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An American National Standard

Standard Test Method for Using a Variable Incidence Tribometer (VIT)[1]

This standard is issued under the fixed designation F 1679; 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—Section 11 was corrected editorially in July 2005.

1. Scope

1.1 This test method covers the operational procedures for using a variable incidence tribometer[2] (VIT) for determining the slip resistance of planar walkway surfaces or walkway surrogates (test surfaces) and can be used for footwear bottom materials and surrogates (test feet) in either the laboratory or field under dry, wet, or contaminated conditions. This test method does not address all methodological issues (for example, test surface and test foot material selection and preparation, experimental design, or report preparation).

1.2 The values stated in inch-pound units are to be regarded as the standard.

1.3 *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:*

F 1646 Terminology Relating to Safety and Traction for Footwear[3]

3. Terminology

3.1 *Definitions*—For definitions of terms, refer to Terminology F 1646.

4. Significance and Use

4.1 The VIT is designed to determine the slip resistance of walkway surfaces or surrogates and footwear bottom materials or surrogates under field or laboratory conditions so that their slip-resistant properties may be evaluated.

4.2 The measurement made by this apparatus relates to slip resistance. Other factors such as environmental conditions can affect slip resistance. When this test method is used in field tests, relevant factors shall be described.

5. Apparatus

5.1 *Mast Assembly*—A rigid metal frame attached to the chassis with a hinge joint permitting its inclination to any angle from vertical to 45°. A hand wheel is attached between the mast assembly and the chassis to adjust the angle of the mast. The top of the mast assembly consists of a round metal handle that can be used to carry the tester or to apply a downward force while testing to prevent slippage. A pointer on the mast assembly indicates the slip index value for each inclination of the mast.

5.2 *Actuating Cylinder*—A pneumatic cylinder mounted to the mast assembly by a hinged joint to permit the test foot assembly to swing when a slip occurs.

5.3 *Test Foot Assembly*—The combination of (*1*) the actuating cylinder, (*2*) the piston, (*3*) a round aluminum shoe that screws onto a nylon nut holding it on the piston ball joint, (*4*) the test foot that is glued onto the shoe, and (*5*) a spring that holds the shoe perpendicular to the piston.

5.4 *Pressure System*—The pneumatic system that drives the actuating cylinder consists of a 12-g carbon dioxide cylinder, tubing that runs to a variable pressure regulator, and tubing that runs to the actuating valve. Pressing the actuating valve pressurizes the actuating cylinder and drives the test foot onto the surface being tested.

6. Test Foot Preparation and Test Surfaces

6.1 *Test Foot Preparation*:

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

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[2] The English XL is covered by a patent held by William English. The sole source of supply of the apparatus known to the committee at this time is William English, Inc., 20500 North River Rd., Alva, FL 33920. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee [1], which you may attend.

[3] 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.

6.1.1 Securely attach a 1.25-in. diameter disc of the desired test foot material to the round aluminum shoe. Attachment methods include epoxy cement, super glue, or double-sided carpet tape cut to fit the size of the foot.

6.1.2 Preparation of the test foot surface will depend on the material, and should be described in detail in reporting so it can be reproduced. If footwear bottom material or surrogate is used, employ a preparation method suitable for that material.

6.1.3 If Neolite[4] Test Liner is used, use 180 grit silicon carbide paper in the dry condition using a sanding block to keep the sandpaper flat and rigid. Sand in a circular motion five cycles.

6.2 *Test Surface*—The test surface shall not be less than 2 in.^{2} (5 cm^2) and should be surrounded by enough material of similar thickness or placed in a suitable fixture so that the tribometer feet will be at the same elevation as the top of the specimen. The test foot material shall fit within the area of the test surface.

7. Reagents and Materials

7.1 *Gas Cartridge*—Carbon dioxide cylinder, 12 g.

7.2 *Epoxy Adhesive*, or equivalent.

7.3 *Neolite Test Liner.*[4]

NOTE 1—While the intended test foot material for this instrument is Neolite[4] Test Liner, this does not preclude the use of other materials.

7.4 *Silicon Carbide Paper*, 180–grit.

7.5 *Water Dispensing Bottle.*

7.6 *Dust brush or compressed air, or both.*

8. Operational Check

8.1 Place the tester on a flat surface.

8.2 Insert a pressurized gas cartridge into the holder on the chassis, and tighten the clamp screw until the pressure registers on the gage. Adjust the operating pressure to 25.0 ± 2 psi (172 ± 10 kPa).

8.3 Cycle the tester by pressing the actuating valve to stabilize the working pressure, and verify that the piston rod moves freely. Upon activation, the heel of the test foot should contact the test surface first.

9. Operational Procedure

9.1 Specific testing procedures may vary depending on the test foot material, surface, and contaminants used.

9.2 Install an appropriately prepared test foot onto the piston.

9.3 When testing dry floors, prepare the Neolite[4] Test Liner test foot after each slip. When testing wet or contaminated floors, preparation should be between flooring samples when there is reason to believe the test foot has become scuffed, polished, or contaminated. Prepare the test foot material in accordance with 6.1.2 or 6.1.3. Remove sanding residue with a dry brush or compressed air, or both, at a sufficient distance away from the test area to assure that sanding residue does not contaminate the test surface. Screw the test foot onto the ball joint until snug and then back-off one-quarter turn.

9.4 Place the tester onto the test surface. The test surface must be in the same plane as the tribometer's feet.

9.5 Adjust the pressure to 25 ± 2 psi.

9.6 Adjust the mast to a position vertical enough to obtain three actuations before a slip occurs.

9.7 Check to assure the pneumatic cylinder is resting against the rubber stop on the cross member of the mast.

9.8 For wet testing, apply water to the test surface so as to provide an unbroken film of water prior to each stroke.

9.9 Keep the chassis stationary and fully depress the actuating valve for approximately ½ s. If the test foot does not ″kick out″ with the piston fully extended, increase the slip index reading by turning the hand wheel no more than a one-quarter turn and retest. When the test foot ″kicks out″ with the piston fully extended, read and record the slip index protractor, estimating results to the nearest 0.01 slip index unit.

9.10 At least four determinations should be performed, at approximately 90° angles from each other. Average the readings to establish the slip index unit.

NOTE 2—For the purposes of activities such as controlled studies, a greater number of determinations may be appropriate.

9.11 *Testing Stairs and Inclined Surfaces*:

9.11.1 *Inclined Surfaces*—Sloped surfaces such as ramps are tested in the same manner as level surfaces. When testing in a downhill direction, the pneumatic cylinder must rest against the rubber stop prior to actuation. If the slope is so steep as to cause the cylinder to move away from the rubber stop, erroneous results will be produced.

9.11.2 *Stair Testing*—When testing stairs, affix the stair fixture to the underside of the chassis. Adjust its height to the approximate dimension of the riser height so that the tester is supported in the same plane as the tread when its front soft feet are positioned on the nosing of the tread. The tester will then be in a "head-on" position so that the actuation thrust will be parallel to the direction of pedestrian travel on stairs.

10. Environmental Conditions

10.1 When testing dry surfaces using Neolite[4], high humidity (90 to 95% RH) can yield slip resistance readings up to 6 % higher than low (20 to 24 % RH) or moderate (50 to 56 %) humidity environments. This variance is more pronounced on polished surfaces, and less so on textured surfaces. Low and moderate humidity environments have no measurable impact on dry test results. Similarly, wet testing is unaffected by humidity levels.

11. Precision and Bias

11.1 The precision and bias of the tester is being determined.

12. Keywords

12.1 dry surface testing; environmental contaminants; field testing; slip resistance; tribometers; wet surface testing

[4] Neolite®, registered trademark with Goodyear Tire and Rubber Company is a suitable test foot material. The sole source of supply of the apparatus known to the committee at this time is Smithers Scientific Services, Inc., 425 West Market Street, Akron, OH 44303. Specify ″Standard Neolite® Liner,″ Nominal size, 6 by 6 in.; 3 mm, color, Natural 11; specific gravity, 1.27 +/- 0.02. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee [1], which you may attend.