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Standard Specification for Rubber Insulating Blankets[1]

This standard is issued under the fixed designation D1048; 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 blankets for protection of workers from accidental contact with live electrical conductors, apparatus, or circuits.

1.2 Two types of blankets are provided and are designated as Type I, not resistant to ozone, and Type II, resistant to ozone.

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

1.4 Two styles of blankets, differing in construction characteristics, are provided and are designated as Style A and Style B.

1.5 The following safety hazards caveat pertains only to the test method portion, Sections 16 – 19, of this specification: *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

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]

D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

D297 Test Methods for Rubber Products—Chemical Analysis

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D518 Test Method for Rubber Deterioration—Surface Cracking (Withdrawn 2007)[3]

D570 Test Method for Water Absorption of Plastics

D573 Test Method for Rubber—Deterioration in an Air Oven

D624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

D1388 Test Method for Stiffness of Fabrics

D2865 Practice for Calibration of Standards and Equipment for Electrical Insulating Materials Testing

F819 Terminology Relating to Electrical Protective Equipment for Workers

2.2 *American National Standards:*

ANSI/IEEE C 2 National Electrical Safety Code[4]

C84.1 Electric Power Systems and Equipment—Voltage Ratings (60 Hz)[5]

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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 J 6.4, 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] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from Institute of Electrical and Electronics Engineers, Inc. (IEEE), 445 Hoes Ln., P.O. Box 1331, Piscataway, NJ 08854-1331, http://www.ieee.org.

[5] Available from National Electrical Manufacturers Association (NEMA), 1300 N. 17th St., Suite 900, Arlington, VA 22209, http://www.nema.org.

3. Terminology

3.1 *beaded edge*—a narrow border of thicker rubber which extends completely around the outer edges of the blanket.

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

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

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

3.5 *electrode clearance*—the shortest path from the energized electrode to the ground electrode.

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

3.7 *insulated*—separated from other conducting surfaces by a dielectric substance (including air space) offering a high resistance to the passage of current.

3.7.1 *Discussion*—When any object is said to be insulated, it is understood to be insulated in a suitable manner for the conditions to which it is subjected. Otherwise, it is, within the purpose of this definition, uninsulated. Insulating covering of conductors is one means of making this conductor insulated.

3.8 *ozone*—a very active form of oxygen that may be produced by corona, arcing, or ultra-violet rays.

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

3.10 *rubber*—a generic term that includes elastomers and elastomer compounds regardless of origin.

3.11 *user*—the employer or entity purchasing the equipment to be utilized by workers for their protection; in the absence of such an employer or entity, the individual purchasing or utilizing the protective equipment.

3.12 *voltage, maximum retest*—voltage, either ac rms or dc avg, that is equal to the proof-test voltage for new protective equipment.

3.13 *voltage, retest*—voltage, either ac rms or dc avg, that used protective equipment must be capable of withstanding for a specified test period without breakdown.

3.14 *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.

3.15 *voltage, maximum use*—the ac 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.

3.15.1 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.

3.15.2 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.

NOTE 1—The work practices and methods associated with removing multiphase exposures at any given work site are not addressed in this specification. Users should refer to ANSI C2, National Electrical Safety Code, Section 44, for proper work practices.

3.16 For definitions of other terms, refer to Terminology F819.

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 Blankets 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 nominal maximum voltage at which blankets shall be used is shown in Table 1.

4.3 Work practices vary from user to user depending upon many factors. These factors may include, but are not limited to, operating system voltages, construction design, work procedures and techniques, weather conditions, etc. 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.

TABLE 1 ~~Proof-Test/Use~~Proof/Design-Test/Use Voltage Relationship

Class of Insulating Blankets	Nominal Maximum Use Voltage [A] Phase-Phase, ac, rms, max	AC Proof-Test Voltage, rms V	DC ~~Proof-Test~~Design-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:
Maximum use voltage (maximum nominal design voltage) 0.95 ac proof-test voltage – 2000

5. Classification

5.1 Blankets covered under this specification shall be designated as Type I or Type II; Class 0, Class 1, Class 2, Class 3, or Class 4; Style A or Style B.

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 The class designation shall be based on the electrical properties as shown in Table 1 and Table 2.

5.1.4 *Style A,* constructed of the elastomers indicated under Type I or Type II, shall be free of any reinforcement.

5.1.5 *Style B,* constructed of the elastomers indicated under Type I or Type II, shall incorporate a reinforcement; this reinforcement shall not adversely affect the dielectric characteristics of the blankets.

6. Ordering Information

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

6.1.1 Type,

6.1.2 Class,

6.1.3 Style,

6.1.4 Size,

6.1.5 Eyelets, and

6.1.6 Color.

6.2 The listing of types, classes, styles, sizes, and eyelets 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 The blankets shall be produced by a seamless vulcanizing process.

7.2 Where eyelets are specified, each blanket shall be equipped with nonmetallic eyelets.

7.3 Each blanket shall be marked clearly and permanently with the name of the manufacturer or supplier, ASTM D1048, type, class, and style.

7.3.1 Blankets may be marked by either molding the information directly into the blanket 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.

TABLE 2 Electrical ~~Proof-Tests~~ AC Proof and DC Design Tests

Class	AC			DC		
	Proof-Test Voltage, rms, V	Nominal Electrode Clearances [A]		~~Proof-Test~~Design-Test Voltages, [B] avg, V	Nominal Electrode Clearances [A]	
		mm	in.		mm	in.
0	5 000	76	3	20 000	76	3
1	10 000	76	3	40 000	76	3
2	20 000	127	5	50 000	152	6
3	30 000	178	7	60 000	203	8
4	40 000	254	10	70 000	305	12

[A] These nominal clearances are intended to avoid flashover and may be increased by no more than 51 mm (2 in.) when required by a change in atmospheric conditions from the standard of 100 kPa (1 atm) barometric pressure and average humidity conditions. These clearances may be decreased if atmospheric conditions permit.
[B] DC ~~proof-test~~design-test voltages were determined using negative polarity.

7.4 Blankets shall have a smooth, flat finish and beaded edges.

8. Chemical and Physical Requirements

8.1 The blanket material shall conform to the physical requirements in Table 3 and the accelerated aging in 19.2.7.

8.2 For Type I blankets, the rubber polymer may be determined in accordance with 19.1.1. This shall be the referee test if a dispute exists between the manufacturer and purchaser regarding the elastomer content of Type I blankets.

8.3 The Type II blanket material shall show no visible effects from ozone when tested in accordance with 18.6. Any visible signs of ozone deterioration, such as checking, cracking, breaks, pitting, etc., shall be considered as evidence of failure to meet the requirements of Type II blankets. In case of dispute, Method A of the ozone resistance test shall be the referee test.

9. Electrical Requirements

9.1 Each blanket shall be given a proof test and shall withstand the 50-Hz or 60-Hz ac proof-test voltage (rms ~~value) or the dc proof-test voltage (average value) specified in~~value). DC design test to be performed on blankets and repeated if a change occurs to the manufacturing process or in the material. See Table 2. The ac proof test and dc design test shall be performed in accordance with Section 18 ~~and~~ . The test voltage shall be ~~conducted~~applied continuously for ~~at least~~ 3 ~~min.~~minutes.

9.2 The blanket material shall show a 60-Hz dielectric strength of not less than 14.8 MV/m (375 V-rms/mil) of specimen thickness for each individual test, when tested in accordance with 18.5.

10. Dimensions and Permissible Variations

10.1 *Length and Width*—The length and width of the blankets shall be specified on the purchase order. Some standard sizes are as shown in Table 4. Permissible variations from the specified length and width shall be ±13 mm (±0.5 in.) except for the 1160 by 1160-mm (45.5 by 45.5-in.) slotted size for which the permissible variation shall be ±25 mm (±1.0 in.).

10.2 *Thickness*—See Table 5.

10.2.1 Manufacturers must meet the minimum thickness requirements for each Class of blanket as specified in Table 5. The manufacturer may label a blanket lower than actual Class value if so specified by the purchaser.

10.3 *Bead on Edge*— The bead shall be not less than 8 mm (0.31 in.) wide nor less than 1.5 mm (0.06 in.) high.

10.4 *Eyelets*—If other than manufacturer's standard is desired; the number, size, and type of eyelet shall be given on the purchase order. The eyelets shall not be less than 8 mm (0.31 in.) in diameter.

10.5 No eyelets, holes, or slots are permitted in a blanket which will reduce the test electrode clearance to less than the values listed in Table 2.

11. Workmanship and Finish

11.1 The blankets shall be free of harmful physical irregularities, which can be detected by thorough test or inspection.

11.1.1 Harmful physical irregularities may be defined as any feature that disrupts the uniform, smooth surface and represents a potential hazard to the user, such as pinholes, cracks, blisters, cuts, conductive imbedded foreign matter creases, pinch marks, voids (entrapped air), prominent ripples, and prominent mold marks.

TABLE 3 Physical Requirements

	Type I		Type II
	Style A Blanket	Style B Blanket	Style A Blanket
Tensile strength, min, Die C, MPa (psi)	17.2 (2500)	17.2 (2500)	10.3 (1500)
Elongation, min, %	500	500	500
Tension set, max, mm (in.)	6.4 (0.25)	6.4 (0.25)	6.4 (0.25)
Tear resistance, min, kN/m (lbf/in.)	21 (120)	26 (150)	16 (90)
Puncture resistance, min, kN/m (lbf/in.)	18 (100)	26 (150)	18 (100)
Drape stiffness, max at 25°C (77°F), mm (in.)	89 (3.5)	89 (3.5)	89 (3.5)
Drape stiffness, max at −10°C (14°F), mm (in.)	110 (4.5)	110 (4.5)	110 (4.5)
Flex stiffness, max at 25°C (77°F), N·m (in.·lbf)	0.028 (0.25)	0.028 (0.25)	0.028 (0.25)
Flex stiffness, max at – 10°C (14°F), N·m (in.·lbf)	0.034 (0.30)	0.034 (0.30)	0.034 (0.30)
Moisture absorption, max, %	1.5	3.0	2.0