Designation: F 1116 – 03

Standard Test Method for Determining Dielectric Strength of Dielectric Footwear [1]

This standard is issued under the fixed designation F 1116; 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 testing to determine the "Dielectric Strength" of dielectric overfoot and overshoe footwear. Testing is done over the maximum possible area of the dielectric footwear without permitting flashover between electrodes.

1.2 The use and maintenance of dielectric footwear is beyond the scope of this test method.

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.* Specific hazard statements appear in 5.2.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

F 1117 Specification for Dielectric Footwear

3. Terminology

3.1 *Descriptions of Terms Specific to This Standard*:

3.1.1 *user—as used in 1.3*, the entity employing the actual worker utilizing the equipment; if no separate employer, then the individual.

3.1.2 *overfoot footwear*—footwear designed to be worn directly over the feet as the only source of foot covering.

3.1.3 *overshoe footwear*—footwear designed to be worn over existing footwear.

4. Significance and Use

4.1 Electrical contact injuries to workers may involve a current path through the feet of the worker. The footwear covered by this specification is dielectrically rated to provide additional insulation and isolation to the wearer. This test method will determine that dielectric footwear has dielectric integrity at the time of the test.

5. Apparatus

5.1 *Electrical Test Criteria*:

5.1.1 *Test Procedure*—The footwear shall be immersed in water or other conducting media to a depth where the flashover clearance is consistent with the proof test voltage as listed in Table 1. Since the water or other conducting media inside the footwear forms one test electrode and the water or the other conducting media in the container outside the footwear forms the other electrode, 152 mm or 6 in. of clearance between electrodes consists of 76 mm or 3 in. of clearance from the top of the footwear to the top of the water or other conducting media both inside and outside of the footwear. Water is recommended as the medium for the electrodes to ensure complete coverage of the surfaces of the footwear. Water may wick up the inner lining on certain brands of footwear. To overcome the wicking effect care needs to be taken to keep the inner area above the water dry and conduct the tests promptly after placing the water inside the footwear. The water or other conducting media inside the footwear forms one test electrode and shall be connected to one terminal of the voltage source by means of a metal chain or sliding rod that dips into the electode. The water or other conducting media in the container outside the footwear forms the other electrode and shall be connected directly to the other terminal of the voltage source. Due to the weight of water or other types of electrode media, support racks are needed to secure footwear being tested. The maximum protective area of the footwear shall be tested. Care must be taken to thoroughly dry the inside of the footwear following the test and prior to storage. See Fig. 1 and Fig. 2 for typical test arrangements for dielectric test of rubbers and boots using water electrodes.

NOTE 1—Water used as electrodes should have a minimum conductance of 0.25 mho.

5.2 *Precautions*—It is recommended that the test apparatus be designed to afford the operator full protection in performance of his duties. Reliable means of de-energizing and grounding the high-voltage circuit shall be provided. It is particularly important to incorporate a positive means of grounding the high-voltage section of the dc test apparatus due

[1] This test method is under the jurisdiction of ASTM Committee F18 on Electrical Protective Equipment for Workers and is the direct responsibility of Subcommittee F18.15 on Worker Personal Equipment.

Current edition approved Nov. 1, 2003. Published January 2004. Originally approved in 1988. Last previous edition approved in 1988 as F 1116–88.

[2] *Annual Book of ASTM Standards*, Vol 10.01.

TABLE 1 Test Voltages and Flashover Clearances Between Electrodes

AC Test		DC Test	
Voltage (rms value)	mm (in.)	Voltage (avg value)	mm (in.)
15 000	127 (5)	45 000	152 (6)
20 000	152 (6)	60 000	178 (7)

to the likely presence of high-voltage capacitance charges at the conclusion of the test.

5.3 *Electrical Test Equipment*:

5.3.1 The test equipment used in the dielectric strength or proof tests shall be capable of supplying an essentially stepless and continuously variable voltage to the test specimen. The equipment shall be inspected at least annually to ensure that the general condition of the equipment is acceptable and to verify the characteristics and accuracy of the test voltage.

5.3.2 Breakdown or failure indicators or accessory circuits shall be designed to give positive indication of failure and shall require resetting by the operator before tests can be continued.

5.4 *AC Tests*:

5.4.1 *Voltage Supply and Regulation*:

5.4.1.1 The test voltage crest factor shall not differ more than 2 % from a sinusoidal wave.

5.4.1.2 The accuracy of the voltage measuring circuit shall be within ±2 % of test voltage.

5.5 *DC Tests*:

5.5.1 *Voltage Supply and Regulation*:

5.5.1.1 The peak to peak ac ripple component of the dc proof-test voltage shall not exceed 2 % of the average voltage value under no-load conditions.

5.5.1.2 The accuracy of the voltage measuring circuit shall be within ±2 % of test voltage.

6. Conditioning

6.1 Perform all electrical tests at room temperature. The exposed portion both inside and outside of the footwear that is not in direct contact with an electrode shall be as dry as practicable in each test method.

7. Procedure (See Test Methods D 149)

7.1 *AC Tests*:

7.1.1 Place each article of footwear to be given a proof test in the test apparatus in accordance with 5.1.1. Smoothly apply the test voltage to 75% of the desired test voltage and increase it at a rate-of-rise of 1000 volts per second (V/s) ±20 % until the prescribed testing voltage is reached, or failure occurs. The test period starts at the instant that the prescribed testing voltage is reached and shall consist of a minimum of 1 min to a maximum of 3 min time at the prescribed test voltage. At the end of the test period, gradually reduce the applied voltage to at least half value before opening the test circuit.

7.2 *DC Tests*:

7.2.1 Place each article of footwear to be given a test in the test apparatus in accordance with 5.1.1. Apply the dc test voltage in the same manner as for ac tests in 7.1.1 except with a rate-of-rise of approximately 3000 V/s.

8. Record Keeping and Marking

8.1 Each piece of footwear shall be marked clearly and permanently with the name of the manufacturer or supplier, ASTM F 1117, size, and AC voltage rating.

8.2 The test procedures of the electrical test facility shall specify the test voltage for each voltage rating of footwear to be tested or a record shall be kept of the voltage used in the test. A date specified as test or retest shall be either recorded or provided by marking or affixing a label to the footwear. The marking or labeling method and material shall not adversely affect the electrical or physical characteristics of the footwear or conflict with the manufacturer's original marking or labeling

8.3 Footwear that have been rejected and are not suitable for electrical service shall be defaced, cut or otherwise marked and identified to indicate that they are not to be used for elecrical service.

9. Precision and Bias

9.1 The precision of this test method has not been determined. No statement can be made as to the bias of this test method since no standard materials are available.

10. Keywords

10.1 dielectric