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Standard Specification for Rubber Insulating Covers[1]

This standard is issued under the fixed designation D1049; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers acceptance testing of rubber insulating covers for use as portable protective devices for protection of workers from accidental contact with live electrical conductors, apparatus, or circuits. It includes insulator hoods, dead-end protectors, line hose connectors, cable end covers, and miscellaneous covers. The electrical, physical, and chemical requirements of this specification shall apply also to any new or modified styles of covers that may be developed for specific purposes.

1.2 Three types of covers, differing in chemical and physical characteristics, are provided, and are designated as Type I, non-resistant to ozone, and Type II and Type III, resistant to ozone.

1.3 Five classes of covers, differing in electrical characteristics, are provided, and are designated as Class 0, Class 1, Class 2, Class 3, and Class 4.

1.4 Five styles of covers, differing in design characteristics, are provided, and are designated as Style A, Style B, Style C, Style D, and Style E.

NOTE 1—Because of the use requirements some covers are semi-rigid and others flexible. The flexible devices should remain suitably flexible for application and removal through normal temperatures of – 29 to 54.5°C (–20 to 130°F).

1.5 *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~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.* See 18.2~~.~~ for a specific cautionary statement.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D297 Test Methods for Rubber Products—Chemical Analysis

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D573 Test Method for Rubber—Deterioration in an Air Oven

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

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

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

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

3.1.4 *ozone cutting and checking*—the cutting action produced by ozone on rubber under mechanical stress into a series of interlacing cracks.

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[1] This specification is under the jurisdiction of ASTM Committee F18 on Electrical Protective Equipment for Workers and is the direct responsibility of Subcommittee F18.25 on Insulating Cover-Up Equipment. This standard replaces ANSI Standard J6.2, which is no longer available.

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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.

3.1.5 *rubber*—a generic term that includes elastomers and elastomeric compounds, regardless of origin.

3.1.6 *user —as used in 4.3.1*, the entity employing the actual worker(s) using the equipment; if no separate employer, then the individual.

3.1.7 *voltage, maximum use*—the ac voltage (rms) rating 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 the phase to phase voltage on multiphase circuits.

3.1.7.1 *Discussion*—

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

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

4. Significance and Use

4.1 This specification covers the minimum electrical, chemical, and physical properties guaranteed by the manufacturer and the detailed procedures by which such properties are to be determined. The purchaser may at his option perform or have performed any of these tests in order to verify the guarantee. Claims for failure to meet the specification are subject to verification by the manufacturer.

4.2 Insulating covers are used for personal protection; therefore, when authorizing their use, a margin of safety shall be provided between the maximum voltage at which they are used and the proof-test voltage at which they are tested. The relationship between proof-test voltage and the maximum voltage at which insulating covers shall be used is shown in Table 1.

4.3 Work practices vary from user to user, depending upon many factors. These may include, but are not limited to, operating system voltages, construction design, work procedures and techniques, weather conditions, and so forth. Therefore, except for the restrictions set forth in this specification because of design limitations, the use and maintenance of this equipment is beyond the scope of this specification.

4.3.1 It is common practice and the responsibility of the user of this type of protective equipment to prepare complete instructions and regulations to govern the correct and safe use of such equipment.

5. Classification

5.1 Covers included under this specification shall be designated as Type I, Type II, or Type III; 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,* non-resistant to ozone, made from a 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 *Type III,* ozone-resistant, made of any combination of elastomer and thermoplastic polymer, elastic in nature.

TABLE 1 Proof-Test/Use Voltage Relationship

NOTE 1—The ac voltage (rms) classification of the protective equipment designates the maximum nominal design voltage of the energized system that may be safely worked. The nominal design voltage is equal to:
1. The phase to phase on multiphase circuits or
2. The phase to ground voltage on single phase grounded circuits.

Class of Insulating Covers	Nominal Maximum Use Voltage,[A] Phase-Phase ac, rms	AC Proof-Test Voltage, rms V	DC Proof-Test Voltage, avg, V
0	1 000	5 000	20 000
1	7 500	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

[A]Except for Class O equipment, the maximum use voltage is based on the following formula:

$$\text{Maximum use voltage (maximum nominal design voltage)} = \frac{0.95 \text{ ac proof-test voltage} - 2000}{}$$

5.1.4 *Class*—The class designation shall be based on the electrical properties and design characteristics as shown in Table 2 or Table 3.

5.1.5 *Style*—The style designation shall describe the item, size, and device or apparatus covered, protected, or connected.

5.1.5.1 *Style A* designates insulator hoods.

5.1.5.2 *Style B* designates dead end protectors.

5.1.5.3 *Style C* designates line hose connectors.

5.1.5.4 *Style D* designates cable end covers.

5.1.5.5 *Style E* designates miscellaneous covers.

6. Ordering Information

6.1 Orders for covers under this specification should include the following information:

6.1.1 Type,

6.1.2 Class, and

6.1.3 Either the style and item number or the size, inside diameter, outside diameter, and length of the covers.

6.2 The listing of types, classes, styles, and item numbers is not intended to mean that all shall necessarily be available from manufacturers; it signifies only that, if made, they shall conform to the details of this specification.

7. Manufacture and Marking

7.1 Each cover shall be marked clearly and permanently with the name of the manufacturer or supplier, ANSI/ASTM D1049, type, and class.

7.1.1 Covers may be marked by either molding the information directly into the cover or by use of a label; either method is equally acceptable. The method shall be at the discretion of the manufacturer. If a label is used, the color shall be that specified for each voltage class: Class 0—red, Class 1—white, Class 2—yellow, Class 3—green, and Class 4—orange.

8. Chemical and Physical Requirements

8.1 The cover material shall conform to the tensile strength requirements in Table 2 or Table 1, the accelerated aging in 5.1.3 and, for Type I covers, the determination of rubber polymer in accordance with 19.1.1.

TABLE 2 Covers—Type I Specifications

Insulator Hoods—Style A										
Item Number [A]	Type Insulator	Insulator Diameter, in.	Hose Size, in.	Length, mm (in.), min	Height, mm (in.), min	Tensile, MPa (psi), min	Class	ac Proof-Test Voltage, V	dc Proof-Test Voltage, V	Suggested Electrode Group [B]
1	pin	4	1	375 (14.75)	159 (6.25)	11.0 (1600)	2	20 000	30 000	2
2	pin	6	1	406 (16.0)	159 (6.25)	11.0 (1600)	2	20 000	30 000	2
3	pin	7	1¼, 1½	406 (16.0)	162 (6.375)	11.0 (1600)	2 and 3	30 000	40 000	2
Dead End Protectors—Style B										
Item Number [A]	Type Insulator	Insulator Diameter, in.	Hose Size, in.	Inside Diameter, mm (in.)	Sleeve Length, mm (in.)	Tensile, MPa (psi), min	Class	ac Proof-Test Voltage, V	dc Proof-Test Voltage, V	Suggested Electrode Group [B]
1	disk or dead end	4¼	any size (adapters)	121 (4.75)	254 (10)	11.0 (1600)	2	20 000	30 000	2
2	2 disk or 2 dead end	4¼	any size (adapters)	121 (4.75)	457 (18)	11.0 (1600)	2	20 000	30 000	2
3	disk or dead end	6	1	165 (6.5)	457 (18)	11.0 (1600)	2	20 000	30 000	2
Line Hose Connectors—Style C										
Item Number [A]	Hose Size, in.	Length, mm (in.)	Tensile, MPa (psi), min	Class	ac Proof-Test Voltage, V	dc Proof-Test Voltage, V	Suggested Electrode Group [B]			
1	1	305 (12.0)	11.0 (1600)	2	20 000	30 000	2			
2	1¼	305 (12.0)	11.0 (1600)	2	20 000	30 000	2			
3	1½	305 (12.0)	11.0 (1600)	3	30 000	40 000	2			

[A] Item numbers are provided for convenient referencing.
[B] Suggested electrode groups for ac tests only.

9. Electrical Requirements

9.1 Each cover, when selected in accordance with Section 13 shall withstand the 60-Hz ac proof-test voltage (rms value) or the dc proof-test voltage (average value) specified in Table 2 or Table 3. The proof test shall be performed in accordance with Section 18 and shall be applied continuously for 3 min.

9.2 Type II and Type III covers shall show no visible effects from corona or ozone when tested in accordance with 18.5.

TABLE 3 Covers—Type II and Type III Specifications

Insulator Hoods—Style A

Item Number [A]	Type Insulator	Insulator Diameter, in.	Insulator Height, in.	Hose Size, in.	Length, mm (in.), min	Height, mm (in.), min	Tensile, MPa (psi), min	Class	ac Proof-Test Voltage, V	dc Proof-Test Voltage, V	Suggested Electrode Group
1	pin	4	4	1	375 (14.75)	159 (6.25)	4.82 (700)	2	20 000	30 000	2–3
2	pin	6	5	1	406 (16.0)	159 (6.25)	4.82 (700)	2	20 000	30 000	2–3
3	pin	7	6	1¼ –1½	406 (16.0 (wide))	162 (6.375)	4.82 (700)	2 and 3	30 000	40 000	2–3
4	pin	10	12	2½	483 (19.0)	406 (16.0)	6.89 (1000)	4	40 000	60 000	2–3
5	pin	11	6	1½	267 (10.5 (ID))	165 (6.5)	4.82 (700)	3	30 000	40 000	2–3
6	pin	8¾	5¾	1½ –2½	381 (15.0)	216 (8.5)	6.89 (1000)	4	40 000	60 000	2–3
7	post	6.5	8¾	1½ –2½	317 (12.5)	298 (11.75)	6.89 (1000)	3	30 000	40 000	2–3
8	post	6.5	13	1½ –2½	317 (12.5)	400 (15.75)	6.89 (1000)	4	40 000	60 000	2–3

Dead End Protectors—Style B

Item Number [A]	Type Insulator	Insulator Diameter	Hose Size, in.	Sleeve Length, mm in.	Tensile, MPa (psi), min	Class	ac Proof-Test Voltage, V	dc Proof-Test Voltage, V	Suggested Electrode Group
1	disk or dead end	4¼	any size (adapters)	254 (10.0)	4.82 (700)	2 and 3	30 000	40 000	2–3
2	disk or dead end	4¼	any size (adapters)	457 (18.0)	4.82 (700)	2 and 3	30 000	40 000	2–3
3	disk or dead end	6	1	457 (18.0)	4.82 (700)	2	20 000	30 000	2–3
4	disk or dead end	4¼	1½ –2½	940 (37.0)	4.82 (700)	4	40 000	50 000	2–3
5	disk or dead end	7	1½ –2½	624 (24.5)	11.0 (1600)	4	40 000	50 000	2–3
6	disk or dead end	10	1½ –2½	624 (24.5)	11.0 (1600)	4	40 000	50 000	2–3

Line Hose Connectors—Style C

Item Number [A]	Hose Size, in.	Length, mm (in.)	Tensile, MPa (psi), min	Class	ac Proof-Test Voltage, V	dc Proof-Test Voltage, V	Suggested Electrode Group
1	1	305 (12.0)	4.82 (700)	2	20 000	30 000	2–3
2	1¼	305 (12.0)	4.82 (700)	2	20 000	30 000	2–3
3	1½	305 (12.0)	4.82 (700)	3	30 000	40 000	2–3
4	1½	267 (10.5)	4.82 (700)	4	40 000	50 000	2–3
5	2½	267 (10.5)	4.82 (700)	4	40 000	50 000	2–3

Cable End Covers—Style D

Item Number [A]	Inside Diameter, mm (in.)	Length, mm (in.)	Conductor Size	Tensile, MPa (psi), min	Class	ac Proof-Test Voltage, V	dc Proof-Test Voltage, V	Suggested Electrode Group
Cable end caps size								
1	13 (0.5)	152 (6.0)	#12 to #6	10.3 (1500)	2	20 000	30 000	1
2	21 (0.81)	152 (6.0)	#4 to 4/0	10.3 (1500)	2	20 000	30 000	1
3	19 (0.75)	178 (7.0)	#10 to #4	10.3 (1500)	2	20 000	30 000	1
4	35 (1.375)	254 (10.0)	#4/0 to 500 MCM	10.3 (1500)	2	20 000	30 000	1
5	57 (2.25)	305 (12.0)	350 MCM to 750 MCM	10.3 (1500)	2	20 000	30 000	1
6	81 (3.19)	406 (16.0)	800 MCM to 1000 MCM	10.3 (1500)	2	20 000	30 000	1
Separator size								
7	25 (1.0)	76 (3.0)	...	10.3 (1500)	2	20 000	30 000	1
8	38 (1.5)	108 (4.25)	...	10.3 (1500)	2	20 000	30 000	1
9	62 (2.44)	114 (4.5)	...	10.3 (1500)	2	20 000	30 000	1
10	70 (2.75)	152 (6.0)	...	10.3 (1500)	2	20 000	30 000	1
Test caps size								
11	16 (0.63)	152 (6.0)	...	10.3 (1500)	2	20 000	30 000	1–2–3
12	24 (0.94)	152 (6.0)	...	10.3 (1500)	2	20 000	30 000	1–2–3
13	19 (0.75)	178 (7.0)	...	10.3 (1500)	2	20 000	30 000	1–2–3
14	35 (1.38)	254 (10.0)	...	10.3 (1500)	2	20 000	30 000	1–2–3
15	57 (2.25)	305 (12.0)	...	10.3 (1500)	2	20 000	30 000	1–2–3
16	76 (3.0)	406 (16.0)	...	10.3 (1500)	2	20 000	30 000	1–2–3
17	127 (5.0)	762 (30.0)	...	4.82 (700)	4	40 000	60 000	1–2–3
18	152 (6.0)	1016 (40.0)	...	4.82 (700)	4	40 000	60 000	1–2–3