

# Electrical insulating protective clothing for low-voltage installations

The European Standard EN 50286:1999 has the status of a  
British Standard

ICS 13.260; 13.340.10

# National foreword

This British Standard is the official English language version of EN 50286:1999, including Corrigendum October 2004.

The UK participation in its preparation was entrusted to Technical Committee PEL/78, Tools for live working, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

## Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

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This British Standard, having been prepared under the direction of the Electrotechnical Sector Committee, was published under the authority of the Standards Committee and comes into effect on 15 August 2001

**Summary of pages**

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EUROPEAN STANDARD

**EN 50286**

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 1999

ICS 13.260; 13.340.10

English version

## **Electrical insulating protective clothing for low-voltage installations**

Vêtements de protection isolants pour  
installations basse tension

Elektrisch isolierende Schutzkleidung

This European Standard was approved by CENELEC on 1998-08-01. 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 standards bodies of Austria, Belgium, Czech Republic, 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

**Central Secretariat: rue de Stassart, 35 B-1050 Brussels**

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## Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 78, Equipment and tools for live working. It is submitted to the unique acceptance procedure.

The text of the draft was submitted to the Unique Acceptance Procedure and was approved by CENELEC as EN 50286 on 1998-08-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1999-12-01

This document complies with the electrical insulating requirements set out by CLC/TC 78 and with the non-electrical requirements set out by CEN/TC 162. This insulating clothing is recognized as a PPE according to EEC Directive (89/686/EEC).

Electrical insulating protective clothing was developed primarily for use by workers for work on low-voltage overhead lines.

For the moment, there is no withstand test applicable to products where the principle risk is of unintentional contact with live parts, and such a test is not included in the present standard. However, despite this lack, it is considered that a satisfactory level of electrical protection is provided by compliance with this standard for both the proof tests and the periodic electrical inspections.

For the moment, no test is available in relation to the risk of workers exposure to an electrical arc generated by low-voltage installations. This task is presently under study by WG7.



## 1 Scope

This standard is applicable to electrical insulating protective clothing used by skilled persons when they are working on or near live parts of low-voltage installations at nominal voltages up to 500 V a.c. or 750 V d.c.

The purpose of this clothing when used in conjunction with other PPE, such as boots and gloves etc., is to prevent dangerous current from passing through persons when there is a risk of unintentional contact with several live parts located in and around the working area. Where the risk of unintentional contact with live parts is restricted, e.g. with live parts in front of the worker, the wearing of this clothing is not essential.

NOTE Some restrictions on the use of this clothing may exist in areas with hot climatic conditions, for example.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 340:1993, *Protective clothing — General requirements*.

EN 532:1994, *Protective clothing — Protection against heat and flame — method of test for limited flame spread*.

EN 20811:1992, *Textiles — Determination of resistance to water penetration — Hydrostatic pressure test*.

EN 31092:1993, *Textiles — determination of physiological properties — Measurement of thermal and water-vapour resistance under steady-state conditions (sweating guarded hotplate test)*.

EN 50110:1996, *Operation of electrical installations*.

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code)* (IEC 529:1989).

HD 588.1 Si:1991, *High-voltage test techniques — Part I: General definitions and test requirements* (IEC 60-1:1989 + corrigendum March 1992).

IEC 60050-151:1978, *International Electrotechnical Vocabulary Chapter 151: Electrical and magnetic devices*.

IEC 60410:1973, *Sampling plans and procedures for inspection by attributes*.

ISO 3175:1998, *Textiles — Dry-cleaning and finishing — Part 1: Method for assessing the cleanability of textiles and garments*.

ISO 4674:1977, *Textiles — Fabrics coated with rubber or plastics — Determination of tear resistance*.

ISO 5077:1984, *Textiles — Determination of dimensional change in washing and drying*.

ISO 5081:1977, *Textiles — Woven fabrics — Determination of breaking strength and elongation (strip method)*.

ISO 6330:1984, *Textiles — Domestic washing and drying procedures for textile testing*

ISO 9000 series, *Quality management and quality assurance standards*.



## **3 Definitions**

### **3.1 Electrical insulating protective clothing**

Electrical insulating protective clothing denotes a non-conductive protective clothing that prevents transmission of electrical current to the wearer if it comes into contact with live conductors. Jacket with hood, trousers and overall with hood are articles of the protective clothing.

### **3.2 Seam**

The junction of two edges of material that are permanently joined by sewing or any other method.

### **3.3 Tests**

#### **3.3.1 Type tests**

A test performed on one or more articles of clothing made to a certain design to show that the design meets certain specifications [1EV 60151-04-15 mod.].

#### **3.3.2 Sampling test**

A test performed on a number of articles, of clothing taken at a random from a batch [1EV 60151-04-17 mod.].

#### **3.3.3 Routine test**

A test to which each article of clothing is subjected during or after manufacture to ascertain whether it complies with certain criteria [1EV 60151-04-16 mod.].

#### **3.3.4 Acceptance test**

A contractual test to prove to the customer that the article of clothing meets certain conditions of its specification [1EV 601 51-04-20 mod.].

#### **3.3.5 Proof test voltage**

A specified voltage that is applied to an article of clothing for the time defined under specified conditions to assure that the electrical strength of the insulation is above a specified value.

## **4 Requirements**

### **4.1 Non-electrical requirements**

#### **4.1.1 Weights, dimensions and design**

No metal parts shall be on the outside of the protective clothing. Touch and close fastener shall be used. The protective clothing shall consist of a jacket with hood and trousers or an overall with a hood.

The weight of protective clothing shall comply with values given in Table 1. The manufacturing dimensions shall comply with those given in Table I, which is based on EN 340. Other dimensions may be chosen in a similar manner.

All seams, except hem-seams, shall be safe in the electrical environments.



The number of pockets in the protective clothing shall be limited to two. The protective suit shall have one pocket for the jacket and one for the trousers. The protective overall shall have two pockets located in similar positions.

One pocket shall be placed at the chest level to the jacket or the overall. One pocket shall be placed laterally to the thigh to the trousers. The pockets shall be equipped with flaps that shall have close and touch fasteners.

The hood shall be securely fastened to the jacket or overall. The method of fastening shall ensure that:

- the hood cannot become separated or detached, either in part or completely, from the jacket or overall, when the clothing is in use;
- the integrity of the electrical insulation of the clothing is maintained both across and along the length of the means of fastening, when the clothing is in use.

Examples of methods of fastening which meet these requirements are:

- sewn seams which meet the requirements in accordance with 4.2;
- zip-fasteners provided inside and outside with insulating flaps and touch and close fasteners that completely cover all parts of the zip-fastener.

The front edge of the hood shall be designed all around in such a way that a cord made from insulating material can be taken in. The cord shall be taken in the hood, but it shall not be fixed.

The hood shall be designed so that a protective helmet with face shield can be worn inside the hood. The cord of the hood shall allow the hood to fit closely to the protective helmet.

Any zip-fastener necessary to close the jacket, the trousers or the overall shall be made from insulating material. However, if metal parts are used for the slider or for the terminal pieces of the zip-fastener, they shall be covered with insulating material.

The length of the zip-fastener shall correspond to the design of the jacket. The length shall be designed in such a way that the zip-fastener begins  $(10 \pm 2)$  cm above the hem seam and ends  $(3 \pm 1)$  cm below the edge of the hood. The zip-fastener shall be covered by a flap that begins at the hem seam and ends at the hood seam. The flap shall be equipped with a touch and close fastener, which covers at least the whole length of the zip-fastener. For the overall, the length of the zip-fastener and the design of the flap shall be chosen in a similar manner.

The cuff of the sleeves shall be adjustable by means of a tab with a touch and close fastener.

The bottoms of the trousers or overall legs shall be wide enough to be worn over footwear. The trousers shall be equipped with a fly that is closed over its length by a zip-fastener. The fly shall be covered by a flap that shall have a touch and close fastener over the whole length.

The trousers shall be equipped with braces that shall be securely connected to the trousers and shall be adjustable or elasticated. The elasticity may be achieved by a complete elastic brace or a piece of elastic in the brace.

The colour shall be bright.

NOTE The protective clothing should have a unique colour. A red colour is recommended. This colour may differ from colour code marking.



**Table 1 — Manufacture dimensions and weights of protective clothing**

<b>Height*</b> cm	164 to 170	170 to 176	176 to 182	182 to 188	188 to 194
<b>Weight (max.)</b> kg	2,2	2,45	2,7	2,95	3,2
<b>Chest girth*</b> cm	92 to 96	96 to 100	100 to 108	108 to 116	116 to 124
<b>Jacket back length (not for overalls)</b> cm	86	88	90	92	94
<b>Trousers and overall waist girth*</b> cm	80 to 88	88 to 96	96 to 104	104 to 116	116 to 128
<b>Crotch length</b> cm	77	79	81	83	85
<p>NOTE 1 * These sizes are body sizes according to EN 340. Others sizes are clothing sizes.</p> <p>NOTE 2 Dimensions as manufactured (cm); tolerances: <math>\pm 2</math> cm.</p> <p>NOTE 3 The dimensions of the protective clothing shall be selected in such a way that this clothing can be worn over the normal working clothing.</p> <p>NOTE 4 The accuracy of the weighting equipment shall be <math>\pm 5</math> %.</p>					

#### **4.1.2 Limited flame spread**

The assembly of layers of fabric shall fulfil the following requirements (testing in accordance with 5.2.2):

- no flaming to the top or either side edge;
- no hole formation in the outer layer;
- no flaming or molten debris;
- the mean value of afterflame shall be  $\leq 2\text{s}$ ;
- the mean value of afterglow time shall be  $\leq 2\text{s}$ .

#### **4.1.3 Tear resistance**

The outer fabric shall have a tear resistance of at least 30 N in the longitudinal and the cross direction (testing in accordance with 5.2.3).

#### **4.1.4 Tensile strength**

The outer fabric shall have a tensile strength of at least 700 N in the longitudinal and the cross direction (testing in accordance with 5.2.4).

#### **4.1.5 Water-vapour resistance**

The  $R_{\text{et}}$  value shall not exceed  $20 \text{ Pa m}^2/\text{W}$  (testing in accordance with 5.2.5).

#### **4.1.6 Water penetration**

The first water drop shall not penetrate below 130 mbar (testing in accordance with 5.2.6).

#### **4.1.7 Dimensional change due to laundering and/or cleaning**

The dimensional change of the outer fabric shall not exceed  $\pm 3 \%$  in the longitudinal and the cross direction (testing in accordance with 5.2.7).

### **4.2 Electrical requirements**

The protective clothing shall pass a proof test, in accordance with 5.3.2, of:

- 2,5 kV under dry conditions;
- 2,0 kV under moisture conditions;
- 1,5 kV after rain.



## **4.3 Marking**

### **4.3.1 General marking**

Electrical insulating protective clothing for low-voltage installations according to this standard shall be marked according to EN 340.

Each article of protective clothing shall be marked on the inner side of the clothing.

The marking shall be affixed so as to be visible, legible and durable and shall give the following information:

- mark of origin (name or trade mark or other means of identification of the manufacturer or his authorized representative);
- year and month of manufacture;
- serial number;
- type or identification code;
- number of this European Standard;
- size designation according to EN 340;
- laundering and/or cleaning instructions.

The marking shall be durable for the appropriate number of laundering and/or cleaning processes.

The height of the letters of the marking shall be at least 2 mm.

### **4.3.2 Specific marking**

The outer side of each of the flaps of the pockets on the jacket, trousers and overall shall be marked with the symbol double triangle with the dimension  $X = 16$  mm or 25 mm assigned to Class 00 or colour code beige for the whole label (see Figure 3).

The marking shall not impair the quality of the protective clothing.

A suitable panel shall be placed on the inner side of the protective clothing, at:

- the chest level of the jacket or overall;
- the upper seam of the trousers.

The suitable panel consists of, e.g. a linen strip of at least 60 mm x 80 mm on which marking shall be applied to indicate date of periodic inspections.

The panel may be combined with the marking label according to 4.3.1.

All marking shall be durable for the appropriate number of laundering and/or cleaning processes.

## **4.4 Instructions for use and periodic inspection**

Instructions for use and periodic inspections shall be in accordance with EN 340 and annex A.

## **5 Tests**

### **5.1 General**

Tests are performed as type, routine and sampling tests.

Tests shall be performed according to annex B and in the given sequence.

For all the following tests the conditioning atmosphere shall be the temperature  $(20 \pm 2) ^\circ\text{C}$  and relative humidity  $(65 \pm 5) \%$  for 24 h if no special pre-treatment is required.

Unless otherwise specified the tests shall be carried out at a temperature between  $15 ^\circ\text{C}$  and  $35 ^\circ\text{C}$  and a relative humidity of 25 % to 75 % starting not later than 5 mm after the item under test is taken from the conditioning atmosphere.

### **5.2 Non-electrical tests**

#### **5.2.1 Verifying dimensions, weight and design**

The compliance of dimensions, weight and workmanship with the requirements of 4.1.1 shall be verified. For routine tests, a visual inspection is sufficient for dimensions and workmanship.

#### **5.2.2 Limited flame spread**

The test shall be carried out on four test pieces, two from the longitudinal and two from the cross direction, according to EN 532, with the size of the test piece 200 mm x 160 mm.

The clothing or the test pieces shall be washed five times in accordance with the ISO 6330 washing procedure and information from the manufacturer.

If the clothing consists of more than one layer the layers have to be arranged in compliance with the design for the test. The flame shall be applied to the outer layer.

The test is passed if the requirements of 4.1.2 are met.

#### **5.2.3 Tear resistance**

The test shall be carried out on ten test pieces according to ISO 4674, method A2, five from the longitudinal and five from the cross direction.

If the clothing consists of several layers it is the outer material that shall meet the requirement.

The test is passed if the requirements of 4.1.3 are met.

#### **5.2.4 Tensile strength**

The test shall be carried out on ten test pieces according to ISO 5081, five from the longitudinal and five from the cross direction.

If the clothing consists of several layers it is the outer material that shall meet the requirement.

The test is passed if the requirements of 4.1.4 are met.



### **5.2.5 Water-vapour resistance**

The conditioning and the test shall be carried out according to EN 31092.

If the clothing consists of several layers all layers shall be tested together.

The test is passed if the requirements of 4.1.5 are met.

### **5.2.6 Water penetration**

The test shall be carried out according to EN 20811.

If the clothing consists of several layers all layers shall be tested together.

The test is passed if the requirements of 4.1.6 are met.

### **5.2.7 Dimensional change due to laundering and/or cleaning**

No conditioning is required.

The test procedure for dimensional change for washing shall be carried out in accordance with ISO 5077 and for dry-cleaning in accordance with ISO 3175.

One test piece shall be subjected to five washing procedures according to ISO 6330 or dry-cleaning processes according to ISO 3175. If both washing and dry-cleaning is permitted the test piece shall only be washed.

The test is passed if the requirements of 4.1.7 are met.

## **5.3 Electrical tests**

### **5.3.1 General**

Test arrangements, power sources and procedures shall be in accordance with HD588.1 S1.

Electrical type tests shall be performed on test pieces. Type tests are destructive.

For the test, nine circular test pieces measuring 170 mm in diameter shall be cut from the jacket, trousers or overall, and at least one shall be cut from the hood. Three of the test pieces shall have seams. One test piece with a seam shall undergo the proof voltage test (dry), one the proof voltage test after conditioning in moisture atmosphere and one the proof voltage test after rain.

For electrical tests the alternating voltage of a voltage source, the output power of which shall be at least 1 000 VA, shall be initially applied at a low-voltage up to 500 V and gradually increased at a constant rate-of-rise of approximately 1 000 V/s until the voltage specified in the relevant subclauses is reached or failure occurs.



### **5.3.2 Proof test**

The test is performed with the following arrangement (see Figure 1):

A plastic pipe with an inner diameter of  $(50 \pm 2)$  mm and a height of  $(10 \pm 1)$  mm equipped with two recess for the seam shall be placed centrally on the test piece and be filled with stainless steel pellets of  $(3,5 \pm 0,6)$  mm diameter in such a way that the plastic pipe lies in the horizontal plane and no pellet can fall out. The pellet filling shall be conductively connected to one pole of the power source.

A grounded metal electrode with 75 mm diameter shall be placed coaxially below the test piece and shall be connected to the other pole of the power source.

For type and sampling tests the voltage shall be applied continuously for 3 min. Herewith the proof test current shall be measured.

#### **5.3.2.1 Proof test under dry conditions**

The test shall be carried out on conditioned test pieces.

A voltage of 2,5 kV (rms) shall be applied to three test pieces, one of them shall have a seam, and the current shall be measured.

The test is passed if no puncture or flashover occurs and the proof test current does not exceed 0,2 mA.

#### **5.3.2.2 Proof test under moisture conditions**

The test shall be carried out on conditioned test pieces. Storing for 48 h at an ambient temperature of  $(23 \pm 2)$  °C and a relative humidity between 91 % and 95 % shall be regarded as conditioning.

The test shall be carried out within 1 min after the removal of the test piece from the conditioning atmosphere.

A voltage of 2 kV (rms) shall be applied to three test pieces (one of them shall have a seam) and the proof test current shall be measured.

The test is passed if no puncture or flashover occurs and the proof test current does not exceed 0,5 mA.

#### **5.3.2.3 Proof test after rain**

Three test pieces (one of them shall have a seam) shall be put over the upper opening of a cup with an inner diameter of 100 mm and a height of 500 mm and then be fastened with a sealing ring (e.g. rubber) at the upper opening in such a way that the inner side of the test pieces remains dry. The edge of the cup shall be rounded to have a minimum radius of  $(3 \pm 1)$  mm.

Subsequently rain simulated by an oscillating tube shall be maintained for 10 min according to EN 60529 subclause 14.2.3 Table VIII and Figure 4. The water resistivity shall be in accordance with HD 588.1 S1.

A voltage of 1,5 kV (rms) shall be applied immediately after rain to the test pieces for 3 min and the proof test current shall be measured.

The test is passed if no puncture or flashover occurs and the proof test current does not exceed 0,5 mA.



### 5.3.3 Routine test

This test shall be carried out to detect misassembly of the materials during the manufacturing of the protective clothing.

Conditioning is not required.

The jacket and the overall shall be tested at least at the hood and at least at one further point.

The trousers shall be tested at least at one point.

Further test points shall be selected if the manufacturing process requires it.

The test piece shall be placed coaxially between a grounded metallic electrode with a diameter of 75 mm and an upper metallic electrode with a diameter of 25 mm. The upper electrode is connected to the high voltage (see Figure 2). The test voltage of 2,5 kV shall be applied 10 s after reaching the specified voltage whereas a force of 3 N is used.

The test is passed if no puncture occurs.

NOTE The force of 3 N may be achieved by the dead weight of the upper electrode or a spring loaded upper electrode.

## 5.4 Marking

The marking shall be rubbed for 15 s with water soaked lint free cloth and then rubbed for 15 s with lint free cloth soaked with ethyl alcohol.

NOTE The solvent ethyl alcohol was selected by CLC/TC 78, but this agreement will be changed if an international agreement on a commonly used solvent is reached.

The test is passed if the marking is still easily legible and has not curled or become detached.

For routine tests it is sufficient to check the completeness of marking.

## 5.5 Instructions for use and periodic inspection

For type tests and sampling tests it shall be checked by visual inspection whether the requirements of 4.4 are fulfilled.

For the routine test it shall be checked by visual inspection whether the protective clothing are accompanied by instructions for use.

# 6 Quality assurance plan and acceptance tests

## 6.1 General

In order to assure the delivery of products that meet this standard, the manufacturer shall employ an approved quality assurance plan that complies with the provisions of the ISO 9000 series.

The quality assurance plan shall ascertain that the products meet the requirements contained in this standard.

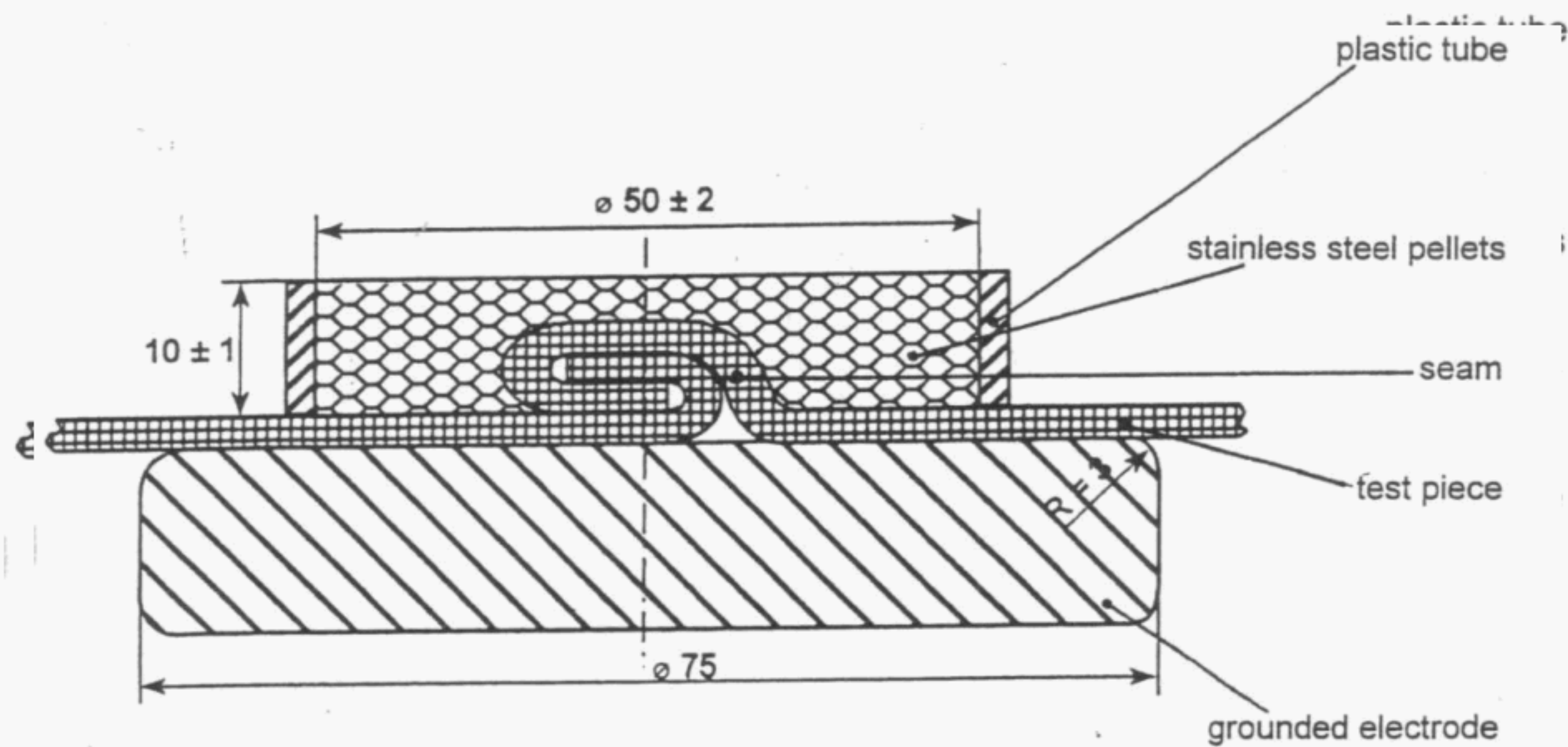
In absence of accepted quality assurance plan as specified above the sampling procedure detailed in annex C shall be carried out.

6.2 Sampling procedure

The sampling procedure shall be in accordance with the type test and as specified in annex C.

6.3 Acceptance tests

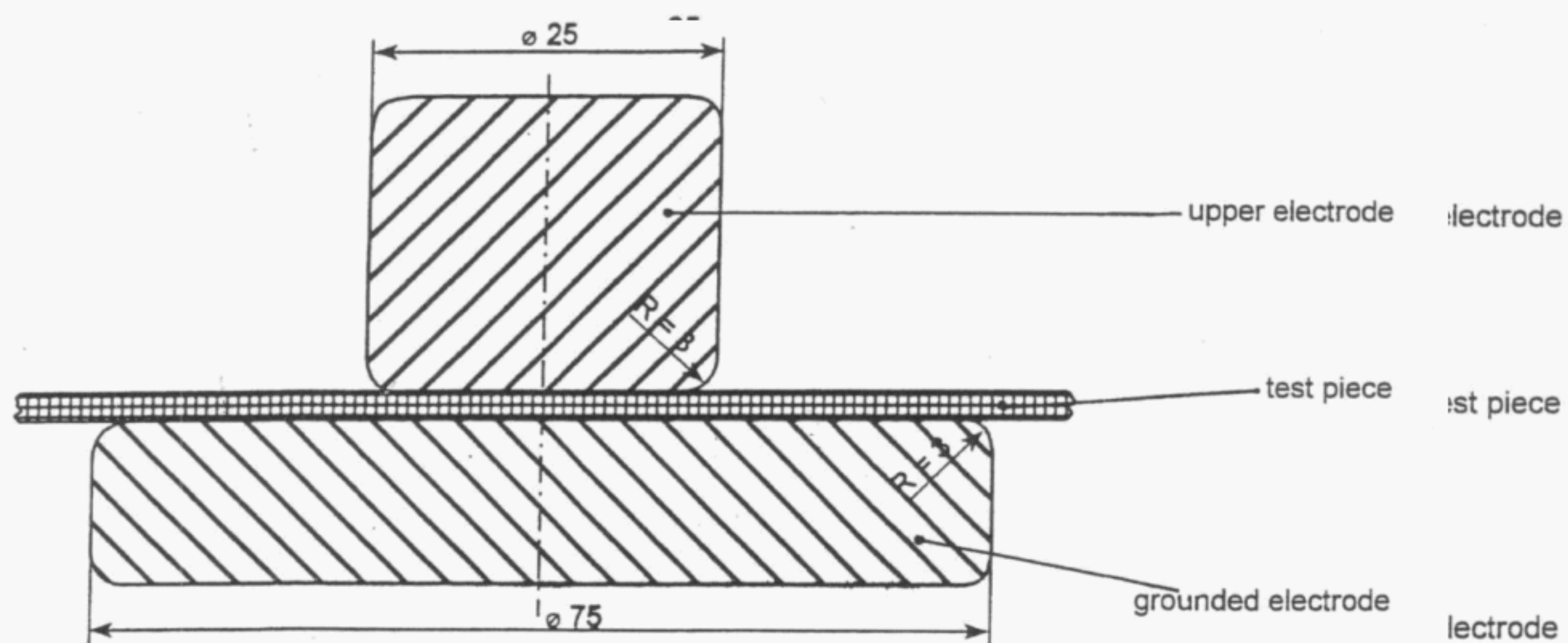
If the customer requests from the manufacturer additional requirements and tests, the manufacturer shall keep all additional test results for inspection by the customer (see annex D).



NOTE All dimensions are in millimeters

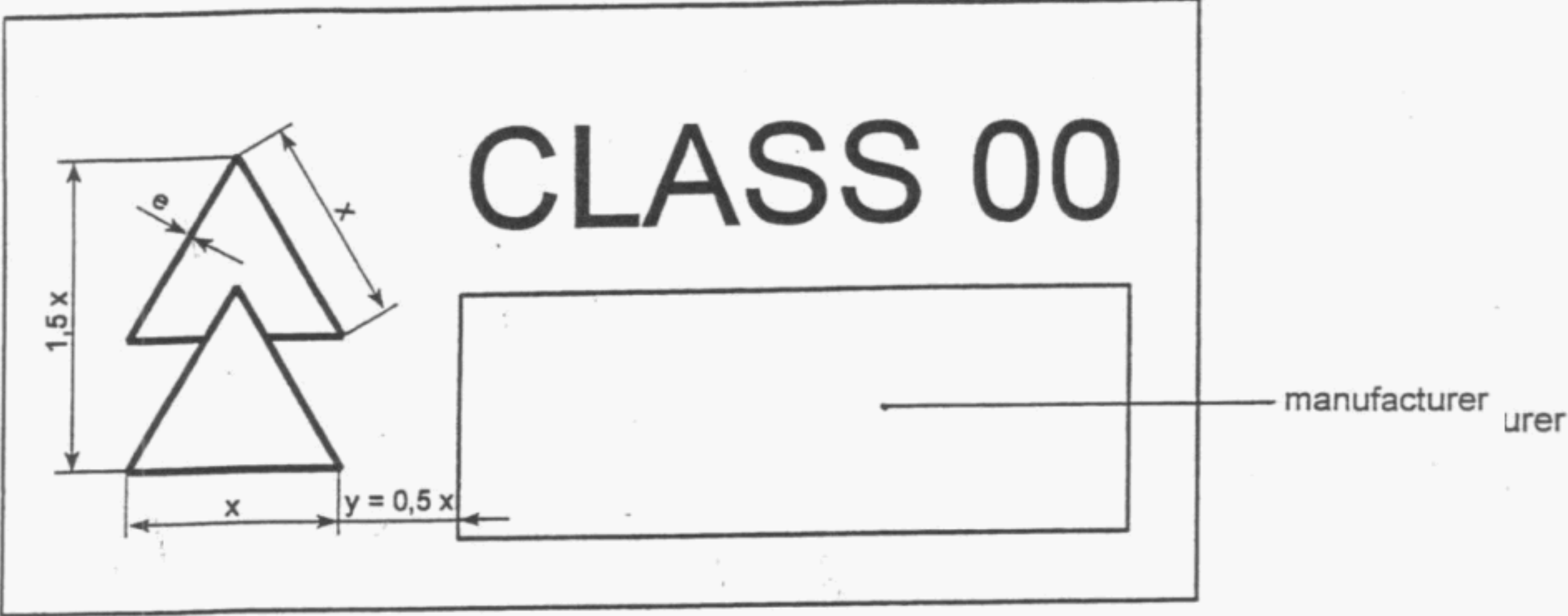
Figure 1 — Arrangement of the test electrodes for proof voltage tests (see 5.3.2)





NOTE All dimensions are in millimeters

**Figure 2 — Arrangement of the test electrodes for routine test (5.3.3) and periodic tests (A.2.2)**



NOTE 1 All dimensions are in millimeters, tolerance are  $\pm 10\%$

NOTE 2 Dimensions

$x = 16$ or $25$
$e =$ minimum thickness of the line: $1\text{mm}$
Size of marking fits to the size of flaps for pockets

NOTE 3 Class 00 (height of letters at least  $x/2$ ) or colour code beige for the whole label alternatively

**Figure 3 — Marking symbol “Double triangle”  
and example of marking according to 4.3.3**



## Annex A (normative)

### Instructions for use and periodic inspection

#### A.1 Instructions for use

Each protective clothing shall be accompanied by the instructions for use, which contain the information necessary for use and maintenance and the prevention from damages. They shall be written at least in the official language(s) of the state of destination.

All information shall be unambiguous.

The following information shall be given:

- name and full address of the manufacturer and/or his authorized representative;
- designation of the product type, commercial name or code;
- number of this European Standard;
- explanation of the symbol “double triangle”;
- information that working on or near live parts of overhead lines shall cease if thunderstorms are perceptible at the working site;
- instruction for use and maintenance in respect of potential risk of loss of protection due to ageing, limited effectiveness of insulation according to the conditions of use.

The instructions for use shall contain the specifications for the application of protective clothing according to EN 50110.

The instructions for use shall further contain:

- information that the electrical protective clothing shall only be used for working on or near live parts of low-voltage installations at nominal voltage up to 500 V a.c. or 750 V d.c.;
- information that the electrical protective clothing cannot be used alone and that it is necessary to use other compatible personal protective equipment according to the risks involved in the work;
- information that trousers shall not be tucked into footwear;
- information that the cuffs of gloves shall be worn over the sleeves of the jacket or the overall;
- information that the pockets shall be used only for personal non-conductive possessions. Tools shall be stored in a separate bag;
- information about periodic inspection (see A.2) and in which manner they have to be marked on the marking panel;
- information about storing, cleaning and maintenance with maximum periods between maintenance checks;
- information about follow-up treatment after laundering and/or cleaning if the resistance to water penetration and hence the electrical properties are impaired.

## **A.2 Periodic inspection**

Periodic inspection consists of a visual inspection followed by an additional electrical test and shall be carried out in intervals in accordance with national regulations.

NOTE An interval of one year is recommended in the case of absence of national regulations.

### **A.2.1 Visual inspection**

Before each use of protective clothing visual inspection has to be carried out. In case of any visible damage and/or soiling the protective clothing shall undergo the routine test especially on the points of possible damages and soiling. This test shall be noted on the marking panel.

A damage is anything that reduces the safety level of the electrical insulating protective clothing according to this standard.

### **A.2.2 Electrical tests**

The electrical tests shall be performed with the test arrangement and follow the test procedure in accordance with 5.3.3 but with the following modifications:

The test voltage of 1,5 kV shall be applied to the clothing with a force of 3 N for 3 s at test points as follows:

- the hood shall be tested at its highest point;
- the jacket shall be tested below one armpit and at both elbows;
- the trousers shall be tested at the seat and both knees;
- the overall shall be tested below one armpit, at the seat, and at both elbows and knees.

The points of tests shall be selected to exclude all seams.

The test shall be carried out with electrodes as shown in Figure 2 on the complete clothing.

NOTE The voltage may initially be applied with 50 % of the test value and then be increased uniformly and after the test period be decreased to 50 % of the test value and then be switched off.

The test is passed if no puncture occurs. If any failure occurs, the clothing shall be rejected.

Month, year and testing institute shall be durably marked on the corresponding marking panel when the periodic test has been passed.



Annex B (normative)

General test procedure

Table B.1 — Classification of tests

List of tests		Requirement	Type test	Routine test	Sampling test
		Subclause	Subclause	Subclause	Subclause
1	Visual inspection, design, size, etc.	4.1.1	5.2.1	5.2.1	
2	Limited flame spread	4.1.2	5.2.2		5.2.2
3	Tear resistance	4.1.3	5.2.3		5.2.3
4	Tensile strength	4.1.4	5.2.4		5.2.4
5	Water-vapour resistance	4.1.5	5.2.5		5.2.5
6	Water penetration	4.1.6	5.2.6		5.2.6
7	Change due to laundering and/or cleaning	4.1.7	5.2.7		5.2.7
8	Electrical test	4.2	5.3.1		5.3.1
	Proof test		5.3.2		5.3.2
	Routine test			5.3.3	
9	Marking	4.3	5.4	5.4	5.4
10	Instruction for use	4.4	5.5	5.5	5.5

Annex C (normative)

Sampling procedure

C.1 General

The sampling procedure does not follow in its entirety the sampling procedure developed in IEC 60410:1973. The product covered by this standard does not lend itself to the application of the above mentioned standard, due to its nature.

The sampling procedure used in conjunction with this standard on protective clothing has been specially developed based on the quality assurance practices of ISO 9000 series. When those requirements are not followed, the procedure of this annex is applicable.

C.2 Classification of defects

Defects are classified as major or minor (see definition in IEC 60410).

Routine tests are performed to detect critical defects.

Table C.1 — Classification of defects

Description of test	Subclause	Minor	Major
Visual inspection	5.2.1	X	
Limited flame spread	5.2.2	X	
Tear resistance	5.2.3	X	
Tensile strength	5.2.4	X	
Water-vapour resistance	5.2.5	X	
Water penetration	5.2.6	X	
Dimensional change due to laundering and/or cleaning	5.2.7	X	
Electrical test:			
proof dry	5.3.2.1		X
proof moisture	5.3.2.2		X
proof rain	5.3.2.3		X
Marking	5.4		X
Instructions for use	5.5		X
NOTE The unit of the sample is an article of the clothing.			



C.3 General sampling plan

C.3.1 Plans for minor defects (AQLIO)

Inspection level: S-1 in accordance with IEC 60410, Table IIA

Table C.2 — Sampling plan for minor defects

Batch or lot size	Sample size	Number of defects for acceptance	Number of defects for rejection
2 to 50	2	0	1
51 to 500	3	0	1
501 to 35 000	5	1	2

C.3.2 Plans for major defects (AQL 2,5)

Inspection level: S-3 in accordance with IEC 60410, Table IIA.

Table C.3 — Sampling plan for major defects

Batch or lot size	Sample size	Number of defects for acceptance	Number of defects for rejection
2 to 15	2	0	1
16 to 50	3	0	1
51 to 150	5	0	1
151 to 500	8	0	1
501 to 3 200	13	1	2
NOTE For a batch less than five, the sample size is the same number.			

## **Annex D (informative)**

### **Acceptance tests**

As defined in IEC 60151-04-20, an acceptance test is a contractual test to prove to the customer that the device meets certain conditions of its specification. These tests may be carried out on every unit (routine tests) or on a sampling of the units (sampling tests).

If a customer indicates in this specification that the device meet this standard only, the acceptance tests are those (both routine and sampling) which are specified in this document.

The customer may wish to witness the tests, have someone witness them, or simply accept the results of the tests as carried out by the manufacturer. He may also specify that the tests be carried out in an independent laboratory of his choosing or even in his own laboratory.

Further, the customer may specify the additional tests or larger sampling sizes, when he is purchasing from a new manufacturer, because he has experienced problems with a particular manufacturer, or he is purchasing a new product or a new design.





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