



Designation: D178 – 22

Standard Specification for Rubber Insulating Matting¹

This standard is issued under the fixed designation D178; 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 matting for use as a floor covering for protection of workers.

1.2 Two types of matting, differing in chemical and physical characteristics, are provided and are designated as Type I and Type II matting.

1.3 The following safety hazards caveat applies only to the test method portion, Sections 17 to 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.*

NOTE 1—Rubber insulating matting should remain flexible for use through normal temperature ranges.

NOTE 2—Rubber as used in this specification is a generic term that includes elastomers and elastomer compounds, regardless of origin.

1.4 *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

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 6.7, which is no longer available.

Current edition approved Dec. 1, 2022. Published January 2023. Originally approved in 1923. Last previous edition approved in 2019 as D178 – 19. DOI: 10.1520/D0178-22.

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.

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D471 Test Method for Rubber Property—Effect of Liquids

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

D1692 Method of Test for Rate of Burning or Extent and Time of Burning of Cellular Plastics Using a Specimen Supported by a Horizontal Screen (Withdrawn 1976)³

2.2 *American National Standard:*⁴

ANSI C84.1 Voltage Ratings for Electric Power Systems and Equipment (60 Hz)

3. Terminology

3.1 *Definitions:*

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

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

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

3.1.4 *voltage, nominal design, n—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.

3.1.5 *voltage, maximum use, n—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.

3.1.5.1 If there is no multiphase exposure in a system area, and the voltage exposure is limited to phase (polarity on dc

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

systems) to ground potential, the phase (polarity on dc systems) to ground potential shall be considered to be the nominal design voltage.

3.1.5.2 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.

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 Rubber insulating matting is used for personal protection; therefore when authorizing its use a margin of safety should be allowed between the maximum voltage at which it is used and the proof-test voltage at which it is tested. The relationship between proof-test and the maximum voltage at which matting 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 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.

5. Classification

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

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:

- The phase to phase on multiphase circuits or
- The phase to ground voltage on single phase grounded circuits.

Class of Insulating Matting	Nominal Maximum Use Voltage ^A Phase-Phase ac rms, max	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 0 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

5.1.1 *Type I*, made of any elastomer or combination of elastomer compounds, properly vulcanized.

5.1.2 *Type II*, made of any elastomer or combination of elastomeric compounds with one or more of the following special properties:

5.1.2.1 *A*—Ozone resistance

5.1.2.2 *B*—Flame resistance

5.1.2.3 *C*—Oil resistance

5.1.3 The class designation shall be based on the electrical properties as shown in [Table 2](#).

6. Ordering Information

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

6.1.1 Type,

6.1.2 Class,

6.1.3 Thickness,

6.1.4 Width,

6.1.5 Length, and

6.1.6 Color.

6.2 The listing of types, classes, thicknesses, widths, lengths, and colors 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 matting shall consist of a rubber compound with a smooth, corrugated, or diamond design on one surface and may be backed with fabric, or may have one or more fabric inserts. The back of the matting may be finished with cloth imprint or other slip-resistant material. Any such fabric insert shall not affect adversely the dielectric characteristics of the matting.

7.2 Each piece of matting shall be marked clearly and permanently at a maximum interval of 1 m (3 ft) with the name of the manufacturer or supplier, ASTM D178, type, and class.

8. Dimensions and Permissible Variations

8.1 *Width*—Standard widths shall be 610 mm ± 13 mm (24.0 in. ± 0.5 in.), 760 mm ± 13 mm (30.0 in. ± 0.5 in.), 914 mm ± 25 mm (36 in. ± 1 in.) and 1220 mm ± 25 mm (48 in. ± 1 in.).

8.2 *Thickness*—The thickness of the matting shall be as specified in [Table 3](#). Measurements shall be made over the corrugations or diamonds. The corrugations shall be not more than 3.2 mm (0.125 in.) deep. The diamonds shall not be higher than 1.6 mm (0.062 in.).

9. Workmanship and Finish

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

9.1.1 *Nonharmful Irregularities*—Surface irregularities may be present on all rubber matting due to imperfections in molds and inherent difficulties in the manufacturing processes. These irregularities may appear as indentations, protuberances, or imbedded foreign material that are acceptable provided that:

TABLE 2 Electrical Test Requirements

Class	AC			Dielectric Test Voltage rms V	DC ^A			
	Electrode Clearances, min ^B		Proof Test Voltage rms V		Electrode Clearances, min ^B		Proof Test Voltage avg V	Dielectric Test Voltage avg V
	mm	in.			mm	in.		
0	76	3	5 000	6 000	76	3	20 000	35 000
1	76	3	10 000	20 000	76	3	40 000	60 000
2	127	5	20 000	30 000	152	6	50 000	70 000
3	178	7	30 000	40 000	203	8	60 000	80 000
4	254	10	40 000	50 000	305	12	70 000	90 000

^A DC proof-test, voltages were determined using negative polarity.

^B These nominal clearances are intended to avoid flashover and may be increased by no more than 2 in. (51 mm) when required by 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.

TABLE 3 Thickness Measurements

Class	Thickness		Tolerance	
	mm	in.	mm	in.
0	3.2	0.13	0.8	0.03
1	4.8	0.19	0.8	0.03
2	6.4	0.25	0.8	0.03
3	9.5	0.38	1.2	0.05
4	12.7	0.50	1.2	0.05

9.1.1.1 The indentation or protuberance tends to blend into a smooth slope upon stretching of the material.

9.1.1.2 The rubber thickness at any irregularity conforms to the thickness requirements.

9.1.1.3 Foreign material remains in place when the matting is bent and stretches equally with the material surrounding it.

10. Chemical and Physical Requirements

10.1 Insulating matting shall conform to the physical requirements in [Table 4](#). For Type II matting, flame or oil resistance can be determined by conducting the tests in [19.2.5](#) or [19.2.6](#), respectively.

11. Electrical Requirements

11.1 The entire length of each roll of matting when new (unused) shall withstand the 50/60-Hz ac proof-test voltage (rms value) or the dc proof-test voltage (average value) specified in [Table 2](#). The test voltage shall be applied continuously for 1 min.

11.2 The matting material when tested between 50 mm (2-in.) disk electrodes with edges rounded to a radius of 6 mm (0.25 in.), shall show a 50/60-Hz dielectric strength of not less

TABLE 4 Physical Requirements

	Type I	Type II
Tensile strength, min, MPa (psi)	4.83 (700)	4.83 (700)
Tension set, max, at 150 % elongation, 51 mm (2-in.) bench mark, mm (in.)	12.7 (0.50)	12.7 (0.50)
Elongation, min, %	250	250
Moisture absorption, max in-crease ^A , %	1½	3
Flame resistance, Type IIB	not applicable	12.7 mm (0.5 in.) after 30 s
Oil resistance, max, volume increase, Type IIC ^B	not applicable	4

^A Distilled water—23 °C (75 °F).

^B ASTM Oil No. 2 room temperature for 24 h.

than the requirements shown in [Table 2](#) for the thickness of each individual specimen.

11.3 The Type IIA matting material shall show no visible effects from ozone when tested in accordance with [18.6.1](#), or [18.6.2](#). In case of dispute, Method A of the ozone resistance test shall be the referee test.

12. Guarantee

12.1 The manufacturer or supplier shall replace, without charge to the purchaser, unused matting which, at any time within a period of nine (9) months from date of initial delivery of shipment to the purchaser or his designee, fail to pass the tests in this specification. This guarantee will be binding on the manufacturer or supplier only if the matting has been properly stored and has not been subjected to more than an original acceptance test and one retest.

12.2 Any acceptance test made by the purchaser, or the purchaser's designee, shall be performed within the first two (2) months of the guarantee period unless otherwise specified.

NOTE 3—Proper storage means that the matting is stored without distortion, and not stored directly above or in proximity to steam pipes, radiators, or other sources of artificial heat, or exposed to direct sunlight or sources of ozone. It is desirable that the ambient storage temperature shall not exceed 35 °C (95 °F).

13. Sampling

13.1 Each roll of matting in a lot or shipment shall be subject to inspection and test by the manufacturer including electrical proof test to levels required in [Table 2](#) of this specification.

13.2 An original sample of sufficient material shall be cut from the end of a roll or rolls selected from the lot for the test requirements of [Section 10](#), [11.2](#), and [11.3](#). A lot is defined as that quantity of material produced by a common manufacturing process during a consecutive time period not to exceed 24 h. If failure occurs in the first sample, a second sample of the same quantity shall be selected and tested.

14. Rejection

14.1 Individual rolls shall be rejected if they fail to meet the manufacturing and marking requirements of [Section 7](#), the electrical requirements of [11.1](#), the width requirements of [8.1](#), the minimum thickness requirements of [8.2](#), or the workmanship requirements of [Section 9](#).