Designation: F559 – 05 (Reapproved 2017)

Standard Test Method for Measuring Length of Road Test Courses Using a Fifth Wheel[1]

This standard is issued under the fixed designation F559; 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 the determination of the accurate length measurement of road courses used for testing all types of pneumatic tires on various associated vehicles.

1.2 This test method is intended for use on public highways or closed circuit test courses, or both, that cannot be measured practically by surveying techniques.

1.3 Use of this test method requires that the surface of the test course to be measured shall be sufficiently smooth to preclude bounce or hop of the fifth wheel, which will affect the accuracy of the measurement. The normal highway surface is adequate for this test method.

1.4 It is not the intent or scope of this test method to encompass distance measurements of test courses whose surfaces are irregular, broken up, jagged, and so forth, such as rock courses, Belgian block, "rumble" surfaces, and the like. Snow- and ice-covered surfaces also are excluded.

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

1.6 *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.*

1.7 *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]

F457 Test Method for Speed and Distance Calibration of Fifth Wheel Equipped With Either Analog or Digital Instrumentation

F538 Terminology Relating to the Characteristics and Performance of Tires

F1082 Practice for Tires—Determining Precision for Test Method Standards (Withdrawn 2005)[3]

3. Terminology

3.1 *Definitions*—See Terminology F538 for terminology used in this test method.

4. Summary of Test Method

4.1 This test method includes the use of a fifth wheel of known accuracy, incorporating a distance counter that is attached to the test vehicle and used to measure distances traveled by that vehicle.

5. Significance and Use

5.1 Maps, automobile odometers, and highway and distance markers are not sufficiently accurate to describe the length of a route for tire testing purposes. The proposed procedure describes a test method for measuring the length of a road course with sufficient accuracy for tire testing purposes.

6. Apparatus

6.1 *Fifth Wheel*—The fifth wheel shall meet the requirements of Test Method F457 and shall incorporate an odometer or distance counter capable of accumulating the distance of the course to be measured. Preferably, the distance counter readout will be in units of 1 m (3.28 ft) or a minimum of 0.25 revolution of the fifth wheel. In any case, the distance readout shall meet the requirements of Test Method F457.

[1] This test method is under the jurisdiction of ASTM Committee F09 on Tires and is the direct responsibility of Subcommittee F09.10 on Equipment, Facilities and Calibration.

Current edition approved May 1, 2017. Published July 2017. Originally approved in 1978. Last previous edition approved in 2010 as F559 – 05 (2010). DOI: 10.1520/F0559-05R17.

[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.

7. Procedure

7.1 Attach the fifth wheel to the rear of the vehicle at a point not in line with the vehicle wheelpath but midway between the vehicle wheelpaths.

7.2 Adjust the fifth wheel tire inflation pressure to the manufacturer's specification.

7.3 Warm up the fifth wheel by running a minimum of 3 km (2 miles) at approximately 65 km/h (40 mph).

7.4 Calibrate in accordance with Test Method F457.

7.5 With the fifth wheel in contact with the road surface, drive the vehicle to the starting point of the test course to be measured. Set its odometer or counter to zero. If the unit is non-resettable, record the reading.

7.6 Drive the vehicle from the starting point of the course completely through the course. At the end of the course, record the reading on the fifth wheel odometer or counter. If the counter is non-resettable, subtract the initial reading at the start of the course from the reading at the end of the course. This figure represents the distance traveled by the vehicle within the tolerances as specified in Test Method F457. If the course is sufficiently long that rest or meal breaks are required, then record each "leg" driven between starting and stopping point before turning off the ignition switch. This operation eliminates extra counts caused by high-frequency pulses generated by the ignition or buzzer system of the vehicle. Compute the total at the finish of the course.

7.7 Repeat measurement of the course a minimum of four times.

7.8 While driving the course, take care to drive as consistently as is reasonable, with as few lane changes as possible. Take care also to drive at a sufficiently slow speed to preclude bounce of the fifth wheel either from road irregularities or from imbalance of the fifth wheel.

7.9 Recalibrate the fifth wheel, within 15 min after completing the course.

8. Calculation

8.1 Calculate the arithmetic average, standard deviation, and 95 % confidence interval for the average.

8.2 Report the average length and confidence interval.

9. Precision and Bias

9.1 Three different testing organizations using a state-of-the-art fifth wheel that meets Test Method F457 requirements measured the length of three separate 1-mile (1609.3-m) courses, each course being in its respective locality. Each testing organization made six replicate measurements of its respective 1-mile course.

9.2 Table 1 gives the results of the measurement. The pooled or overall standard deviation is 0.11 m (0.35 ft). Bias (expressed as the difference of measured distance in ft—5280.0) shows values that range from +0.37 m (+1.2 ft) to −0.30 m (−1.0 ft).

9.3 *Precision*—The precision is expressed as recommended in Practice F1082 in terms of a repeatability, r, where $r = 2.83\ S_r$.

9.3.1 *Repeatability*—Typical state-of-the-art fifth wheels give a repeatability of 0.30 m (1.0 ft) when measuring a course of exactly 1609.3 m (5280.0 ft). If the difference between two nominally identical and properly calibrated fifth wheels is less than 0.30 m (1.0 ft) (or 0.02 %) when measuring a 1609.3-m (1-mile) course, the two fifth wheels may be assumed to be equivalent in precision.

9.3.2 *Bias*—The bias (expressed as mean distance in ft—5280.0) of typical state-of-the-art fifth wheels has been found to vary as to direction, between +0.37 m (+1.2 ft) to −0.30 m (−1.0 ft). This is equivalent to a magnitude of 0.02 %, which may be either positive or negative.

9.4 The precision and bias as expressed in this section pertain to a 1-mile (1609.3-m) course. The precision and bias of the length of courses longer than 1 mile (1609.3 m) may be different, and if simple additivity of precision and bias applies, the precision parameters found for a course of n miles should be n times the values found for 1 mile (1609.3 m) (in absolute units, ft (m)).

10. Keywords

10.1 automotive; distance measurement; fifth wheel; road course; tire testing; treadwear

TABLE 1 Results of Precision and Bias Evaluation of Fifth Wheel Measurement of a 1609.3-m (5280.0-ft) Course

Testing Organization	Measured Length, ft (m)	(S_r) Standard Deviation, ft (m)[A]	Bias, ft (m)[B]
1	5281.2 (1609.7)	0.28 (0.09)	+1.2 (0.37)
2	5280.0 (1609.3)	0.43 (0.13)	0.0 (0.00)
3	5279.0 (1609.0)	0.33 (0.10)	−1.0 (−0.30)
Average or pooled values	5280.1 (1609.4)	0.35 (0.11)	0.08 (0.02)

[A] Standard deviation for six replicate measurements of the 1-mile (1609.3-m) course.
[B] Bias = measured distance in ft—5280.0.