



Designation: F 1116 – 88 (Reapproved 1995)

## Standard Test Method for Determining Dielectric Strength of Overshoe Footwear<sup>1</sup>

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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This test method covers the determination of the dielectric strength of overshoe footwear. Three procedures are provided, the use of which depends upon the portion of the footwear that it is desired to test.

1.1.1 *Procedure A*—Withstand voltage proof test of the sole portion of the overshoe footwear.

1.1.2 *Procedure B*—Withstand voltage proof test of the sole and foot portion of the overshoe footwear.

1.1.3 *Procedure C*—Withstand voltage proof test of the maximum possible portion of the overshoe footwear without permitting flashover between electrodes.

1.2 The use and maintenance of this equipment 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:

D 149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies<sup>2</sup>

### 3. Descriptions of Terms Specific to This Standard

3.1 *sole*—the underside of the boot or rubber that would be in contact with the ground. In this type footwear it is normally one piece and constructed of a molded elastomer.

3.2 *foot portion*—the portion of the footwear below the wearer's ankle bone.

### 4. Significance and Use

4.1 Electrical contact injuries to workers may involve a current path through the feet of the worker. This test method will determine that overshoe footwear, if provided as additional isolation or insulation, has a particular value of dielectric strength at the time of the test.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee F-18 on Electrical Protective Equipment for Workers and is the direct responsibility of Subcommittee F18.15 on Worker Personal Equipment.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 10.01.

TABLE 1 Flashover Clearances Between Electrodes

| A-C Proof Test |          | D-C Proof Test |          |
|----------------|----------|----------------|----------|
| Voltage        | mm (in.) | Voltage        | mm (in.) |
| 5 000          | 76 (3)   | 20 000         | 76 (3)   |
| 10 000         | 76 (3)   | 40 000         | 102 (4)  |
| 20 000         | 127 (5)  | 50 000         | 152 (6)  |

### 5. Apparatus

#### 5.1 Electrodes:

5.1.1 *Procedure A*—The footwear shall be filled with water or conductive metal shot so that the inner sole is completely covered. The footwear shall then be placed in water to such a depth that the under side of the sole is, to the greatest extent practicable, in contact with the water without the water going above the top of any part of the sole. The water or shot inside the footwear forms one test electrode and shall be connected to one terminal of the voltage source by means of a chain or sliding rod that dips into the electrode. The water in the container outside the footwear forms the other electrode and shall be connected directly to the other terminal of the voltage source (see Figs. 1-4).

5.1.2 *Procedures B and C*—These procedures differ from Procedure A in how much of the overshoe footwear is subjected to the voltage proof test. In Procedure B, the footwear is immersed to a level of the top of the foot, while in Procedure C the footwear is immersed to a depth where the flashover clearance is consistent with the proof test voltage as listed in Table 1. In Procedures B and C, the inner electrode would preferably be water because of the weight of that quantity of shot. Care must therefore be taken to thoroughly dry the inside of the footwear following the proof test and prior to storage or issue.

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

5.2 **Precaution**—It is recommended that the test apparatus be designed to afford the operator full protection in performance of his duties. Reliable means of deenergizing 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 d-c test apparatus due 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



**FIG. 1 Typical Test Arrangement for Dielectric Test of Soles of Boots—Shot Electrode Inside Boots, Water Outer Electrode in Pan**



**FIG. 2 Typical Test Arrangement for Dielectric Test of Soles of Boots—Enclosure Safety Gate Closed for Test**

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 A-C Tests:**

**5.4.1 Voltage Supply and Regulation:**

5.4.1.1 The test voltage crest factor shall not differ more than 5 % from a sinusoidal wave.

5.4.1.2 The accuracy of the voltage measuring circuit shall be within  $\pm 2\%$  of full scale.

**5.5 D-C Tests:**

**5.5.1 Voltage Supply and Regulation:**

5.5.1.1 The peak to peak a-c ripple component of the d-c 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  $\pm 2\%$  of full scale.

**6. Conditioning**

6.1 Perform all electrical tests at room temperature. The exposed portion of the overshoe 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 A-C Proof 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 or 5.1.2. Smoothly apply the proof-test voltage to 75% of proof voltage and then increase it at a rate-of-rise of  $1000 \text{ V/s} \pm 20\%$  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 and a maximum of 3 min. At the end of the test period, gradually reduce the applied voltage to at least half value before opening the test circuit.

**7.2 D-C Proof Tests:**

7.2.1 Place each article of footwear to be given a proof test in the test apparatus in accordance with 5.1.1 or 5.1.2. Apply the d-c proof-test voltage in the same manner as for a-c proof tests except with a rate-of-rise of approximately  $3000 \text{ V/s}$ .

**8. Report**

8.1 The report shall include the following information:

8.1.1 Make and style of footwear specimen.

8.1.2 Date of test.

8.1.3 Type of test; a-c or d-c, and prescribed proof-test voltage.

8.1.4 Length of proof test at prescribed voltage.

8.1.5 Breakdown voltage, if specimen failed proof test.

**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.

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**FIG. 3 Typical Test Arrangement for Dielectric Test of Soles of Boots—Enclosure Safety Gate Open**



**FIG. 4 Typical Test Arrangement for Dielectric Test of Soles of Boots—Boots Standing in Water in Pan Serving as Outer Electrode**

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