Designation: D 5859 – 96ε1

An American National Standard

Standard Test Method for Determining the Traction of Footwear on Painted Surfaces Using the Variable Incidence Tester[1]

This standard is issued under the fixed designation D 5859; 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.

ε[1] NOTE—Per Committee F13 Bylaws, editorially replaced term definitions with reference to Terminology F 1646 in January 2004.

1. Scope

1.1 This test method covers the measurement of the traction of footwear on painted walkway surfaces under both dry and wet conditions in the laboratory and the field.

1.2 The values stated in inch-pound units are to be regarded as the standard. The SI values given in parentheses are provided for information only.

1.3 *This test method 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:*

F 1646 Terminology Relating to Safety and Traction for Footwear[2]

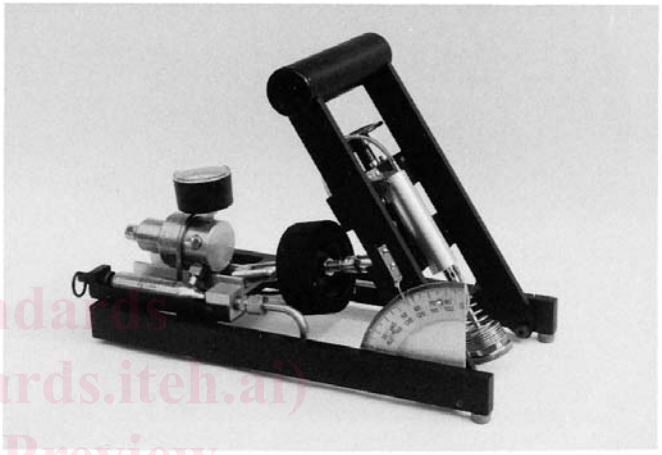

FIG. 1 Variable Incidence Tester

3. Terminology

3.1 See Terminology F 1646 for the following terms used in this test method:

3.1.1 Friction, and

3.1.2 Coefficient of friction.

4. Summary of Test Method

4.1 The variable incidence tester, shown in Fig. 1,[3] operates independent of gravity and is self-powered by a miniature carbon dioxide cartridge. It uses an articulated strut but differs from the James and Hunter machines. Its fluidics actuation applies the load to a slider shoe instantaneously, thereby overcoming the well-known "stiction" problem that arises from the delay between the time the slider is set down onto the surface and the time it starts to slip.

4.2 As the test progresses, the shoe descends, makes contact with the substrate, and continues to be subjected to the constant vertical load, in addition to an increasing horizontal or tangential load, until slip occurs. The tangent of the angle that the tester makes with respect to the vertical, at the instant of slip, is taken to be the ratio of the horizontal and vertical components of the force applied to the shoe and thus the coefficient of friction.

4.3 When slippage occurs, the strut will kick out in an arc. The angle at which slippage just begins to occur, which is read from the protractor scale, is the slip index or the static coefficient of friction.

5. Significance and Use

5.1 The variable incidence tester[3] is a laboratory and field instrument designed to measure the slip resistance of paint or related materials to determine their traction properties in a

[1] This test method is under the jurisdiction of ASTM Committee F13 on Safety and Traction for Footwear and is the direct responsibility of Subcommittee F13.10 on Traction.

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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] The English XL, is covered by a patent held by William English and is available from William English, Inc., 20500 North River Rd., Alva, FL 33920. It has been found suitable for this use. Interested parties are invited to submit information regarding the identification of acceptable alternatives to this patented item to the Committee on Standards, ASTM Headquarters, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

clean and dry state or in the presence of environmental contaminants encountered in situ.

5.2 The indication of this test apparatus is believed to relate slip resistance of the surface tested in the test environment. It does not contemplate floor materials, characteristics of individual human gaits, and other factors besides the floor surface conditions.

5.3 The relative slip resistance of a floor surface may be measured under wet or dry conditions or in the presence of other environmental contaminants using the specific foot assembly.

6. Apparatus

6.1 *Variable Incidence Tester*[3]—The tester is constructed as follows:

6.1.1 *Chassis*—A rigid welded aluminum frame fabricated from ⅜ by 1-in. (9 by 25-mm) flat bar fitted with three slip-resistant feet that rest on the test surface.

6.1.2 *Mast Assembly*—A rigid welded aluminum frame fabricated from ¼ by 1-in. (6 by 25-mm) flat bar attached to the chassis with a hinge joint that permits it to be inclined from vertical 90° to 45°.

6.1.3 *Handle*—A 1-in. (25-mm) diameter aluminum tube bolted to the top of the mast assembly that can be used to lift and carry the tester and is grasped to apply a downward force to the tester to prevent sliding on the test surface while operating.

6.1.4 *Actuating Cylinder*—A miniature pneumatic cylinder is mounted to the mast assembly by a hinged joint to permit swinging of the universal foot when slippage occurs.

6.1.5 *Universal Foot Assembly*—A universal joint between the slider disc and the piston rod of the actuating cylinder permits the operating force to apply the slider to the test surface in a manner not unlike the human foot in walking. A coil spring brings the universal foot to approximate neutral alignment following each power stroke.

6.1.6 *Articulated Strut*—The actuating cylinder and universal foot assembly comprise the articulated strut. It is the movement of this assembly about its hinge pin that permits the slippage of the foot.

6.1.7 *Control Valve*—A four-way pneumatic spindle valve attached to the mast assembly actuates the power cylinder and causes it to stroke.

6.1.8 *Pressure System*—The pressure operation of the tester is powered by a compressed gas source mounted on the rear of the chassis. It consists of a miniature liquid carbon-dioxide cartridge supplying high-pressure that is reduced to a working pressure of 40 psi (276 kPa) by a pressure regulator. This regulated pressure is piped to the control valve by tubing that flexes to accommodate mast inclination variations.

7. Test Sensor

7.1 The slider pad[4] is prepared by cutting a disc of 1.25-in. (3.2-cm) diameter elastomer and affixing it to the bottom of the universal foot, sheen side exposed, using epoxy cement or other suitable adhesive.

7.2 The slider pad is then prepared by sanding with 400-grit wet or dry silicon carbide paper in the dry condition, backed by a flat surface, until all the sheen is removed. The edges should be slightly beveled to remove any sharp edges. Sanding particles should then be dusted off with a clean paint brush.

7.3 Following initial preparation, the foot is screwed onto the nut on the universal joint. Screw the joint together until snug and then back off ¼ turn.

8. Reagents and Materials

8.1 *Silicon Carbide Paper*, 400-grit wet or dry.
8.2 *Cleaner.*[5]
8.3 *Standard Slider Pad.*[4]
8.4 *Rags, Sponge or Paper Towels*.
8.5 *Distilled Water*.
8.6 *Hand-Pumped Spray Bottle*.
8.7 *Paint Brush*.
8.8 *Two (2) Part Epoxy Adhesive*.
8.9 *Soft Fiber Bristle Brush*.
8.10 *Double-Stick Tape*.

9. Tester Operational Check

9.1 Place the tester on a flat surface.

9.2 Insert a pressurized gas cartridge into its holder on the chassis and tighten the clamp screw until pressure registers on the gage.

9.3 Cycle the tester twice to verify that the piston shaft moves freely and stabilizes the working pressure.

10. Procedure (Dry)

10.1 The test area or test specimens shall not be less than 2 in.^{2} (5 cm^2).

10.2 Before testing is begun, clean the test surface with a soft fiber bristle brush and cleaner at a dilution rate of one part cleaner to ten parts distilled water. Rinse the surface with distilled water and let air dry.

10.3 Resurface the slider pad after each fill slip tested with 400-grit wet or dry silicon carbide paper, in the dry condition, using a sanding block to back up the paper in a flat configuration. Remove sanding residue with a dry paint brush.

[4] Neolite®, registered trademark with Goodyear Tire and Rubber Company is a suitable slider material. This sensor material may be obtained from Smithers Scientific Services Inc., 425 West Market Street, Akron, OH 44303. Specify" Standard Neolite® Liner," Nominal size, 6 by 6 in.; 3.78 irons (2 mm), color, Natural 11; specific gravity, 1.27 ± 0.02; hardness Shore A, 93–96.

[5] Hillyard's Renovator® #120, available from Hillyard, Inc., 302 North 4th Street, St. Joseph, MO 64502, has been found suitable for our testing.