Designation: D 120 – 95

Standard Specification for Rubber Insulating Gloves[1]

This standard is issued under the fixed designation D 120; 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 Department of Defense.

1. Scope

1.1 This specification covers acceptance testing of rubber insulating gloves for protection of workers from electrical shock.

1.2 Two types of gloves are provided and are designated as Type I, non-resistant to ozone, and Type II, resistant to ozone.

1.3 Six classes of gloves, differing in electrical characteristics, are provided and are designated as Class 00, Class 0, Class 1, Class 2, Class 3, and Class 4.

1.4 The values stated in SI units are to be regarded as the standard.

1.5 The following safety hazards caveat pertains only to the test method portion, Sections 16, 17, 18, and 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 and health practices and determine the applicability of regulatory limitations prior to use.* For specific precaution statements, see 18.2.

2. Referenced Documents

2.1 *ASTM Standards:*

D 297 Test Methods for Rubber Products—Chemical Analysis[2]

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension[2]

D 518 Test Method for Rubber Deterioration—Surface Cracking[2]

D 573 Test Method for Rubber—Deterioration in an Air Oven[2]

D 624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers[2]

D 1149 Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber[2]

D 1415 Test Method for Rubber Property—International Hardness[2]

D 2240 Test Method for Rubber Property—Durometer Hardness[2]

2.2 *ANSI Standard:*

ANSI C84.1 Voltage Ratings for Electric Power Systems and Equipment[3]

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 *color splash*—a smear or streak of contrasting color evident on the inside or outside surface of the gloves that was deposited during the dipping operation and is vulcanized into the glove as part of the homogenous compound.

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

3.1.4 *gauntlet*—the area of the glove between the wrist and the reinforced edge of the opening.

3.1.5 *glove cuff roll*—the roll or reinforced edge of an insulating glove at the cuff.

3.1.6 *halogenation*—exposure of the entire glove surface area to a halogen for the purpose of reducing surface friction.

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

3.1.7.1 *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 the conductor insulated.

3.1.8 *isolated*—an object that is not readily accessible to persons unless special means of access are used.

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

[1] This specification is under the jurisdiction of ASTM Committee F-18 on Electrical Protective Equipment for Workers and is the direct responsibility of Subcommittee F18.15 on Worker Personal Equipment. This standard replaces ANSI Standard J 6.6, which is no longer available.

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[2] *Annual Book of ASTM Standards*, Vol 09.01.

[3] Available from American National Standards Institute, Inc., 11 West 42nd Street, 13th Floor, New York, NY 10036.

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

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

3.1.12 *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 and utilizing the protective equipment.

3.1.13 *voltage, maximum use*—the a-c 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.

3.1.13.1 If there is no multiphase exposure in a system area and the voltage exposure is limited to the 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.

3.1.13.2 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.

3.1.14 *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.

3.1.15 *working area*—all finger and thumb crotches, the palm (area between the wrist and the base of the finger and thumb) and the area of the finger and thumb facing the palm not extending beyond the center line of the crotch. See Fig. 1. Table 1

TABLE 1 Proof-Test/Use Voltage Relationship

Class of Glove	A-C Proof-Test Voltage rms V	D-C Proof-Test Voltage avg V	Maximum Use Voltage[A] a-c rms, V
00	2 500	10 000	500
0	5 000	20 000	1 000
1	10 000	40 000	7 500
2	20 000	50 000	17 000
3	30 000	60 000	26 500
4	40 000	70 000	36 000

[A] Except for Class 00 and Class 0 gloves, the maximum use voltage is based on the following formula:

Maximum A-C use voltage (maximum nominal design voltage) = 0.95 a-c proof-test voltage − 2000 V

This formula takes into account the reduction in the volts per mil capability of the glove with increasing thickness of the rubber.

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 has the option to 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 Gloves are used for personal protection; therefore, when authorizing their use, a margin of safety shall be allowed between the maximum voltage on 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 the gloves shall be used is shown in Table 1.

4.3 Work practices vary from user to user and are dependent upon many factors. These may include, but are not limited to, operating system voltages, construction design, work procedure techniques, weather conditions, etc. Therefore, except for the restriction set forth in this specification because of design

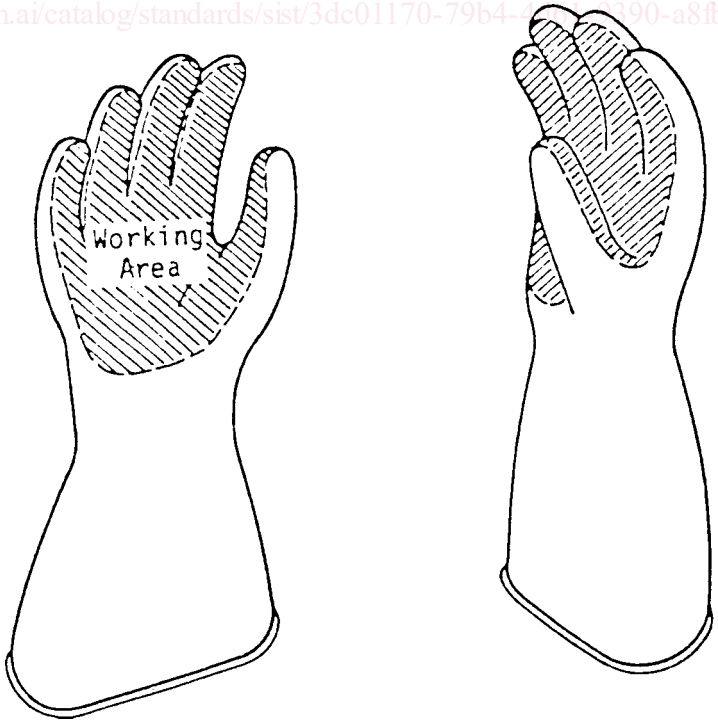

FIG. 1 Working Area of a Rubber Insulating Glove

limitations, the use and maintenance of this equipment is beyond the scope of this specification.

4.4 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 Gloves covered under this specification shall be designated as Type I or Type II; Class 00, Class 0, Class 1, Class 2, Class 3, or Class 4.

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 2 and Table 3.

6. Ordering Information

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

6.1.1 Type,
6.1.2 Class,
6.1.3 Length, Fig. 2
6.1.4 Size,
6.1.5 Color, and
6.1.6 Cuff design.
6.1.7 With or without a halogenation treatment.

6.2 The listing of types, classes, lengths, sizes, colors, and cuff designs 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 gloves shall be produced by a seamless process.

7.2 The gloves shall have a smooth finish and the cuff edges shall be finished with a roll or a reinforcing strip of rubber, unless otherwise specified.

7.3 Each glove shall be marked clearly and permanently with the name of the manufacturer or supplier, ANSI/ASTM D120, type, class, and size. All such marking shall be confined to the cuff portion of the glove and shall be nonconducting and applied in such a manner as to not impair the required properties of the glove.

7.3.1 Each glove shall be marked with a label that gives the information specified in 7.3. This label shall be the color specified for each voltage class: Class 00—beige, Class 0—red, Class 1—white, Class 2—yellow, Class 3—green, and Class 4—orange.

TABLE 3 D-C Voltage Requirements

Class of Glove	Proof-Test Voltage avg V	Minimum Breakdown Voltage avg V
00	10 000	13 000
0	20 000	35 000
1	40 000	60 000
2	50 000	70 000
3	60 000	80 000
4	70 000	90 000

7.4 At the request of the user, the gloves may be given a halogenation treatment to reduce surface friction. This treatment shall have no detrimental effect on the electrical, chemical, or physical properties of the gloves.

8. Dimensions and Permissible Variations

8.1 The thickness shall fall within the limits specified in Table 4, when determined in accordance with 17.1.

8.2 Standard sizes when determined in accordance with 17.2 are 203 mm (8 in.), 216 mm (8½ in.), 229 mm (9 in.), 241 mm (9½ in.), 254 mm (10 in.), 267 mm (10½ in.), 279 mm (11 in.), 292 mm (11½ in.), and 305 mm (12 in.). The permissible variation in size shall be ±13 mm (±½ in.).

8.3 Lengths shall be measured in accordance with 17.3.

8.3.1 Standard lengths for Class 00 gloves are 278 mm (11 in.), and 356 mm (14 in.). The permissible variations shall be ±13 mm (±½ in.).

8.3.2 Standard lengths for Class 0 gloves are 280 mm (11 in.), 360 mm (14 in.), 410 mm (16 in.), and 460 mm (18 in.). The permissible variations shall be ±13 mm (±½ in.).

8.3.3 Standard lengths for Class 1, 2, and 3 gloves are 360 mm (14 in.), 410 mm (16 in.), and 460 mm (18 in.). The permissible variation shall be ±13 mm (±½in.).

8.3.4 Standard lengths for Class 4 gloves are 410 mm (16 in.) and 460 mm (18 in.). The permissible variation shall be ±13 mm (±½ in.).

9. Workmanship and Finish

9.1 Gloves shall be free on both inner and outer surface of harmful physical irregularities that can be detected by thorough test and inspection.

9.1.1 Harmful physical irregularities may be defined as any feature that disrupts the uniform, smooth surface contour and represents a potential hazard to the user, such as pinholes,

TABLE 2 A-C Voltage Requirement Proof Test Currents[A]

Class of Glove	Proof-Test Voltage rms V	Minimum Breakdown Voltage rms V	Maximum Proof-Test Current, mA			
			280-mm (11-in.) Glove	360-mm (14-in.) Glove	410-mm (16-in.) Glove	460-mm (18-in.) Glove
00	2 500	4 000	8	12	[B]	[B]
0	5 000	6 000	8	12	14	16
1	10 000	20 000	...	14	16	18
2	20 000	30 000	...	16	18	20
3	30 000	40 000	...	18	20	22
4	40 000	50 000	...	...	22	24

[A] Proof test current shall be measured to an accuracy of ±1 mA.
[B] Not applicable.

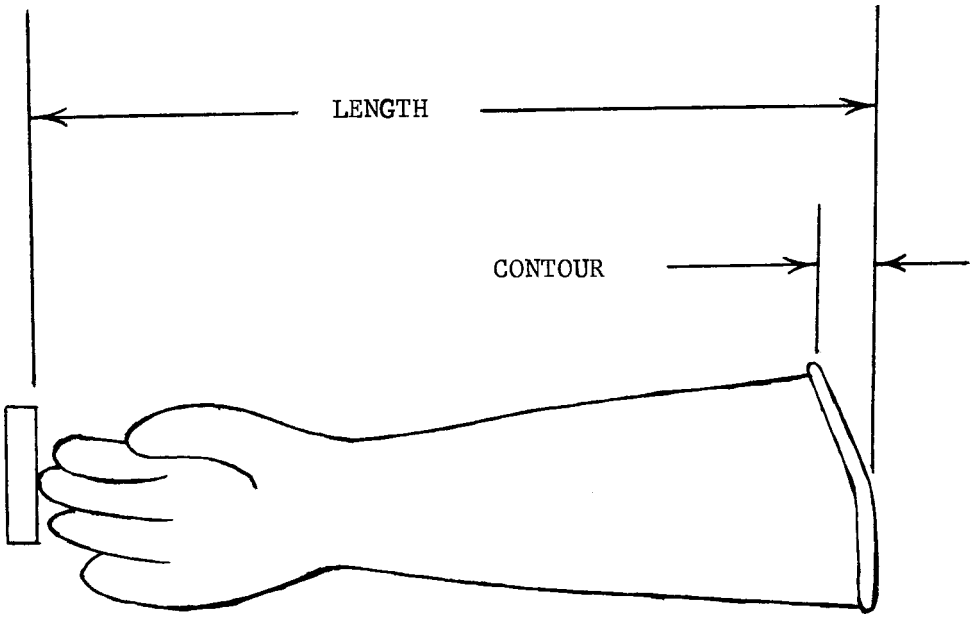

FIG. 2 Length and Contour Measurements on Contour Cuff Gloves

TABLE 4 Thickness Measurements

Class of Glove	Minimum Thickness				Maximum Thickness	
	In Crotch		Other Than Crotch			
	mm	in.	mm	in.	mm	in.
00	0.20	0.008	0.25	0.010	0.75	0.030
0	0.46	0.018	0.51	0.020	1.02	0.040
1	0.63	0.025	0.76	0.030	1.52	0.060
2	1.02	0.040	1.27	0.050	2.29	0.090
3	1.52	0.060	1.90	0.075	2.92	0.115
4	2.03	0.080	2.54	0.100	3.56	0.140

cracks, blisters, cuts, conductive imbedded foreign matter, creases, pinch marks, voids (entrapped air), prominent ripples, and prominent mold marks.

9.2 Nonharmful physical irregularities may be defined as surface irregularities present on the inner and outer surfaces of the rubber glove due to imperfections on forms or molds and inherent difficulties in the manufacturing process. These irregularities may appear as mold marks that look like cuts even though they are actually a raised ridge of rubber, indentations, protuberances, embedded foreign material, or color splashes that are acceptable provided that:

9.2.1 The indentations, protuberance or mold marks tend to blend into a smooth slope upon stretching of the material.

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

9.2.3 Foreign material remains in place when the glove is folded and stretched with the material surrounding it.

9.2.4 Color splashes are no larger than 1 mm in any direction on the inner surface of the work area.

9.2.4.1 The working area is defined as all finger and thumb crotches, the palm (area between the wrist and the base of the finger and thumb) and the area of the finger and thumb facing the palm not extending beyond the center line of the crotch. See Fig. 1.

10. Chemical and Physical Requirements

10.1 The glove material shall conform to physical requirements in Table 5, the accelerated aging in 19.2.6.

10.2 In the event of a dispute, the identification of the rubber polymer in Type I gloves shall be performed in accordance with 19.1.

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

11. Electrical Requirements

11.1 Each glove shall be given a proof test and shall withstand the 60-Hz a-c proof-test voltage (rms value) or the d-c proof-test voltage (average value) specified in Table 2 or Table 3. The proof test shall be performed in accordance with Section 18. The test voltage shall be applied continuously for 3 min.

11.1.1 When the a-c proof test is used, the 60-Hz proof-test current shall not exceed the values specified in Table 2 at any time during the test period. (Note 4 and Note 1)

11.2 Sample gloves selected in accordance with 13.2 shall not break down at voltages below those specified in Table 2 or Table 3 when tested in accordance with Section 18.

TABLE 5 Physical Requirements

Property	Type I	Type II
Tensile strength, min, Die C, MPa (psi)	17.2 (2500)	10.3 (1500)
Tensile stress at 200 %, max, MPa (psi)	2.1 (300)	2.1 (300)
Ultimate elongation, min, %	600	500
Tension set, max at 400, %	25	25
Tear resistance, min, kN/m (lbf/in.)	21 (120)	14 (80)
Puncture resistance, min, kN/m (lbf/in.)	18 (100)	18 (100)
Hardness, max, shore A	47	47