Designation: F1805 – 06

Standard Test Method for Single Wheel Driving Traction in a Straight Line on Snow- and Ice-Covered Surfaces[1]

This standard is issued under the fixed designation F1805; 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 covers a procedure for measuring the driving traction of passenger car and light truck tires while traveling in a straight line on snow- or ice-covered surfaces.

1.2 This test method utilizes a dedicated, instrumented, four-wheel rear-wheel drive test vehicle with a specially instrumented drive axle to measure fore-aft and vertical forces acting on a single driven test tire.

1.3 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 traction performance level with those obtained under other environmental conditions on other surfaces or the same surface after additional use.

1.4 The values stated in SI units are to be regarded as the standard. Ordinarily, N and kN should be used as units of force. This standard may utilize kgf as a unit of force in order to accommodate the use of load and pressure tables, as found in other standards both domestic and global that are commonly used with this standard. The values given in parentheses are for information only.

1.5 *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]

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

F377 Practice for Calibration of Braking/Tractive Measuring Devices for Testing Tires

F538 Terminology Relating to the Characteristics and Performance of Tires

F1046 Guide for Preparing Artificially Worn Passenger and Light Truck Tires for Testing

F1572 Test Methods for Tire Performance Testing on Snow and Ice Surfaces

F1650 Practice for Evaluating Tire Traction Performance Data Under Varying Test Conditions

3. Terminology

3.1 *Definitions:*

3.1.1 *candidate tire, n*—a test tire that is part of a test program. **F538**

3.1.1.1 *Discussion*—The term "candidate object" may be used in the same sense as *candidate tire*.

3.1.2 *control tire, n*—a reference tire used in a specified manner throughout a test program. **F538**

3.1.2.1 *Discussion*—A control tire may be of either type and typical tire use is the reference (control) tire in Practice F1650 that provides algoritms for correcting (adjusting) test data for bias trend variations (See Practice F1650).

3.1.3 *driving coefficient (nd), n*—the ratio of the driving force to a normal force. **F538**

3.1.4 *driving force (F), n— of a tire*, the positive longitudinal force resulting from the application of driving torque. **F538**

3.1.5 *grooming, v—in tire testing*, mechanically reworking a snow test surface in order to obtain a surface with more consistent properties. **F538**

3.1.6 *ice, dry, n*—smooth ice without loose surface materials. **F538**

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 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 *reference tire, n*—a special tire included in a test program; the test results for this tire have significance as a base value or internal benchmark. **F538**

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[1] This test method is under the jurisdiction of 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.

3.1.10 *snow, hard pack, n— in tire testing*, packed base without loose snow. **F538**

3.1.11 *snow, medium pack, n— in tire testing*, groomed packed base with 2.5 to 5.0 cm (1 to 2 in.) loose snow. **F538**

3.1.12 *snow, medium hard pack, n— in tire testing*, packed base with some loose snow. **F538**

3.1.13 *snow, soft pack, n— in tire testing*, freshly fallen or deeply groomed base snow with 5.0 to 7.5 cm (2 to 3 in.) loose snow. **F538**

3.1.14 *spin velocity, n*—the angular velocity of the wheel about its spin axis. **F538**

3.1.15 *standard reference test tire (SRTT), n*—a tire that meets the requirements of Specification E1136, commonly used as a control tire or a surface monitoring tire. **F538**

3.1.16 *surface monitoring tire, n*—a reference tire used to evaluate changes in the test surface over a selected time period. **F538**

3.1.17 *test (or testing), n*—a procedure performed on an object (or set of nominally identical objects) using specified equipment that produces data unique to the object (or set). **F538**

3.1.17.1 *Discussion*—Test data are used to evaluate or model selected properties or characteristics of the object (or set of objects). 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.

3.1.18 *test matrix, n— in tire testing* a group of candidate tires, usually with specified reference tires; all tests are normally conducted in one testing program. **F538**

3.1.19 *test run, n*—a single pass of a loaded tire over a given test surface. **F538**

3.1.20 *test tire, n*—a tire used in a test. **F538**

3.1.21 *test tire set, n*—one or more test tires, as required by the test equipment or procedure, to perform a test, thereby producing a single test result. **F538**

3.1.21.1 *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 the test tire set may be substituted for the test tire, if a test tire set is required for the testing.

3.1.22 *traction test, n— in tire testing,* a series of *n* test runs at a selected operational condition; a traction test is characterized by an average value for the measured performance parameter. **F538**

3.1.23 *vertical load, n*—the normal reaction of the tire on the road which is equal to the negative of normal force. **F538**

4. Summary of Test Method

4.1 These test methods describe the use of an instrumented vehicle with a single test wheel capable of measuring the tire performance properties under drive torque on snow and ice surfaces when traveling in a straight line.

4.2 The test is conducted by driving the test vehicle over the test surface. Driving torque is gradually increased to the test wheel while maintaining the vehicle speed by applying braking torque to the non-test wheels of the vehicle. The driving traction coefficient is determined from the measured values of longitudinal and vertical forces over a specified slip or time range. The recommended vehicle test speed is 8.0 km/hr (5.0 mph).

5. Significance and Use

5.1 This test method describes a technique for assessing the performance characteristics of tires in a winter environment on snow and ice surfaces. When snow is referred to hereafter, ice is implied as appropriate.

5.2 The measured values quantify the dynamic longitudinal traction properties of tires under driving torque. Dynamic traction properties are obtained on snow surfaces prepared in accordance with the stated test procedures and attempts to quantify the tires' performance when integrated into a vehicle-environmental system. Changing any one of these environmental factors will change the measurements obtained on a subsequent test run.

5.3 This test method addresses longitudinal driving traction properties only on snow and ice surfaces. Refer to Test Methods F1572 for test methods for braking and lateral traction properties on snow or ice, or both.

6. Interferences

6.1 Factors that may affect tire snow performance and must be considered in the final analysis of data include:

6.1.1 Snow temperature,

6.1.2 Ambient temperature,

6.1.3 Mechanical breakdown of the agglomerated snowflake into granular crystals,

6.1.4 Solar load,

6.1.5 Tire temperature,

6.1.6 Tire wear condition (preparation),

6.1.7 Tire pressure,

6.1.8 Tire vertical load,

6.1.9 Snow surface characteristics, and

6.1.10 Rim selection.

7. Apparatus

7.1 The test vehicle shall have the capability of maintaining the specified test speed ± 0.8 km/h (± 0.5 mph) during all levels of driving torque application.

7.2 The test vehicle shall be equipped with an automatic throttle actuator to allow the gradual increase of driving torque at a predetermined (repeatable) rate.

7.3 The test vehicle shall be a rear drive, four wheel passenger car or a light truck less than or equal to 44.5 kN (10 000 lbf) GVW. The range of test tires and load conditions will determine the vehicle size and selection. Utilizing a front wheel drive test vehicle is not addressed in this standard although the basic procedures could be applied with appropriate conditional modifications.

7.4 The test vehicle shall be instrumented to measure longitudinal and vertical forces at the tire and test surface interface during the application of driving torque.

7.5 The test vehicle shall have provisions to automatically and completely disengage the brake on the test wheel (if installed) prior to throttle application. Complete disengagement is necessary to eliminate all drag that might be caused by the brake assembly.

7.6 *Opposite Tire:*

7.6.1 The tire installed opposite the instrumented test wheel shall have a sufficiently large traction coefficient to minimize slip of this tire during the traction test. The opposite tire should have a coefficient at least 50 % greater than the expected coefficient of the test tire. A tire chain may be utilized to increase the traction of the opposite tire when testing on snow surfaces.

7.6.2 The opposite tire shall be selected to have an outside diameter that is within ±2.5 cm (±1 in.) of that of the test tire.

7.7 A suitable ride height adjustment system on the rear axle shall be provided to permit adjustment for each tire size and load to minimize transducer crosstalk as established during calibration.

7.8 *Instrumentation*—The test wheel position on the test vehicle shall be equipped with a wheel rotational velocity measuring system and with transducers to measure the dynamic longitudinal force and vertical load at the test wheel.

7.8.1 *General Requirements for Measurement System*—The instrumentation system shall conform to the following overall requirements at ambient temperatures between –23 and 43°C (–10 and 110°F):

7.8.1.1 *Overall system accuracy, force*—± 1.5 % of vertical load or traction force from 450 N (100 lbf) to full scale.

7.8.1.2 *Overall system accuracy, speed*—± 1.5 % of speed from 6.4 km/h (4.0 mph) to 48.0 km/h (30.0 mph).

7.8.1.3 *Shunt Calibration*—All strain-gage transducers shall be equipped with shunt calibration resistors that can be connected before or after test runs. The calibration signal shall be in the range of the expected measurement for each analogue channel..

7.8.1.4 *Ruggedness*—The exposed portions of the system shall tolerate 100 % relative humidity (rain or spray) and all other adverse conditions such as dust, shock, and vibrations which may be encountered in regular operation.

7.8.2 *Vehicle Speed*—Vehicle forward speed (normally obtained from a front non-driven wheel on the test vehicle) shall be measured digitally with an encoder or optical system having a minimum of 500 counts per revolution. Output shall be directly visible to the driver and shall be simultaneously recorded. It may be necessary on a very low coefficient surface, i.e., ice, to disconnect any braking action to the wheel being utilized for measuring vehicle speed. A separate fifth-wheel system may be utilized to measure vehicle forward speed.

7.8.3 *Test Wheel Speed*—Test wheel speed shall be measured digitally with an encoder or optical system having a minimum of 1000 counts per wheel revolution. The output shall be recorded.

7.8.4 *Vertical Load*—The vertical load-measuring transducer shall measure the vertical load at the test wheel during driving torque application. The transducer full scale range shall be in excess of the dynamic loading during a test. Data points shall be evaluated to ensure dynamic loading is within the calibrated range of the transducer. The static load should be less than 80 % of the calibrated range. The transducer design and location shall minimize inertial effects and vibration-induced mechanical resonance. The transducer shall have an output directly proportional to the force with less than 1 % hysteresis and less than 1 % nonlinearity at full scale. It shall have less than 2 % cross-axis sensitivity at full scale. The transducer shall be installed in such a manner as to experience less than 1° angular rotation with respect to its measuring axes at a maximum expected driving torque. The transducers typically have a minimum full scale range of 0 to 8.9 kN (2000 lbf).

7.8.5 *Driving Traction Forces*—The driving traction force-measuring transducers shall measure longitudinal force generated at the tire-road interface as a result of driving torque application with a full scale range of at least 100 % of the applied static vertical load. Otherwise, the transducers shall have the same specifications as those described in 7.8.4.

7.8.6 *Signal Conditioning and Recording System*—All signal conditioning and recording equipment shall provide linear output with necessary gain and reading resolution to meet the requirements of 7.8.1. Additionally, it shall have the following specifications:

7.8.6.1 *Minimum Frequency Response*—flat from dc to 18 Hz, within ±1 %,

NOTE 1—Based on a study of a sample acquisition and force transducer system, a resonant frequency of 20 Hz was measured.

7.8.6.2 *Signal-to-Noise Ratio*—at least 20/1,

7.8.6.3 Gain shall be sufficient to permit full-scale display for full-scale input signal level,

7.8.6.4 Input impedance shall be at least ten times larger than the output impedance of the signal source,

7.8.6.5 The system must be insensitive to vibrations, acceleration, and changes in ambient temperature. The error in reading shall not exceed 1 % full scale when subjected to vibration acceleration of 49.0 m/s^2 (5 g's) in the 0.5 to 40 Hz frequency range and operating temperature range from –23 to 43°C (–10 to 110°F),

7.8.6.6 The system shall not be affected by storage temperature variations between –40 and 71°C (–40 and 160°F),

7.8.6.7 The individual data inputs shall have a sample rate of not less than 100 samples/s. For a given sample, vehicle speed, test wheel speed, vertical load, and driving traction force shall all be recorded within 0.0005 s,

7.8.7 *Power Supply*— The power supply for transducers and recording system shall meet or exceed requirements specified by transducer and recorder manufacturers.

7.8.8 Temperature measurement devices for taking surface and ambient temperatures shall have a resolution of 0.5°C (1°F) and an accuracy of ±1°C (±2°F).

8. Calibration

8.1 All instrumentation shall be calibrated within six months prior to testing.

8.2 Calibrate the reference load cell by inputting known vertical and horizontal forces. The known forces must be traceable to the National Institute of Standards and Technology (NIST).

8.3 Calibrate the transducer for measuring vertical and horizontal forces on the test wheel with the reference load cell in accordance with Practice F377.

8.3.1 For longitudinal force calibration, place vehicle transmission in "park" position. Restrain the test vehicle using the vehicle brakes normally used while testing.

8.4 Calibrate the vehicle and test tire speed transducers and any other instrumentation in accordance with the manufacturers' specification.

8.5 Calibrate temperature measuring devices (snow and ambient temperatures) in accordance with the manufacturer's recommendations.

9. Selection and Preparation of Test Tires

9.1 Ensure all test tires are approximately the same age and stored essentially at the same conditions prior to testing unless otherwise specified.

9.2 Test tires shall have no evidence of force or run-out grinding.

9.3 New test tires shall be trimmed to remove all protuberances in the tread area caused by mold air vents or flashing at mold junctions.

9.4 Any objects (for example, shipping labels) in the tread area shall be removed prior to testing.

9.5 Tires that have been buffed to simulate wear must be prepared and run until all evidence of buffing is removed in accordance with Guide F1046.

9.6 Mount the test tires on rims specified by the appropriate tire and rim standards organization, using conventional mounting methods. Ensure proper bead seating by the use of a suitable lubricant. Excessive use of lubricant should be avoided to prevent slipping of the tire on the wheel rim.

9.7 Test tire balance is not necessary.

9.8 New test tire break-in is optional, however, the design of the test may necessitate on-the-road conditioning of up to 322 km (200 miles). Tire break-in may improve repeatability of results on ice surfaces.

9.9 Mounted test tires shall be placed near the test site in such a location that they all have the same temperature prior to testing. Test tires should be shielded from the sun to avoid excessive heating by solar radiation.

9.10 Test tires shall be checked and adjusted for specified pressure just prior to testing.

10. Preparation of Apparatus

10.1 All transducers and instrumentation shall have been calibrated in accordance with Section 8.

10.2 Turn on the test vehicle instrumentation and allow it to warm up as required for stabilization.

10.3 Ensure the test vehicle has sufficient fuel to complete a test matrix.

10.4 Maneuver the test vehicle to the tire changing area.

10.5 Position the temperature measurement devices.

10.6 Allow sufficient time to ensure that the temperatures of all equipment have stabilized.

10.7 Set the front speed reference tire or fifth wheel to the pressure utilized during the speed calibration ±3.5 kPa (±0.5 psi). Non-test rear tire pressures should be set as appropriate.

10.8 Perform a resistive shunt calibration on the force transducers once per day at a minimum. It is recommended that a resistive shunt calibration check be performed at the start and end of each testing day.

11. Procedure

11.1 *Course Surface*—See Annex A1-Annex A4 for environmental and snow properties, surface characterization, course preparation, and course maintenance. When testing to the requirements of "RMA Definition for Passenger and Light Truck Tires for use in Severe Snow Conditions,"[3] a medium-packed snow surface shall be used.

11.2 Lift the rear axle so that the rear tires are off the ground.

11.3 Install a control or candidate tire at the test wheel position with the vehicle jacked up.

11.4 Opposite the test wheel position install a tire that has an outside diameter within ±2.5 cm (±1 in.) of the test tire. A chained tire is optional in snow.

11.5 Record basic test information and tire conditions. Ambient and surface temperatures shall be updated with each control tire.

11.6 With the transmission in park or neutral, tare vertical load and tractive force by zeroing the signals.

11.7 Verify the vehicle and test wheel speeds are zero.

11.8 Lower the rear axle, placing the tires on the ground.

11.9 Ballast the test tire for the desired load, ±22 N (±5 lbf), and set the tire to the specified test inflation pressure, ±3.5 kPa (±0.5 psi). One of the following three options shall be selected for determining load and inflation pressure for testing. The option selected shall be noted in the final report. See Annex A5 for examples of load and pressure determination for options 1 and 2.

NOTE 2—A P195/75R14 SRTT (Specification E1136) control tire is tested at a load of 468 kgf (1031 lbf) and a pressure of 240 kPa (35 psi).

11.9.1 Option 1. The test load for passenger car tires shall be the lower value of 85 % of the 180 kPa (26 psi) load recommended in the Tire & Rim Association Yearbooks[4] or

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

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

567 kgf (1250 lbf). The test load for light truck tires (LT-metric) shall be 567 kgf (1250 lbf). An inflation pressure of 240 kPa (35 psi) shall be used for passenger tires and 345 kPa (50 psi) shall be used for LT-metric tires.

11.9.2 Option 2. The test load shall be equal to 74 % of the test inflation rated load. The test inflation rated load for XL tires shall be determined at 280 kPa (41 psi). The test inflation rated load for LT-metric and commercial vehicle light truck tires shall be determined at 345 kPa (50 psi). This option meets the requirement for equivalent percentage loads as specified in the "RMA Definition for Passenger and Light Truck Tires for use in Severe Snow Conditions."[3]

11.9.3 Option 3. The test tire loads and inflation pressures shall be any other loads and pressures required to meet the individual requirements of a specific test program.

11.10 Adjust the vehicle ride height to the value established during the calibration for minimum crosstalk taking into account differences in tire dimensions.

11.11 Re-verify test load. Adjusting vehicle ride height may change the test load. Several load/ride height adjustments may be necessary before meeting both requirements.

11.12 Calibrate the test wheel speed for each test tire by bringing the vehicle up to approximately 8 km/h (5.0 mph). Place the vehicle in neutral and adjust the test wheel speed to be equal to vehicle speed. Care must be taken to see that the vehicle is going in a straight line without tire slippage during speed calibration.

11.13 Set the automatic throttle applicator to keep fore-aft force increase to less than a maximum of 1780 N/s (400 lbf/s).

11.14 Begin a test by activating the automatic throttle applicator when on the test course. A straight line should be maintained throughout testing and a smooth modulated brake load applied to maintain an 8.0 ± 0.8 km/h (5.0 ± 0.5 mph) test vehicle speed. In the course of testing do not use any test run when a test tire digs through the base material or where the average vehicle speed is outside 8.0 ± 0.8 km/h (5.0 ± 0.5 mph).

11.15 Repeat step 11.14 a minimum of ten times. At the completion of ten or more test runs, process the data and examine for a minimum of eight valid test runs after outliers (individual test run data values more than 1.5 standard deviations from the calculated average) have been eliminated and for a calculated sample coefficient of variation (C.V.) less than 0.15 (15 %). If requirements are met, record data and return to the tire changing area. Rerun the test tire if requirements are not met. Surface monitoring tire (SRTT, Specification E1136) coefficients should be noted, ensuring compliance with the specified range 0.25–0.41 for medium pack snow.

11.16 Run a control tire at the beginning and end of each test sequence or test matrix and every third test in between. For example: C, T1, T2, C, T3, T4, C, where C represents a control tire and T represents a candidate tire.

NOTE 3—A single control or candidate tire may be used repeatedly as long as the tread surface maintains a "new" appearance.

11.17 Each candidate tire should be tested at least three times, preferably on different days.

11.18 Each new test tire shall be run on a surface as near as possible to the previous pass. Care must be taken not to allow the test tire to drift into disturbed snow used during previous test runs.

11.19 Testing continues until the total test sequences or test matrix is completed or the available test surface is exhausted. Regrooming the course will normally allow testing to continue.

12. Calculation

12.1 For each test run of each control and candidate tire, read from accumulated data the values of longitudinal force and vertical load corresponding to the values of longitudinal slip velocity within the range 1.6 and 24 km/h (1 and 15 mph) or a range starting at 3.2 km/h (2 mph) and continuing for 1.5 s. Calculate the average force and load values over the specified slip or time range. Calculate the average values of driving coefficient as follows:

$$u = \frac{F}{W} \tag{1}$$

where:

u = average driving coefficient,
F = average longitudinal force kN or lbf, and
W = average vertical load kN or 1bf.

12.2 Calculate the values of longitudinal slip velocity as follows:

$$V_S = \frac{V_o(W_d - W_o)}{W_o} \tag{2}$$

where:

V_s = longitudinal slip velocity km/h or mph,
V_o = test vehicle speed km/h or mph,
W_o = spin velocity of non-driven wheel, and
W_d = spin velocity of driven wheel.

12.3 Calculate the average value of test run driving coefficients for each test tire and the value of sample standard deviation for ten or more test runs. Eliminate any individual test run value more than 1.5 standard deviations from the calculated average. A minimum of eight test runs shall remain. Recalculate the average and standard deviation for each test tire.

12.4 Calculate the traction test coefficient of variation as follows:

$$\text{C.V.} = \frac{\text{Sample Standard Deviation}}{\text{Mean}} \tag{3}$$

If the data have a C.V. greater than 0.15, the tire data set should not be used and the entire test run shall be repeated.

13. Data Adjustment Procedures

13.1 The traction performance (traction coefficients) of the candidate tires in any extended sequence of testing may vary due to changing environmental or other test conditions. To evaluate traction performance without this potentially perturbing influence it is common practice to adjust or correct candidate tire coefficients based on the values obtained for one or more control tires tested throughout the evaluation program.

13.2 Practice F1650 is the reference standard that gives a comprehensive background and recommended control and candidate tire test sequence as well as procedures for making these corrections. (See Section 7.) Practice F1650 permits corrections to be made if there is any significant time trend or other perturbation in environmental or other testing conditions during the testing program.

13.3 Other correction procedures are also in current use. These are the Gradient Correction Procedure and the Average Correction Procedure. The calculation algorithms for these two are given below. The Gradient Procedure which uses weighted control tire values for correcting candidate tire coefficients is equivalent to the procedure as given in Practice F1650, Annex A2. (See Plan A or B.)

13.4 *Gradient Correction Method*—The gradient method makes adjustments for changes of control tire values that bracket the candidate tire runs. For the normal sequence of Control 1, Candidate Tire 1, Candidate Tire 2, Control 2, the traction performance index (TPI) rating is computed as follows:

$$\text{TPI }(T_1) = \frac{\text{TC }(T_1)}{\text{TC }(C_1) + 1/3\,[\text{TC }(C_2) - \text{TC }(C_1)]} \times 100 \tag{4}$$

$$TPI\,(T_2) = \frac{\text{TC }(T_2)}{\text{TC }(C_1) + 2/3\,[\text{TC }(C_2) - \text{TC }(C_1)]} \times 100 \tag{5}$$

where:

TC (T_1) = Average Tractive Coefficient Candidate Tire 1,
TC (T_2) = Average Tractive Coefficient Candidate Tire 2,
TC (C_1) = Average Tractive Coefficient First Control Run, and
TC (C_2) = Average Tractive Coefficient Second Control Run.

13.4.1 The TPI for second and subsequent candidate tires is calculated utilizing the new bracketing control tire values, that is, C_2 and C_3, C_3 and C_4, etc.

13.5 *Average Correction Method*—Calculate the average value of all control tire driving coefficients within a day's test tire matrix. To obtain the traction performance index (TPI) rating, divide individual candidate tire driving traction coefficient values by the tire matrix average control tire coefficient and multiply by 100 to obtain the TPI:

$$\text{TPI} = \frac{\text{Coefficient (Candidate Tire)}}{\text{Coefficient (Control Tire Avg.)}} \times 100 \tag{6}$$

14. Report

14.1 Report the following information:

14.1.1 Candidate tire TPI (rating).

14.1.2 Correction method applied to the "as measured" tractive coefficient.

14.1.3 Ambient and surface temperatures.

14.1.4 Type of surface.

14.1.5 Tire I.D., load and inflation.

14.2 State that the test was performed in accordance with ASTM Test Method F1805

15. Precision and Bias

15.1 *Precision*—Data are not yet available for making a statement on the precision or reproducibility of this test method. When such data becomes available, a statement on precision will be included in the method.

15.2 *Bias*—There are no standards or reference values with which the results of this test method can be compared. The function of the test as indicated in the scope is to be able to make comparisons among types of tires tested within the same test program. It is believed that the results of the test method are adequate for making such comparisons without external references for assessing bias.

16. Keywords

16.1 driving traction (snow, ice); single test wheel vehicle; snow/ice surfaces; traction measurement

ANNEXES

(Mandatory Information)

A1. ENVIRONMENTAL AND SNOW PROPERTIES

A1.1 Snow and ice surfaces often exhibit significant variation in traction properties due to changes in temperature and other climactic conditions. For determining relative tire performance on snow or ice surfaces, or both, it is necessary to be able to quantify these conditions.

A1.1.1 *Temperature*—Air and surface temperature shall be measured throughout testing at least at every control tire run.