Reference tires serve as an “internal benchmark” which may be used to adjust for variation in test results to give improved comparisons among the candidate tires. Numerous approaches have been adopted using different terminology for such testing. This causes confusion and the purpose of this practice is to standardize some of the elementary concepts and terminology on this topic.

4. Summary of the Practice

4.1 Elementary testing concepts, terms, and definitions are developed in hierarchical or sequential order beginning with basic testing operations. Each definition may be accompanied by a specific discussion or expanded text section appropriate to

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.

*A Summary of Changes section appears at the end of this standard

general definitions. Many of the terms could be defined as adjectives; however, as recommended by ASTM policy, the word “tire” is included in each definition avoiding the complication of defining adjectives. The definitions apply equally to items or objects other than tires.

5. Basic Testing Concepts and Terms

5.1 Background on Testing:

5.1.1 Despite the adoption of standardized testing procedures, test result variation influences data generated in any type of testing. As outlined in **Annex A1**, there are two main categories: [1] variation inherent in the production process for a group of nominally identical objects or tires and [2] variation due to the measurement operation. Each of these two sources may be further divided into two types of variation; [1] systematic or bias variation (the variation causing one laboratory to be consistently different from another laboratory) and [2] random error variation. Both types can exist simultaneously for either of the main categories.

5.1.2 Random variation can be reduced to a low level by appropriate replication and sampling procedures, but bias variation cannot be so reduced. Bias variation can be reduced or eliminated by the appropriate use of reference objects or tires. This is the major rationale for their use in testing operations (see **Annex A1**).

5.1.3 Bias variation can also be reduced or eliminated by comprehensive programs to sort out causes of such perturbations and eliminate these causes.

5.2 Elementary Testing Terms:

5.2.1 *test (or testing)*, *n*—a technical procedure, method, or guide performed on an object (or set of objects) that produces data; the data are used to evaluate or model properties or characteristics of the object (or set of objects). **F538**

5.2.1.1 *Discussion*—The scope of testing depends on the decisions to be made for any program, and sampling and replication plans (see definitions below) need to be specified for a complete program description.

5.2.2 *test tire (set)*, *n*—one or more tires, as required by the test equipment or procedure to perform a test, producing a single test result; the tires within a test tire set are usually nominally identical. **F538**

5.2.2.1 *Discussion*—The four nominally identical tires required for vehicle stopping distance testing constitute a test tire set. In the discussion below where the test tire is mentioned, it is assumed that test tire set may be substituted for test tire, if a test tire set is required for the testing.

5.2.3 *test program*, *n*—an ordered series of tests grouped together using a predefined plan. **F538**

5.2.3.1 *Discussion*—A test program may include multiple test repetitions over an extended time period.

5.2.4 *candidate tire (set)*, *n*—a test tire (or test tire set) that is part of an evaluation program; each candidate tire (set) usually has certain unique design or other features that distinguish it from other candidate tires (sets) in the program. **F538**

5.2.4.1 *Discussion*—The term “candidate object” may be used in the same sense as *candidate tire*.

5.3 Tire testing may be divided into two major categories:

5.3.1 *local testing*, *n*—testing conducted at one laboratory or test site for the purpose of comparing a number of candidate tires for selected characteristic properties. **F538**

5.3.1.1 *Discussion*—A tire manufacturer’s internal development programs and proving ground testing conducted by a contract testing organization to compare commercial market tires are two examples of local testing.

5.3.2 *global testing*, *n*—testing conducted at two or more laboratories or test sites for the purpose of comparing candidate tire performance at each location for selected characteristic properties. **F538**

5.3.2.1 *Discussion*—Producer-user testing or interlaboratory comparisons for such properties as rolling resistance, endurance, or high speed dynamometer wheel performance are examples of global testing.

5.4 *sample*, *n*—a selected number of *n* test objects that accurately represent the lot or population of interest. **F538**

5.4.1 *Discussion*—A lot is a finite number of objects such as a limited period of tire production at a given facility or a selected number of tires of a particular commercial market type. A population is the collection (or potential collection) of all objects produced by a given process or operation.

5.5 *sampling*, *v*—the act of selecting samples. **F538**

5.5.1 *Discussion*—The primary purpose of sampling is the reduction of random production process variation. See **Annex A1** for details.

5.6 *replicate*, *n*—either (1) an individual test object from a sample of *n* objects or (2) one of *m* individual test values for a test object. **F538**

5.6.1 *Discussion*—Each test object of a set of replicates is nominally identical to all other objects from that particular source. Nominally identical implies that in long run testing all objects would give essentially identical average test values.

5.7 *replication*, *v*—the act of selecting and testing a number of replicates. **F538**

5.7.1 *Discussion*—The primary purpose of replication is the reduction of random measurement variation. See **Annex A1** (A1.3.6) for additional discussion on types of replication.

6. Reference Tire Concepts and Terms

6.1 In this section a basic term, reference tire, is defined. A number of terms, each describing a special type of reference tire, are derived from the basic term. Reference tires usually have special characteristics unique to a particular test program. However, for some testing programs the same reference tire may be used for more than one purpose.

6.1.1 *reference tire (set)*, *n*—a special test tire (test tire set) that is used as a base value or benchmark included in an evaluation program; these tires usually have carefully controlled design features to minimize variation. **F538**

6.1.2 There are two types of reference tires or objects that may be used in any test program.

6.1.2.1 *Type 1 (reference tire)*, *n*—tires subject to production, composition, and often, performance specifications; they are designed to have minimal variation and to be stable in their characteristic properties for an extended period of time.