

Specification for

Gloves and mitts of insulating material for live working

The European Standard EN 60903 : 1992 with the incorporation of amendment A11 : 1997 has the status of a British Standard

ICS 13.340.10

Cooperating organizations

The European Committee for Electrotechnical Standardization (CENELEC), under whose supervision this European Standard was prepared, comprises the national committees of the following countries:

Austria	Italy
Belgium	Luxembourg
Denmark	Netherlands
Finland	Norway
France	Portugal
Germany	Spain
Greece	Sweden
Iceland	Switzerland
Ireland	United Kingdom

This British Standard, having been prepared under the direction of the Power Electrical Engineering Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 15 April 1993

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Summary of pages

The following table identifies the current issue of each page. Issue 1 indicates that a page has been introduced for the first time by amendment. Subsequent issue numbers indicate an updated page. Double vertical sidelining on replacement pages indicates the most recent changes (amendment, addition, deletion) (but see national foreword).

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National foreword

This British Standard has been prepared under the direction of the Power Electrical Engineering Standards Policy Committee (PEL/-) and is the English language version of EN 60903 : 1992 *Specification for gloves and mitts of insulating material for live working*, including amendment A11 : 1997 published by the European Committee for Electrotechnical Standardization (CENELEC). It was derived by CENELEC from IEC 903 : 1988, published by the International Electrotechnical Commission (IEC) and prepared by IEC Technical Committee No. 78, Tools for Live Working.

The foreword of EN 60903 makes reference to the 'date of withdrawal', dow, of the relevant national standard. In this case, the relevant national standard is BS 697 : 1986 which will be withdrawn on 1 September 1993. Certificates and marks will not be awarded after this date with respect to the withdrawn British Standard. However, such certificates and marks already awarded may continue to apply to production until 1 September 1998.

A new standard will be published with the conflicting Parts of BS 697 having been omitted.

The CENELEC common modifications have been implemented at the appropriate places in the text and are indicated by a single side line in the margin. Parts of the original IEC text that have been modified by CENELEC have been quoted in national annex NA. Amendment A11 to EN 60903 : 1992 introduces further CENELEC common modifications to IEC 903 : 1988 (viz. the inclusion of new annexes A and E) and these are also indicated by a single sideline in the margin. The graphic signs, symbols and letters used in this standard may be found in the following British Standards:

BS 3939 *Graphical symbols for electrical power, telecommunications and electronics diagrams*

Part 1 : 1986 *General information, general index*
(Related to IEC 617-1)

Part 2 : 1985 *Symbol elements, qualifying symbols and other symbols having general application.*

(Identical with IEC 617-2)

From 1 January 1997, all IEC publications have the number 60000 added to the old number. For instance, IEC 27-1 has been renumbered as IEC 60027-1. For a period of time during the change over from one numbering system to the other, publications may contain identifiers from both systems.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

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Descriptors: Live working, electrical equipment, insulating glove, rubber, characteristic, dimension, test

English version

Specification for gloves and mitts of insulating material for live working

(Includes amendment A11 : 1997)
(IEC 903 : 1988, modified)

Spécification pour gants et moufles en
matériaux isolants pour travaux électriques
(Inclut l'amendement A11 : 1997)
(CEI 903 : 1988, modifiée)

Norm für Handschuhe aus isolierendem
Material zum Arbeiten an unter Spannung
stehenden Teilen
(enthält Änderung A11 : 1997)
(IEC 903 : 1988, modifiziert)

This European Standard was approved by CENELEC on 1992-09-15; amendment A11 was approved by CENELEC on 1997-03-11. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 903 : 1988 could be accepted without textual changes, has shown that some common modifications were necessary for the acceptance as European Standard.

The reference document, together with the common modifications prepared by the CENELEC Technical Committee TC 78, was submitted to the CENELEC members for formal vote.

The text of the draft was approved by CENELEC as EN 60903 on 15 September 1992.

The following dates were fixed:

- latest date of publication
of an identical national
standard (dop) 1993-09-01
- latest date of withdrawal
of conflicting national
standards (dow) 1993-09-01

For products which have complied with the relevant national standard before 1993-09-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 1998-09-01.

Annexes and appendices designated 'normative' are part of the body of the standard. Annexes and appendices designated 'informative' are given only for information. In this standard, appendices C and D and annex ZA are normative, appendices B, F and G are informative.

Foreword to amendment A11

This amendment was prepared by the Technical Committee CENELEC TC 78, Equipment and tools for live working.

It comprises the texts of two draft amendments.

The text of prAB was submitted to the formal vote and was approved by CENELEC on 1996-10-01 for inclusion into the future amendment A11.

The text of prAA was submitted to the Unique Acceptance Procedure and was approved by CENELEC as amendment A11 to EN 60903 : 1992 on 1997-03-11.

The following dates were fixed:

- latest date by which the
amendment has to be
implemented at national
level by publication of an
identical national standard
or by endorsement (dop) 1997-12-01
- latest date by which the
national standards
conflicting with the
amendment have to be
withdrawn. (dow) 1997-12-01

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SPECIFICATION FOR GLOVES AND MITTS OF INSULATING MATERIAL FOR LIVE WORKING

1. Scope

This standard is applicable to insulating gloves and mitts.

Unless otherwise stated the use of the term “glove” only includes gloves and mitts.

- 1.1 Six classes of gloves, differing in electrical characteristics, are provided and are designated Class 00, Class 0, Class 1, Class 2, Class 3 and Class 4.
- 1.2 Six categories of gloves, differing in properties related to acid, oil, ozone, mechanical strength (higher level), and a combination of all are provided and designated A, H, Z, M and R respectively and, for extreme low temperature, Category C.

2. Definitions

Within the scope of this standard, the terms hereafter have the following significance :

<i>Palm</i>	part of glove covering the face of the central inside hand
<i>Wrist</i>	the narrowest part of the glove above the cuff
<i>Contour glove</i>	a glove shaped at the upper part of the cuff in such a way as to facilitate the bending of the arm
<i>Fork</i>	part of glove at the junction of two fingers, or finger and thumb
<i>Curved glove</i>	a glove on which the fingers are slightly bent in a position corresponding to the position the hand forms while holding an object
<i>Lined glove</i>	a glove with an inside lining of textile material attached to the elastomer
<i>Composite glove</i>	a glove composed of several attached or superimposed layers of different colours and/or different types of elastomer
<i>Mitt</i>	a glove which has less than four finger enclosures
<i>Cuff</i>	part of a glove from the wrist to the open part of the glove
<i>Cuff roll</i>	the roll or reinforced edge of a glove at the cuff
<i>Colour splash</i>	a splash, smear or streak of contrasting colour evident on the inside or outside surface of the glove that was deposited during the dipping operation and is vulcanized into the glove as part of the homogeneous compound
<i>Puncture</i>	a disruptive breakdown through a solid insulant (IEV * 121-03-13)
<i>Flashover</i>	an arc by-passing an insulating body (IEV 121-03-14)
<i>Nominal voltage</i>	a suitable approximate value of voltage used to designate or identify a system (IEV 601-01-21)
<i>Elastomer</i>	a generic term that includes rubbers, latex and elastomeric compounds that may be natural or synthetic or a mixture or a combination of both

* See the International Electrotechnical Vocabulary (IEV) (IEC Publication 50).

<i>Type test</i>	a test performed on one or more devices made to a certain design to show that the design meets certain specifications (IEV 151-04-15)
<i>Routine test</i>	a test to which each device is subjected during or after manufacture to ascertain whether it complies with certain criteria (IEV 151-04-16)
<i>Sampling test</i>	a test performed on a number of devices taken at random from a batch (IEV 151-04-17)
<i>Acceptance test</i>	a contractual test to prove to the customer that the device meets certain conditions of its specification (IEV 151-04-20)

3. Composition

The gloves shall be manufactured of elastomers. They may be lined or unlined, uncovered or have an exterior covering for protection against mechanical wear, chemical attack and the effects of ozone.

In the case of wear on the exterior of a composite glove made up of layers of different colours, the different colour layer underneath shall appear.

The gloves shall be provided with a cuff.

4. Classification

The gloves covered under this standard shall be designated as follows :

- by class as Class 00, Class 0, Class 1, Class 2, Class 3 and Class 4 ;
- by special properties by the addition of a suffix as shown in Table I.

TABLE I
Special properties

Category	Resistant to
A	Acid
H	Oil
Z	Ozone
M	Mechanical (higher level)
R *	Acid, oil, ozone, mechanical (higher level)
C	Extreme low temperature

* Category R combines the characteristics of categories A, H, Z and M.

Note.— Guidance for use will be given in Appendix A (under consideration).

5. Physical requirements

5.1 Shape

5.1.1 The shape of a glove is indicated in Figure 1, page 59. The letter “h” in Figure 1 represents the curve of the finger in curved gloves.

5.1.2 The shape of a mitt is indicated in Figure 2, page 60, but it should be noted that one or more fingers can be enclosed.

5.1.3 Gloves may be manufactured with or without cuff roll.

5.2 Dimensions

5.2.1 Standard length for the different classes are :

Class 00: 270 mm and 360 mm

Class 0: 270 mm, 360 mm, 410 mm and 460 mm

Class 1, 2, 3: 360 mm, 410 mm and 460 mm

Class 4: 410 mm and 460 mm

The permissible variation in length shall be ± 15 mm for any class.

5.2.2 For contour cuff gloves the difference between the maximum and minimum lengths shall be 50 ± 6 mm (see Figure 3, page 61).

5.2.3 It is not practicable to specify other dimensions, but typical glove dimensions are suggested in Appendix B.

5.3 Thickness

5.3.1 The maximum thickness of the elastomer on the flat surface (not ribbed area if present) of a glove shall be as follows in order to obtain flexibility :

TABLE II
Maximum elastomer thickness

Class	mm
00	0.50
0	1.00
1	1.50
2	2.30
3	2.90
4	3.60

5.3.2 The minimum thickness shall be determined only by the ability to pass the tests defined in Clauses 6 and 7.

5.3.3 Gloves of categories A, H, Z, M and R may require additional thickness which shall not exceed 0.6 mm.

5.4 Workmanship and finish

5.4.1 Gloves shall be free on both inner and outer surfaces from harmful physical irregularities that can be detected by thorough test and inspection.

Harmful physical irregularities shall be defined as any feature that disrupts the uniform, smooth surface contour, such as pinholes, cracks, blisters, cuts, conductive embedded foreign matter, creases, pinch marks, voids (entrapped air), prominent ripples and prominent mould marks.

Non-harmful physical irregularities shall be defined as surface irregularities present on the inner and outer surfaces of the glove due to imperfections on forms or moulds or other imperfections inherent to the manufacturing process. These irregularities appear as mould marks that look

like cuts even though they are actually a raised ridge of elastomer, indentations, or protuberances that are acceptable provided that :

- a) the depression is not larger than 1.6 mm in diameter, has rounded edges and no visible break in the surface, and cannot be seen on the opposite side when stretched over the thumb ;
- b) there are not more than three depressions as described in Item a) anywhere on the glove and any two are separated by at least 15 mm ;
- c) the indentations, protuberances or mould marks tend to blend into a smooth slope upon stretching of the material ;
- d) the small projections or protuberances represent only a small amount of excess elastomer that cannot be readily removed with the finger and these projections do not appreciably affect the stretching of the elastomer ;
- e) no such irregularities occur in the palm or in the forks of the glove.

The working area of the glove on both the inner and outer surfaces shall also be free from non-harmful physical irregularities, but may include colour splash(es) no larger than 1 mm in any direction on the inner surface of the working area.

The working area is defined as all finger and thumb crotches, the palm and the palm side of the fingers and thumb (see Figure 11, page 70).

5.4.2 Palm and finger surfaces designed to improve the grip shall not be considered as irregularities.

5.5 Marking

5.5.1 Each glove which is claimed to comply with the requirements of this standard shall be marked with the following (Figure 4, page 63) :

- symbol (double triangle) ;
- name, trade mark, or identification of the manufacturer ;
- category if applicable ;
- size ;
- class ;
- month and year of manufacture.

In addition, each glove shall be marked as follows :

- a rectangular band permitting the marking of the date of entry into service and the dates of periodic inspection and test. Its dimensions and position are given in Figure 4,
or
- a band in which holes can be punched. This band shall be affixed to the edge of the cuff and the date of entry into service and the dates of periodic inspection and testing shall be given by punched holes which shall be located at not more than 20 mm from the periphery from the cuff. This is not permitted for Class 3 and Class 4 gloves,
or
- any other suitable means to identify the date of entry into service and the dates of periodic inspection and testing.

5.5.2 The marking shall be clearly visible, durable and shall not impair the quality of the glove.

The durability of the marking is checked by rubbing the marking for 15 s with a piece of lint-free cloth soaked in soapy water and then rubbing it for a further 15 s with a piece of lint-free cloth soaked in denatured alcohol. At the end of the test, the marking must remain legible.

5.5.3 Any additional marking shall be subject to agreement between the manufacturer and the customer.

5.5.4 When a colour code is used, the symbol (double triangle) shall correspond to the following code :

Class 00: beige
Class 0: red
Class 1: white
Class 2: yellow
Class 3: green
Class 4: orange

5.6 *Packaging*

Each pair of gloves shall be packaged in an individual container or package of sufficient strength to protect properly the gloves from damage. The outside of the container or package shall be marked with the name of the manufacturer or supplier, classification, category, size, length and cuff design.

At the request of the customer and in accordance with any national regulation, information contained in Appendix G and any additional or amended instructions shall be included in the package.

6. **Tests on gloves**

6.1 *General*

Each of the following sub-clauses defines whether type, routine or sampling tests are required.

In order to carry out the type tests, it is necessary to have :

- 4 pairs of gloves to cover all tests common to all categories of gloves (Clause 6) ;
- 2 additional pairs for gloves of Category A ;
- 2 additional pairs for gloves of Category H ;
- 1 additional pair for gloves of Category Z ;
- 9 pairs of gloves of Category R.

The allotment of these gloves in various testing lots and the order in which these tests are carried out are given in Appendix C.

Gloves shall be preconditioned for a period of 2 ± 0.5 h at a temperature of 23 ± 2 °C and 50 ± 5 % relative humidity (see IEC Publication 212, standard atmosphere B).

6.2 *Visual inspection and measurements*

6.2.1 *Shape*

Type test and sampling test (see Sub-clause 5.1).

The shape shall be verified by visual inspection.

6.2.2 Dimensions

Type test and sampling test (see Sub-clause 5.2 and Figures 1 and 2, pages 59 and 60).

The length shall be measured from the tip of the second finger in the case of a glove and from the extremity of the finger enclosure in the case of a mitt, to the outer edge of the cuff, measured with the glove in a relaxed position and the edge of the cuff perpendicular to the line of measurement.

The difference in length for contour gloves shall be measured with the glove in the relaxed position, along a line parallel to the length dimension, as shown in Figure 3, page 61.

6.2.3 Thickness

Type test and sampling test (see Sub-clause 5.3).

Thickness measurements shall be made on complete gloves at not less than four points on the palm and four points on the back of the glove but not on the cuff. Such points shall be distributed over the surface, and not concentrated.

Measurements shall be made with a micrometer or any alternative instrument giving substantially the same results. The micrometer shall be graduated to within 0.02 mm, have an anvil about 6 mm in diameter and a presser foot 3.17 ± 0.25 mm in diameter. The presser foot shall exert a total force of 0.83 ± 0.03 N. Sufficient support shall be given the glove so that it will present an unstressed, flat surface between the anvil faces of the micrometer.

In case of dispute, the micrometer method described above shall be used.

6.2.4 Workmanship and finish

Type test and sampling test (see Sub-clause 5.4).

The workmanship and finish shall be verified by visual inspection.

6.2.5 Marking

Type test and routine test (see Sub-clause 5.5).

The marking shall be verified by visual inspection and durability test (Sub-clause 5.5.2) for type test. No durability test is required for routine test.

6.2.6 Packaging

Type test and sampling test (see Sub-clause 5.6).

The packaging shall be verified by visual inspection.

6.3 Mechanical tests

6.3.1 General

6.3.1.1 All mechanical tests shall be performed on test pieces which have been conditioned by storing each glove separately in a horizontal position for 24 h at a room temperature of 23 ± 2 °C, 50 ± 5 % relative humidity (see IEC Publication 212, standard atmosphere B).

6.3.1.2 If fabric is attached to the glove, it shall be removed before cutting the test pieces. Cloth-marked surfaces shall be made smooth by buffing.

Note. – The properties of vulcanized elastomeric materials change continuously with time, these changes being particularly rapid in the period immediately following vulcanization.

6.3.2 Tensile strength and elongation at break

Type test and sampling test.

Four dumb-bell test pieces having the outline shown in Figure 5, page 64, shall be cut from each glove under test, one from the palm, one from the back, and two from the wrist area (see ISO Standard 37). If the area of one glove is too small to cut the four test pieces, an additional glove shall be used.

Reference lines, 20 mm apart, shall be marked on these test pieces, symmetrically placed on the narrow part of the dumb-bell (see Figure 5).

The test pieces shall be tested in a tensile testing machine which shall be power driven at a sufficient speed to maintain the rate of traverse of the driven grip substantially constant up to the maximum force capacity of the machine. The rate of traverse shall be 500 ± 50 mm/min.

The tensile strength shall be calculated by dividing the force at break by the initial area of the cross-section under test. The average of the measurements on the four test pieces shall not be less than 14 MPa.

The elongation at break shall be calculated by subtracting the initial distance between the reference lines on the test piece from the distance between the lines at breaking point and expressing the result as a percentage of the initial distance.

The average of the measurements on the four test pieces shall not be less than 600 %.

Notes 1. – The machine shall be equipped to give a continuous indication of the force applied to the test piece and a graduated scale to measure the elongation.

2. – After the test piece has been broken the machine shall give a permanent indication of the maximum force and where possible the maximum elongation.

6.3.3 Mechanical puncture resistance

Type test and sampling test.

Two circular test pieces 50 mm in diameter shall be cut from the glove and each shall be clamped between flat 50 mm diameter test plates. The top plate shall have a circular opening 6 mm in diameter and the bottom plate a 25 mm diameter circular opening. The edges of both openings shall be rounded to a radius of 0.8 mm (see Figure 6, page 65).

A needle shall be produced from a 5 mm diameter metallic rod and one end shall be machined to produce a taper with an angle of 12° and with the tip rounded to a radius of 0.8 mm (see Figure 6). The needle shall be clean at time of use.

The needle shall be positioned perpendicularly above the test piece (clamped between the plates) and shall be driven into and through the specimen. The rate of traverse shall be 500 ± 50 mm/min. The force required to puncture the test piece shall be measured.

The puncture resistance shall be calculated by dividing the puncturing force by the thickness of the test piece and for each test the result shall be greater than 18 N/mm.

6.3.4 Tension set

Type test and sampling test.

Three test pieces, having the outline shown in Figure 5, page 64, shall be cut from each glove under test, one from the palm, one from the back and one from the wrist. The test pieces shall be fitted in a straining device consisting of a metal rod or other suitable guide fitted with a pair of

holders, one fixed and one movable, for the ends of the test piece.

The measurement of the unstrained reference length (shown as l_0 in Figure 5) shall be checked to the nearest 0.1 mm and the test piece shall be placed in the holder. The test piece shall be extended at a speed of between 2 mm/s and 10 mm/s to a $400 \pm 10\%$ elongation and held for 10.0 min. After this time the strain shall be released at a speed of between 2 mm/s and 10 mm/s, and then the test piece shall be removed from the holder and laid free on a flat surface. After a 10.0 min recovery time the reference length shall be measured again.

The tension set is calculated as a percentage of the initial strain as follows:

$$\text{tension set} = 100 \times \frac{l_1 - l_0}{l_s - l_0}$$

where:

l_0 = original unstrained reference length

l_s = strained reference length

l_1 = reference length after recovery

The tension set shall not exceed 15 %.

6.4 Dielectric tests

6.4.1 General

Dielectric testing at a.c. or d.c. voltage shall be carried out at a temperature of 23 ± 2 °C. The choice of a.c. or d.c. shall be made between manufacturer and customer.

Note. — The equivalence of d.c. tests and a.c. tests is under consideration and consequently the values of d.c. test voltages are under consideration.

For type and sampling tests the gloves shall be conditioned for moisture absorption by immersion in water for a period of 16 ± 0.5 h. For routine tests such conditioning is not required.

6.4.1.1 General test procedure

After conditioning, if necessary, the gloves shall be filled with tap water and immersed in a tank of water to a depth in accordance with Table III. The water level during the test shall be the same inside and outside the glove.

On certain types of gloves (e.g. lined) where the water would be injurious to the inside surface, nickel stainless steel balls 4 mm in diameter can be used in place of water. The water inside the glove forms one electrode and shall be connected to one terminal of the voltage source by means of a chain or sliding rod that dips into the water. The water in the tank outside the glove forms the other electrode and shall be connected directly to the other terminal of the voltage source. The water shall be free of air bubbles and air pockets and the exposed portion of the glove above the water line shall be dry.

The test equipment used shall be capable of supplying an essentially stepless and continuously variable voltage to the test specimen. Motor-driven regulating equipment is convenient and tends to provide a uniform rate of rise to the test voltage. The test apparatus should be protected by an automatic circuit-breaking device designed to open promptly on the current produced by failure of a specimen under test. This circuit-breaking device should be designed to protect the test equipment under any conditions of short circuit.

Notes 1. — It is recommended that the test equipment be inspected and calibrated at least annually.

2. — To eliminate excessive ozone and possible flashover along the cuff there should be a downward movement of air on the surface of the water tank.

TABLE III
Clearance from open part of glove to waterline

Class of glove	Clearance for test			
	a. c.		d. c.	
	Proof test	Withstand test	Proof test	Withstand test
00	40	40	40	50
0	40	40	40	50
1	40	65	50	100
2	65	75	75	130
3	90	100	100	150
4	130	165	150	180

Notes 1. – See Figure 7, page 66, for distance from open part of glove to waterline.

2. – Permissible tolerance for the clearance between the open part of the glove and the waterline is ± 13 mm.

3. – In the cases where high humidity (above 55%) or low barometric pressure (below 933 mbar; see IEC Publication 160), is encountered, the specified clearances may be increased by a maximum of 25 mm.

6.4.1.2 Failure indicators

Glove failure indicators or accessory circuits shall be designed to give positive indication of failure.

6.4.2 A.C. test procedure

The desired a.c. test voltage can be most readily obtained from a step-up transformer energized from a variable low-voltage source. The transformer and its control equipment shall be of such size and design that, with the test specimen in the circuit, the crest factor of the test voltage (ratio of maximum voltage to mean r.m.s. voltage) shall not differ by more than 5 % from that of the sinusoidal wave over the upper half of the range of test voltage.

Voltage control may be ensured in one of several ways:

- a) generator field regulation;
- b) variable ratio autotransformer;
- c) induction regulator.

Note. – Voltage-controlling equipment should not give rise to voltage distortion and should have an approximately straight line voltage-to-time characteristic.

The correct r.m.s. value of the actual sinusoidal voltage waveform applied to the glove is measured by one of the following methods:

- a) a voltmeter used in conjunction with a calibrated instrument transformer connected directly across the high-voltage circuit;
- b) a calibrated electrostatic voltmeter connected across the high-voltage circuit by means of a capacitive divider;
- c) a voltmeter connected to a tertiary coil in the test transformer, provided it has been demonstrated that the assigned transformation ratio does not change appreciably with load;
- d) an a.c. voltmeter connected in series with appropriate high-voltage type resistors directly across the high-voltage circuit.

The accuracy of the voltage measuring circuit shall be within 2 % of full scale.

Note. – A voltmeter connected to the low-voltage side of the testing transformer may be used only if the transformation ratio has been properly determined and is known not to change appreciably with load. A calibrated sphere gap may be used to check the accuracy of the voltage as indicated by the voltmeter.

The crest factor may be checked by the use of a peak reading voltmeter connected directly across the high-voltage circuit ; or, if an electrostatic voltmeter or a voltmeter in conjunction with an instrument voltage transformer is connected across the high-voltage circuit, a standard sphere gap may be sparked over, and the corresponding voltage compared with the reading of the r.m.s. voltmeter (see IEC Publication 60-1).

The leakage current is measured directly by inserting a milliammeter in series with each individual glove in turn. The reading should be taken towards the end of the proof-test voltage period.

- Notes 1.* – It is customary to make this type of high-voltage test with one end of the circuit grounded. When proof current tests are made on one glove at a time, the water in the tank is usually connected to the grounded end of the high-voltage circuit. The milliammeter is connected in the grounded end of the circuit and shunted by a short-circuiting automatic self-closing switch which keeps the circuit closed except at the instant of reading and thus maintains an uninterrupted ground.
2. – When proof current tests are made on more than one glove at one time, the water in the tank shall be connected to the high voltage circuit if it is required that the water electrodes inside the gloves be the grounded electrodes. The ammeter for reading proof-test current is then connected to the ground electrode through a suitable switching arrangement to permit reading of the proof-test current in each glove separately.
 3. – If ammeter and switching arrangements are suitably insulated, they may be used in the high-voltage circuit of the gloves, and the water in the tank may be grounded.

6.4.2.1 *Proof voltage test*

Type test, routine test and sampling test.

Each glove shall be given a proof voltage test as specified in Table IV. The a.c. voltage shall be initially applied at a low value and gradually increased at a constant rate-of-rise of approximately 1000 V/s until the specified test voltage level is reached or failure occurs. The test period shall be considered to start at the instant the specified proof voltage is reached. For the type and the sampling tests the proof-test voltage shall be applied continuously for 3 min. For the routine test the proof-test voltage shall be applied continuously for 1 min.

Note. – At the end of the test period the applied voltage should be reduced to half its value before opening the test circuit, unless an electrical failure has already occurred.

6.4.2.2 *Leakage current at proof voltage*

Type test, routine test and sampling test.

The leakage current shall not exceed the values specified in Table IV at any time during the proof voltage test period.

6.4.2.3 *Withstand voltage test*

Type test and sampling test.

The a.c. voltage shall be applied as specified in Sub-clause 6.4.2.1 until the minimum withstand voltage given in Table IV is reached. If no puncture occurs, the test is considered successful. The voltage is immediately reduced and then the test circuit opened. If flashover occurs the clearance in Table III may be increased (see Table III, Note 3).