



Designation: F 478 – 92 (Reapproved 1999)

## Standard Specification for In-Service Care of Insulating Line Hose and Covers<sup>1</sup>

This standard is issued under the fixed designation F 478; 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 specification covers the in-service care, inspection, testing, and use voltage of insulating line hose and covers for protection from electrical shock.

1.2 The following safety hazards caveat applies only to the test method portion, Section 7, of this specification: *This standard does not purport to address all of the safety problems, 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 precautionary statements are given in Note 1.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- D 1049 Specification for Rubber Insulating Covers<sup>2</sup>
- D 1050 Specification for Rubber Insulating Line Hose<sup>2</sup>
- D 2865 Practice for Calibration of Standards and Equipment for Electrical Insulating Materials Testing<sup>3</sup>
- F 819 Definitions of Terms Relating to Electrical Protective Equipment for Workers<sup>2</sup>

#### 2.2 ANSI Standards:

- C 84.1 Voltage Ratings for Electric Power Systems and Equipment (60 Hz)<sup>4</sup>

#### 2.3 IEEE Standard:

- IEEE Standard 4, Techniques for High Voltage Testing<sup>5</sup>

### 3. Terminology

3.1 *breakdown*—the electrical discharge or arc occurring between the electrodes and through the equipment being tested.

3.2 *bulk storage*—the storage of hose or covers together with one or more layers piled neatly, but without the benefit of spacers, supports, or special protective containers.

3.3 *cover*—an electrically insulated enclosure designed to be installed temporarily on various types of irregularly shaped electrical equipment to protect personnel and equipment working in the close proximity.

3.4 *designated person*—an individual who is qualified by experience or training to perform an assigned task.

3.5 *distorted*—physically changed from the natural and original shape, caused by stress of any type.

3.6 *electrical testing facility*—a location with qualified personnel, testing equipment, and procedures for the inspection and electrical testing of electrical insulating protective equipment.

3.7 *electrode*—the energized or grounded conductor portion of electrical test equipment which is placed near or in contact with the material or equipment being tested.

3.8 *flashover*—the electrical discharge or arc occurring between electrodes and over or around, but not through, the equipment being tested.

3.9 *hose*—an electrical insulating tube with a longitudinal slit designed to be installed temporarily on energized electrical wires.

3.10 *ozone*—a very active form of oxygen that may be produced by corona, arcing, or ultraviolet rays.

3.11 *ozone cutting and checking*—cracks produced by ozone in a material under mechanical stress.

3.12 *retest*—the tests given after the initial acceptance test, usually performed at regular periodic intervals or as required because of physical inspection.

3.13 *voltage, maximum use*—the a-c voltage (rms) classification of the protective equipment that designates the maximum nominal design voltage of the energized system that may be safely worked. The nominal design voltage is equal to phase-to-phase voltage on multiphase circuits.

3.13.1 If there is no multiphase exposure in a system area, and the voltage exposure is limited to phase (polarity on d-c systems) to ground potential, the phase (polarity on d-c systems) to ground potential shall be considered to be the nominal design voltage.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F-18 on Electrical Protective Equipment for Workers and is the direct responsibility of Subcommittee F18.25 on Insulating Cover-up Equipment.

Current edition approved Feb. 11, 1992. Published April 1992. Originally published as F 478 – 76. Last previous edition F 478 – 87.

<sup>2</sup> Annual Book of ASTM Standards, Vol 10.03.

<sup>3</sup> Annual Book of ASTM Standards, Vol 10.02.

<sup>4</sup> Available from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

<sup>5</sup> Available from Institute of Electrical and Electronics Engineers, Inc., 445 Hoes Lane, Piscataway, NJ 08854-4150.

3.13.2 If electrical equipment and devices are insulated, or isolated, or both, such that the multiphase exposure on a grounded wye circuit is removed, then the nominal design voltage may be considered as the phase-to-ground voltage on that circuit.

3.14 *voltage, maximum retest*—voltage, either a-c rms or d-c average, that is equal to the proof test voltage for new protective equipment.

3.15 *voltage, nominal design*—a nominal value consistent with the latest revision of ANSI C84.1, assigned to the circuit or system for the purpose of conveniently designating its voltage class.

3.16 *voltage, retest*—voltage, either a-c rms or d-c average, that used protective equipment must be capable of withstanding for a specific test period without breakdown.

#### 4. Significance and Use

4.1 Compliance with this specification should continue to provide personnel with insulating line hose and covers of known and acceptable quality after initial acceptance in accordance with Specifications D 1050 and D 1049. The standards herein are to be considered as minimum requirements.

4.2 A margin of safety shall be provided between the maximum use voltage and their class proof voltage in accordance with Specifications D 1050 and D 1049, as shown in Table 1.

4.3 The user of this type of protective equipment shall be knowledgeable of and instructed in the correct and safe inspection and use of this equipment.

#### 5. Classification

5.1 Line hose covered in this specification are designed as Type I or Type II; Class 0, Class 1, Class 2, Class 3 or Class 4; Style A, Style B, Style C or Style D. Covers covered in this standard are designated as Type I or Type II; Class 0, Class 1, Class 2, Class 3 or Class 4; Style A, Style B, Style C, Style D or Style E.

5.1.1 *Type I*—High-grade *cis*-1,4-polyisoprene rubber compound of natural or synthetic origin, properly vulcanized.

5.1.2 *Type II*—Ozone resistant, made of any elastomer or combination of elastomeric compounds.

5.1.3 The class designations are based on the electrical properties in Specifications D 1050 and D 1049.

**TABLE 1 Voltage Requirements Line Hose and Covers**

Class Designation of Hose and Covers	A-C Use Voltage, rms, max <sup>A</sup>	A-C Retest Voltage, rms	D-C Retest Voltage, avg
0	1000	5000	20 000
1	7500	10 000	40 000
2	17 000	20 000	50 000
3	26 500	30 000	60 000
4	36 000	40 000	70 000

<sup>A</sup> The maximum use voltage is based on the following equations:

1. Maximum use voltage = 0.95 a-c and d-c retest voltage – 2 000, Classes 1, 2, 3, and 4.

2. Maximum use voltage = 0.95 a-c and d-c retest voltage – 30 500, Classes 1, 2, 3, and 4.

3. Maximum use voltage = 0.95 a-c and d-c retest voltage – 18 000, Class 0.

5.1.4 The style designations are based on the designs and descriptions in Specifications D 1050 and D 1049.

#### 6. Washing and Inspection

6.1 The recommended sequence of washing and inspection of contaminated insulating line hose and covers is as follows:

6.1.1 Washing,

6.1.2 Drying,

6.1.3 Inspection,

6.1.4 Marking, and

6.1.5 Packing for storage and shipment.

6.2 The hose and covers may be washed with a soap, mild non-bleaching detergent, or a cleaner recommended by the equipment manufacturer. After washing, the hose and covers shall be rinsed thoroughly with water.

6.2.1 The cleaning agent shall not degrade the insulating qualities of the line hose and covers.

6.2.2 A commercial tumble-type washing machine may be used, where practicable, but caution must be observed to eliminate any interior surfaces or edges that will cut, abrade, puncture, or pinch the hose or covers.

6.3 The hose and covers shall be air dried. The air temperature shall not be over 150°F (65.5°C). They may be suspended to allow drainage and air circulation or dried in a commercial tumble-type automatic dryer. In an automatic dryer, caution must be observed to eliminate any ozone-producing lamps and interior surfaces that will cut, abrade, puncture, or pinch the hose and covers.

6.4 Insulating line hose and covers shall be given a detailed inspection over the entire inner and outer surface for punctures, cuts, severe ozone cutting, or any other obvious condition that would adversely affect performance.

6.5 The hose and covers shall be marked in accordance with Section 12.

#### 7. Electrical Tests

7.1 Where the inspection specified in Section 6 indicates that there may be reason to suspect the electrical integrity of a line hose or cover, an electrical test shall be performed before reissuing the line hose or cover for service.

7.2 Both a-c and d-c voltage retest methods are included in this section and either or both methods may be selected for electrical test.

**NOTE 1—Precaution:** In addition to other precautions, it is recommended that the test apparatus be designed to afford the operator full protection in the performance of duties. Reliable means of de-energizing and grounding the high-voltage circuit should be provided. It is particularly important to incorporate positive means of grounding the high-voltage section of d-c test apparatus due to the likely presence of high-voltage capacitance charges at the conclusion of the test.

7.3 Any electrical retest shall be performed at normal room temperatures and on clean hose or covers at an electrical testing facility.

##### 7.4 Electrodes:

7.4.1 The entire area of each hose and cover shall be tested, as nearly as practicable, between electrodes that apply the electrical stress uniformly over the test area without producing damaging corona or mechanical strain in the hose or cover. The