

DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

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**UNITED STATES GOVERNMENT MASTER SPECIFICATION FOR
RUBBER GLOVES FOR ELECTRICAL WORKERS**
**(For Use in Connection With Apparatus or Circuits Not Exceeding
3,000 Volts to Ground)**

FEDERAL SPECIFICATIONS BOARD SPECIFICATION No. 312

This specification was officially promulgated by the Federal Specifications Board on July 6, 1925, for the use of the Departments and Independent Establishments of the Government in the purchase of rubber gloves for electrical workers.

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I. CLASSES

This specification covers electrical worker's rubber gloves of two classes: Class A, gloves intended for use without external protection; and class B, gloves intended for use with external protection of leather or other material.

II. MATERIAL AND WORKMANSHIP

1. PROCESS.—The gloves shall be made by the "dipping" process, of high-grade rubber or rubber compound properly vulcanized and shall be reversible. Unless otherwise specified cuff edges shall be finished with a roll.

2. SURFACE DEFECTS.—Gloves shall be free from patches, blisters, pinholes, cracks, protuberances, embedded foreign matter, or other physical defects which can be detected by thorough surface inspection.

III. GENERAL REQUIREMENTS

See Section IV.

IV. DETAIL REQUIREMENTS

1. VOLTAGE AND LEAKAGE TESTS.—(a) Each glove shall withstand an alternating potential of 10,000 volts (r. m. s. value) for three minutes without showing a leakage of current of more than 10 milliamperes at any time during the test.

(b) Each glove shall be capable of withstanding the application of the following voltage (r. m. s. value) for one minute without showing a leakage current in excess of that given below:

| | Volts | Milliamperes |
|--------------|---------|--------------|
| Class A..... | 16, 000 | 18 |
| Class B..... | 14, 000 | 14 |

2. TENSILE STRENGTH, ELONGATION, AND SET.—A standard test specimen cut from any glove shall have the following physical properties:

(a) The tensile strength shall be not less than 1,200 lbs./in.²

(b) The total elongation at rupture shall be not less than 500 per cent in 2 inches (2 inches stretch to 12 inches).

(c) The set following a stretch from 2 to 12 inches shall not exceed 0.7 inch.

3. SIZE AND LENGTH.—(a) The size of each glove shall be as specified, subject to a permissible variation of plus or minus one-fourth inch, and shall be expressed in inches as measured around the palm at the base of knuckles.

(b) Unless otherwise specified, the length of each glove from the tip of the second finger to the edge of the cuff shall be 14 inches, subject to a permissible variation of plus or minus one-half inch.

4. **THICKNESS.**—The respective thicknesses of the two classes of gloves, in inches, shall be within the following limits:

| Class | Part of glove other than crotch | | Crotch | |
|--------|---------------------------------|---------|---------|---------|
| | Maximum | Minimum | Maximum | Minimum |
| A..... | 0.065 | 0.050 | 0.065 | 0.038 |
| B..... | .050 | .030 | .050 | .022 |

V. METHOD OF INSPECTION AND TESTS

1. **PLACE AND TIME OF TESTS.**—Inspection and test, unless otherwise specified, shall be made within two weeks of receipt by the purchaser at his own expense at such place as he may designate.

2. **REJECTIONS.**—(a) Each glove that fails to meet the requirements of Section IV, 1 (a) or II, 2, shall be rejected. In the case of gloves failing to meet the requirements of Sections IV, 3, and VI, rejection is optional with the purchaser.

(b) If any of the measurements of thickness made as prescribed in Section V, 5, or any additional measurements which the purchaser may elect to make fall below the minimum thickness specified in Section IV, 4, the glove shall be rejected. If any of the measurements exceed the maximum thickness specified, rejection is optional with the purchaser.

(c) If rejections under paragraphs (a) and (b) exceed 25 per cent of the shipment, the whole shipment may be rejected without further tests.

(d) If 50 per cent or more of the gloves subjected to the test prescribed in Section IV, 1 (b), fail to pass the test, the entire shipment shall be rejected.

(e) If the average of the results for either the tensile strength, elongation, or set tests made as prescribed in Section VIII fail to meet the requirements of Section IV, 2, the entire shipment shall be rejected.

3. **MARKING REJECTED GLOVES.**—All rejected material shall be returned to the manufacturer without being defaced by rubber stamp or other permanent marking, excepting gloves which have been punctured on electrical tests. These shall be stamped, punched, or cut to indicate that they are unfit for electrical use.

4. **ORDER OF PROCEDURE.**—The order of procedure in testing rubber gloves shall preferably be as follows:¹

(a) Inspection of inside and outside surfaces (see Section II, 2).

(b) Measurement of length (see Section IV, 3 (b)).

¹ This procedure has been found by experience to minimize the expense of the inspection and testing, particularly where an appreciable number of gloves fail to meet the requirements as to workmanship or dimensions.

- (c) Measurement of size (see Section IV, 3 (a)).
- (d) Measurement of thickness (see Section IV, 4).
- (e) Electrical test (see Section IV, 1 (a)).
- (f) Dielectric strength (see Section IV, 1 (b)).
- (g) Mechanical test (see Section IV, 2).

5. THICKNESS.—(a) The thickness of each glove shall be measured at not less than four points on the face and four points on the back.

(b) Measurements shall be made at one or more points in the crotch of thumb and index finger and in the crotches between the fingers.

(c) These measurements shall be made with any micrometer graduated to mils or tenths of mils having a ratchet friction or spring attachment. The tension on the friction attachment should be so adjusted that when the spindle has come to a stop the specimen can be moved between the spindle and anvil without causing any appreciable stretching of the rubber.

A dial-type micrometer graduated to mils and mounted in a manner similar to that shown in Figure 1 is particularly convenient for

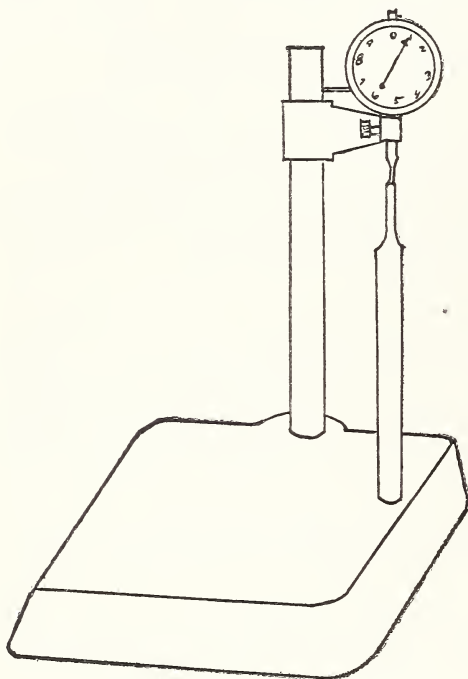


FIG. 1.—Dial micrometer

making all of these measurements, especially the crotches. The anvil is about one-fourth inch (6.4 mm) in diameter and the foot of the spindle about one-eighth inch (3.2 mm) in diameter.

6. ELECTRICAL TESTS.—(a) *Leakage*.—Each glove shall be tested for leakage in fresh water at normal room temperature (60 to 90° F.) by immersing in the water to within about 1½ to 2 inches of the edge of the cuff and filling with water up to the same point. The water inside the glove and that outside the glove form the test electrodes. These are conveniently connected to the testing transformer by means of a chain suspended in the glove and by direct connection to the containing vessel.

(b) *Source of test voltage*.—The testing voltage shall be obtained from a testing equipment, no part of which has a testing capacity of

less than one-half kva. per glove being tested. In no case shall the rating of any part of the testing apparatus be less than 2 kva. The frequency of the testing voltage shall be not more than 65 cycles.

(c) *Application of test voltage.*—The potential shall be applied at a low value and gradually and steadily raised at a rate of approximately 800 to 1,000 volts per second until the prescribed testing voltage is reached.

(d) *Test period.*—The test period shall be counted from the instant when the prescribed testing voltage is reached.

(e) *Voltage regulation.*—The method regulating the testing voltage shall be one which does not distort the wave form of the testing voltage from a sine wave. Acceptable methods include:

- (1) Field regulation of the alternator supplying the transformer,
- (2) Induction-type regulator,
- (3) Variable-ratio-transformer type of regulator, and
- (4) Potentiometer type of rheostatic control where the current in the portion of the potentiometer resistance in parallel with the primary of the transformer is at least five times the exciting current of the transformer.

(f) *Voltage measurement.*—The testing voltage shall be measured by one of the following methods:

- (1) A properly calibrated electrostatic voltmeter connected directly across the gloves under test.
- (2) Any properly calibrated commercial type of alternating current voltmeter connected to the low-tension side of the transformer in conjunction with the ratio of transformation of the transformer, provided that the ratio is definitely known for all test conditions.
- (3) A calibrated potential transformer with a voltmeter.

(g) *Leakage current measurement.*—The leakage current shall be measured by one of the following methods:

- (1) Directly, by inserting a milliammeter in series with each individual glove in turn.

NOTE.—It is customary to make high voltage tests of this character with one end of the circuit grounded, the containing vessel usually being the grounded end of the circuit. The milliammeter should, therefore, be connected in at the grounded end of the circuit and shunted by a short circuiting automatic self-closing switch which will therefore always keep the circuit closed except at the instant of reading and thus maintaining an uninterrupted ground.

(2) By an ammeter in the low-tension circuit of the testing transformer. In this case the leakage current shall be determined by noting the decrease in the low-tension current when one glove at a time is disconnected from the high-tension testing circuit, the voltage being left on the test circuit and the remaining gloves in the meantime.

The difference in the two currents divided by the ratio will give the leakage current for the glove disconnected from the circuit.

NOTE.—This method is inaccurate where only one or two gloves are being tested at a time because of the neutralizing effect of the leading current taken by the gloves on the magnetizing current, which is a lagging one. This effect is usually negligible with three or more gloves. The minimum number of gloves which may be safely measured in this manner is easily determined by noting the leakage current of a particular glove when tested with 1, 2, 3, etc., additional gloves, respectively.

(h) *Dielectric strength test.*—(1) One per cent of the gloves (in no case less than two gloves) which have passed all the tests previously prescribed herein shall be selected at random and tested for compliance with Section IV, 1 (b), and also for ultimate dielectric strength. The tests shall be made in accordance with the general method described in Sections V, 6 (a) to V, 6 (g), inclusive. If the glove passes the test prescribed in IV, 1 (b), the potential shall be raised steadily and gradually at a rate of approximately 1,000 volts per second until failure occurs, the voltage at failure being recorded.

(2) If any glove fails to meet the requirements of Section IV, 1 (b), an additional glove shall be selected at random and tested.

7. **GUARANTEE.**—The manufacturer shall replace, without cost to the purchaser, gloves which at any time within a period of eight months from the date of initial test, fail to pass the tests herein prescribed; provided, the gloves have been properly stored in their original boxes.

NOTE.—“Proper storage” is to be interpreted to mean that gloves are not to be stored directly above or in proximity to steam radiators or other sources of artificial heat. It is desirable that the ambient temperature be not in excess of 90° F. (32.2° C.).

VI. PACKING AND MARKING

1. **PACKING.**—Each pair of gloves shall be packed in an individual stiff paper box of sufficient strength to properly protect the gloves. The end of the box shall be marked with the glove size and in the case of class B gloves with the words “For use with protectors.”

2. **MARKING.**—Unless otherwise specified each glove shall be marked with the manufacturer’s name and the size of glove. Such marking shall be confined to the back of the glove and shall be so done as not to injure the glove. Indelible and nonconducting ink shall be used.

VII. ADDITIONAL INFORMATION

This specification is identical, except in form, with Standard Specification D-120-23 adopted by the American Society for Testing Materials in 1923.

VIII. GENERAL SPECIFICATIONS

All physical tests shall be conducted in accordance with the methods described in United States Government General Specifications for Rubber Goods, F. S. B. No. 59a in effect on date of proposal. The essential features of these methods are:

(1) Temperature of testing room and of specimens, between 65 and 90° F.

(2) Rate of separation of jaws of testing machine, 20 inches per minute.

(3) Tensile strength and elongation shall be made on one sample and set test on a separate sample.

(4) Set test shall be made by stretching the 2-inch gauge length to 12 inches, holding for 10 minutes and measuring the distance between the gauge marks 10 minutes after release.

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