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An American National Standard

Standard Test Method for Using a Horizontal Pull Slipmeter (HPS)[1]

This standard is issued under the fixed designation F609; 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 measurement of the slip index of footwear sole, heel, or related materials on dry walkway surfaces in the laboratory and in the field.

1.2 The dimensional values used in the test method are given in units of inches, pounds, or degrees Fahrenheit. Alternative equivalent values are in parentheses and are for informational purposes only.

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:*[2]

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

F1646 Terminology Relating to Safety and Traction for Footwear

3. Terminology

3.1 For definitions of terms, refer to Terminology F1646.

4. Significance and Use

4.1 The Horizontal Pull Slipmeter[3] is a laboratory and field instrument designed to provide information about the slip index characteristics between walkway surfaces and a test foot material under dry conditions only. The HPS can not be used on wet surfaces. Slip index can be affected by surface roughness, presence of water, contaminants such as grease and other foreign materials, and floor surface wear over time. Slip index, as determined by the HPS, most likely will not give useful information for evaluating liquid contaminated surfaces, and therefore, will not provide an effective assessment of a potential slipping hazard on a walkway surface under these conditions.

4.2 The value reported by the Horizontal Pull Slipmeter is called the slip index. Slip index is ten times the static coefficient of friction. For example, a static coefficient of friction of 0.4 is displayed by a slip index of 4.0 when measured by the Horizontal Pull Slipmeter.

4.3 The HPS can be used on inclined surfaces. No adjustment for slope is needed for measurements in the direction perpendicular to the slope and when averaging four measurements at one location taken according to step 10.14.

5. Apparatus[4]

5.1 *Horizontal Pull Slipmeter*—See Fig. 1.

6. Reagents and Materials

6.1 *Silicon carbide abrasive paper,* No. 400 grit.

6.2 *Camel hair brush or other non-static bristle material.*

7. Test Foot

7.1 The test foot shall be Trademark Neolite[5] Test Liner that measure 0.5 in. (12.7 mm) in diameter and 0.25 in. (6.35 mm) to 0.2 in. (5.08 mm), but not less than 0.2 in. (5.08 mm) in thickness. When testing actual shoe materials, Neolite[5] should be replaced with the desired test materials.

7.2 A set of three test feet of the same material are required for performance of the test.

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[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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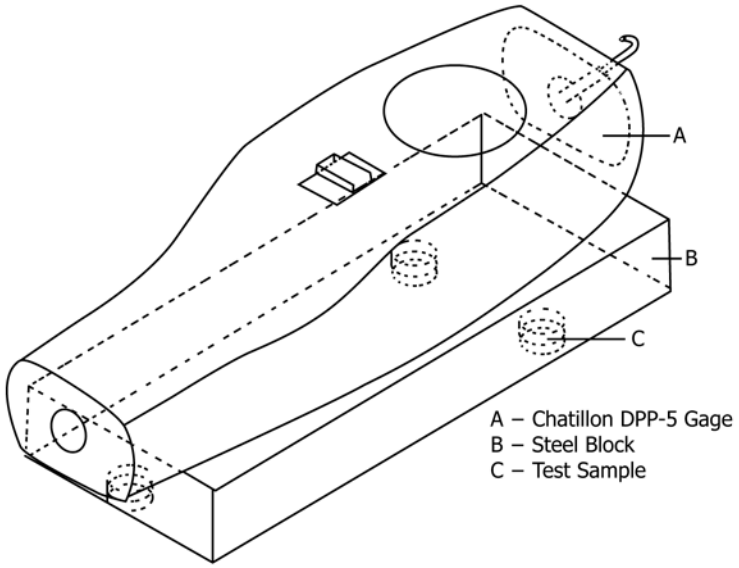
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The Horizontal Pull Slipmeter was developed by C. H. Irvine of Liberty Mutual Insurance Co., Hopkinton, MA.

[4] The sole source of supply of the apparatus known to the committee at this time is C.S.C Force Measurement Inc., 84 Ramah Circle North, Agawam, MA 01001. 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. Plans for the instrument may be obtained at a nominal cost from ASTM International Headquarters. Order ADJ12-606090-47.

[5] Neolite is a registered trademark with Goodyear Tire and Rubber Company. 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, with an average specific gravity of 1.27 ± 0.02 and an average Shore A hardness of 93–96. 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.



NOTE 1—Total weight of slipmeter less power unit is 5.95 ± 0.07 lb (2700 ± 34 g). Speed of power unit is 3.5 ± 0.5 in./min. Later model Chatillon DPP-5 gages do not have a switch. Peak hold feature is found in the gage dial.

FIG. 1 Horizontal Pull Slipmeter

8. Calibration

8.1 Place the switch button, which is located just below the dial, in the center position. No switch is found on later model Chatillon DPP-5 gages. Later model gages have replaced the switch button with a peak hold mode feature.

8.2 Grasp the slipmeter and hold in vertical position.

8.3 Set the gage on zero by moving the rim on the gage.

8.4 Use a separate hook to suspend the slipmeter by the hook located on one end of the slipmeter. The slipmeter should hang freely.

8.5 The needle on the dial of the gage should be within calibration range as indicated on the dial. If it is not within the calibration range, the HPS should be sent to the manufacturer[4] for calibration.

9. Conditioning

9.1 For testing in laboratories, condition test feet for at least 18 to 24 h in atmosphere maintained at 73 ± 3.6°F (22.8 ± 2°C) and 50 ± 5 % relative humidity.

9.2 When testing feet in the field or on fixed floor surfaces, conditioning of test feet in accordance with 9.1 may not be possible. The results obtained during the ruggedness test indicated that temperature could have a significant effect on the measured slip index when tested at 50° and 85°F. Interpolation has not been established to make proper adjustments for different temperature and humidity. However, it is recommended that the temperature and humidity be recorded, since these records could help explain potential inconsistencies.

10. Procedure

10.1 Insert a set of three test feet in the slipmeter recesses. Test feet can be held in place using all purpose glue.

10.2 Mount the abrasive paper on a flat 3 by 7-in. (76.2 by 77.8-mm) piece of 0.5-in. (12.7-mm) plywood.

10.3 Sand the test feet with No. 400 abrasive paper. The sanding procedure should consist of five strokes of 5 to 6 in. in length, parallel to the friction measurement direction, followed by five strokes of 5 to 6 in. in length, perpendicular to the friction measurement direction.

10.4 Lightly brush the test feet using the non-static brush to remove loose surface particles.

10.5 Place the slipmeter on its feet on the test walkway surface. The hook end shall face the power unit. Be sure all three test feet rest on the level walkway surface and not on a grout joint or other uneven surface.

10.6 Place the slipmeter power unit on the walkway surface in front of the slipmeter.

10.7 Put the switch that permits retention of maximum slip index indication in the center position. For later model Chatillon DPP-5 gages with no switch, ignore this step.

10.8 Set the slip index meter on zero by rotating the bezel until pointer meets zero on dial. For later model gages with no switch, use black knob on dial to set red needle on zero with black peak hold needle immediately to right.

10.9 Push the switch on top of the gage toward the hookless end of the slipmeter to record the maximum. For later model gages with no switch, ignore this step.

10.10 Connect the string of the power unit pulley to the hook of the slipmeter. The string should be parallel with the test surface and in line with the pulley on the power unit. Align the pulley on the power unit with the hook on the slipmeter. Be sure to keep the string alignment from the pulley straight (0 to 5°) with the hook on the slip meter. The string length between

the pulley and the hook of the slipmeter should not be too short, that is, no less than 4 in. or no more than two loops around the pulley.

10.11 Hold down the power unit with one or both hands to prevent it from moving; then depress the switch.

NOTE 1— Do not exceed 10 min dwell time between placing the test feet in contact with the walkway surface and slip index measurement. This dwell time is the time needed from 10.5 to and including 10.11. Slip index should be measured within 30 min after sanding and brushing, detailed in 10.3 and10.11.

10.12 Switch off the power unit when the slipmeter begins to move.

10.13 Record the peak slip index reading shown on the slip index gage (position of black needle). Record slip index readings in excess of 8 as >8.

10.14 Repeat 10.5 through 10.13 for a total of four times for each location. Rotate the slipmeter 90° in the same direction (clockwise or counterclockwise) after each time.

11. Report

11.1 The recording of the following items is recommended.

11.1.1 Client/customer.

11.1.2 Location/address.

11.1.3 Date and time of test(s).

11.1.4 Cite ASTM Test Method F609 was used.

11.1.5 Name of HPS slipmeter operator.

11.1.6 Address and telephone number of operator.

11.1.7 Brand, model, and serial number of HPS slipmeter used.

11.1.8 Test foot preparation protocol.

11.1.9 Specific floor location and orientation of HPS slipmeter where test was performed.

11.1.10 Type of test foot material.

11.1.11 Slope of surface tested.

11.1.12 Floor material and texture. Provide details of grout joints and floor texture for tile and brick floors, and so forth.

11.1.13 *Floor Finish*—Indicate type of finish (for example, wax, polish, or paint) applied, if any, and condition of the finish.

11.1.14 *Floor Conditions*—Indicate surface condition.

11.1.15 Indicate dry testing.

11.1.16 Temperature and relative humidity (if relevant).

11.1.17 Record each slip index reading, and record the average of four readings under dry conditions.

11.1.18 Provide any comments relative to testing.

12. Precision and Bias[6]

12.1 Six laboratories participated in the precision and bias testing using Trademark Neolite[5] Test Liner under dry conditions with six floor materials which represented typical floor materials used. There were 16 determinations, four in each direction, for each floor material. The values displayed below are slip index that are ten times static friction coefficient. The values of Sr and SR are the standard deviations for the repeatability and reproducibility, respectively, determined in accordance with Practice E691. The values of *r* and *R* specify the 95 % repeatability and reproducibility limits, respectively, for each material.

Material	Average	Sr	SR	r	R
Glazed ceramic	9.3344	0.3781	0.9670	1.0585	2.7077
OVCT	8.7917	0.6597	1.1251	1.8472	3.1502
Glazed porcelain	8.3396	03753	0.7738	1.0507	2.1665
Red quarry	8.1667	0.2861	0.5416	0.8012	1.5164
Unglazed porcelain[A]	8.1427	0.2400	0.5233	0.6721	1.4653
Glazed ceramic rough[A]	8.5469	0.2888	0.6692	0.8087	1.8738

[A] Random texture pattern

12.2 *Bias*—The bias for the HPS is yet to be determined.

13. Keywords

13.1 shoe heel; shoe soling; slip index; static coefficient of friction

[6] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:F13-1001.