



Designation: F2803 – 21

Standard Test Method for Evaluating Rim Slip Performance of Tires and Wheels¹

This standard is issued under the fixed designation F2803; 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 test method is performed to determine the amount of rotational slip occurring at the tire/wheel interface while under heavy longitudinal load conditions.

1.2 This test method is suitable for research and development purposes where tires are compared during a single series of tests. They may not be suitable for regulatory statutes or specification acceptance because the values obtained may not necessarily agree or correlate either in rank order or absolute performance level with those obtained under other environmental conditions on other surfaces or the same surface after additional use.

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

1.4 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

F538 Terminology Relating to Characteristics and Performance of Tires

¹ This test method 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.

2.2 SAE Standards:³

SAE J2013 Military Tire Glossary

SAE J670e Vehicle Dynamics Terminology

3. Terminology

3.1 Definitions:

3.1.1 *bead, n—of a tire*, the part of a tire that comes in contact with the rim and is shaped to secure the tire to the rim.

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3.1.2 *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**

3.1.3 *control tire (set), n*—a reference tire (or reference set) repeatedly tested in a specified sequence, typically in conjunction with a candidate tire (set), throughout an evaluation program.

3.1.3.1 *Discussion*—Control tires (sets) are used for adjustment of data sets generated from an evaluation program or the statistical procedures used on data sets, or both, in order to offset or reduce variation in test results. They can also be used to improve the accuracy of candidate tire (set) data and to detect variation in test equipment. **F538**

3.1.4 *deflection, n*—difference between the unloaded and loaded section heights. **SAE J2013**

3.1.5 *drawbar, n*—device for coupling a hauling vehicle to a load.

3.1.6 *dynamometer, n*—machine used to measure torque and rotational speed (rpm) from which power produced by an engine, motor or other rotating prime mover can be calculated.

3.1.6.1 *Discussion*—For the purpose of this test method, a dynamometer can be any vehicle or trailer that can be towed and produce longitudinal resistance.

3.1.7 *longitudinal force [F], n—of a tire*, the component of the tire force vector in the X direction. **F538**

3.1.8 *longitudinal slip velocity [L/T], n*—the effective rolling radius multiplied by the difference between the spin

³ Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, <http://www.sae.org>.

velocity (in rad/unit time) of a driven or braked tire and that of a free rolling tire when each is traveling in a straight line. **F538**

3.1.9 *maximum load rating [M]*, *n*—of a passenger tire, the load rating at the maximum permissible cold inflation pressure for that tire. **F538**

3.1.10 *paved road*, *n*—two or more lanes, all-weather, maintained, hard surface roads with good driving visibility used for heavy and high-density traffic, in accordance with the U.S. Federal Highway Administration. **F538**

3.1.11 *rim*, *n*—the specially shaped circular periphery to which a tire may be mounted with appropriate bead fitment. **F538**

3.1.12 *rim slip*, *n*—circumferential distance along the rim flange between the corresponding marks.

3.1.13 *section height [L]*, *n*—radial height of a tire section, expressed as one half the difference between the outside diameter of the unloaded tire and the nominal rim diameter; the outside diameter is measured on a tire-wheel assembly with the tire inflated to rated inflation pressure. **F538**

3.1.14 *sidewall*, *n*—of a tire, that portion of a tire between the tread and the bead. **F538**

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

3.1.16 *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**

3.1.17 *torque [FL]*, *n*—of a wheel, the external torque applied to a tire from a vehicle about the wheel spin axis. **F538**

3.1.18 *tractive effort*, *n*—total force output of the traction device acting parallel to the surface of the ground and in the direction of travel of a driving wheel.

3.1.18.1 *Discussion*—Tractive effort is expressed as a ratio of load to vehicle weight. **SAE J2013**

4. Summary of Test Method

4.1 This test method is used to quantify the amount a driven tire rotates relative to a rim under severe conditions. This method is designed to produce the greatest amount of rim slip in the shortest amount of time using a test vehicle that is capable of 60 % tractive effort. The 60 % tractive effort is a target from military requirements but can be adjusted to fit a commercial application. This test method can be modified to accommodate different objectives including longer distances or various drawbar loads. Test tire results are compared to a control tire to evaluate the relative change in performance and to negate affects from environmental conditions.

5. Significance and Use

5.1 This test method establishes a standard procedure of comparative testing, for driven wheel rim slip, between candidate tire group(s) and a control tire group. This test method is suitable for research and development purposes where tire and rim specimens are compared during a brief testing time period.

They may not be suitable for regulatory or specification acceptance purposes because the values obtained may not necessarily agree or correlate, either in rank order or absolute value, with those obtained under other conditions (for example, different locations or different seasonal time periods on the same test course).

6. Interferences

6.1 The absolute values of the parameters obtained with this test method are dependent upon the characteristics of the vehicle, the selected test pavement(s), and the environmental conditions at the test course. A change in any of these factors may change the absolute values and may also change the relative rating of the tires and wheels so tested. It is recommended that all testing occur at similar conditions and in as short a time frame as possible to reduce this variability.

6.2 Wheel condition, lubrication, and the elapsed time from tire mounting may affect the results of testing. It is recommended tires are mounted consistently, without lube if possible, between tire and wheel specimens.

7. Apparatus

7.1 The testing apparatus shall consist of a wheeled vehicle capable of providing consistent torque to the test wheel locations, a dynamometer, load cell, calibrated speedometer, and tire/wheel specimens. The test course shall be a smooth, less than 2 % grade, dry pavement surface. The surface and ambient temperature must be above 0°C (32°F).

8. Reagents and Materials

8.1 This test method requires a paint pen or equivalent device capable of marking tires and rim surfaces.

9. Hazards

9.1 The towing vehicle shall be secured with a load cell and a cable/drawbar that is suitable to provide safety for testing personnel.

10. Sampling, Test Specimens, and Test Units

10.1 The speed and drawbar load data shall be acquired at a minimum of 10 Hz. The speed data shall be accurate to ± 1 km/h (0.6 mph). The drawbar load cell shall be accurate to within 2 % for the maximum reading.

10.2 Prior to testing, the tires and wheels shall be marked on the side facing away from the test vehicle. Two lines shall be made at the valve stem with a paint pen or suitable marker, across the tire bead and rim a minimum of 6 cm (2.5 in.) on each surface. A similar single mark shall be made 180 radial degrees on the same face of the tire. Refer to Fig. 1 for example tire and rim markings.

10.3 All units in this test method are listed in SI units; the results of testing may be presented in the units chosen by test personnel.

11. Preparation of Apparatus

11.1 The test vehicle shall be loaded so that each wheel position shall be within 5 % of the maximum load rating for each test tire at a minimum of two wheel positions.