BRITISH STANDARD

BS EN
1149-1:2006

Protective clothing — Electrostatic properties —

Part 1: Test method for measurement of surface resistivity

The European Standard EN 1149-1:2006 has the status of a British Standard

ICS 13.340.01

BSI
British Standards

National foreword

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The UK participation in its preparation was entrusted to Technical Committee PH/3, Protective clothing, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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Summary of pages

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English Version

Protective clothing - Electrostatic properties - Part 1: Test method for measurement of surface resistivity

Vêtements de protection - Propriétés électrostatiques - Partie 1: Méthode d'essai pour la résistivité de surface

Schutzkleidung - Elektrostatische Eigenschaften - Teil 1: Prüfverfahren für die Messung des Oberflächenwiderstandes

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Contents

Page

Foreword

This document (EN 1149-1:2006) has been prepared by Technical Committee CEN/TC 162 “Protective clothing including hand and arm protection and lifejackets”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2006, and conflicting national standards shall be withdrawn at the latest by December 2006.

This document supersedes EN 1149-1:1995.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

EN 1149 consists of the following parts, under the general title "Protective clothing – Electrostatic properties":

— Part 1: Test method for measurement of surface resistivity

— Part 2: Test method for measurement of the electrical resistance through a material (vertical resistance)

— Part 3: Test methods for measurement of charge decay

— Part 5: Performance requirements[1]

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

[1] This document is under development.

Introduction

This European Standard is part of a series of test methods and requirements for electrostatic properties of protective clothing. Different parts are necessary, because of the various fields of application and materials. The method of this European Standard is most appropriate for materials for which the electrostatic dissipative behaviour is based on surface conductivity. It determines resistance over short distances and may not be appropriate for evaluating full garments.

1 Scope

This European Standard specifies a test method for materials intended to be used in the manufacturing of electrostatic dissipative protective clothing (or gloves) to avoid incendiary discharge. This test method is not applicable for materials to be used in the manufacturing of protection clothing or gloves against mains voltages.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 340:2003, *Protective clothing — General requirements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
surface resistance
resistance in ohm (Ω) as determined by using specified electrodes placed on the surface of the material

3.2
surface resistivity
resistance in ohm (Ω) between opposite edges of a square of the material along the surface of the material

NOTE The surface resistivity is independent of the electrode dimensions and is calculated by multiplying the measured surface resistance by an appropriate factor.

4 Test method

4.1 Principle

The specimen is placed on an insulating base plate and an electrode assembly is rested on the specimen. A DC potential is applied to the electrode assembly and the resistance of the fabric is measured.

4.2 Apparatus

4.2.1 Electrodes

The electrodes shall consist of a cylindrical and an annular electrode which are arranged concentrically with each other. The electrodes made of stainless steel are shown in Figure 1. The insulation resistance between the inner and the outer electrode shall be not less than 10^{14} Ω when determined in accordance with the method described in 4.4.2.

4.2.2 Flat base plate

A flat base plate shall consist of insulating material of surface resistivity not less than 10^{14} Ω (see 4.4.2), of a thickness between 1 mm and 10 mm and it shall be larger than the overall dimensions of the electrode. This plate is used as a support for the specimen during the measurement, and is rested in turn on an earthed conducting surface, e.g. metal plate.

4.2.3 Ohmmeter

Ohmmeter with a range of 10^5 Ω to 10^{14} Ω;

and an accuracy of ± 5 % for ≤ 10^{12} Ω and

± 20 % for > 10^{12} Ω.

4.2.4 Cleaning agent

Use an appropriate cleaning agent, e.g. propan-2-ol or ethanol.

WARNING — Propan-2-ol and ethanol are highly flammable and harmful to health. Avoid breathing the vapour and contact with skin, eyes and clothing.

4.3 Specimen and conditioning

4.3.1 Pre-treatment

The specimen shall be pre-treated according to the manufacturer's instructions including the number of cleaning cycles or otherwise undergo five cycles of cleaning according to 5.4 of EN 340:2003.

NOTE This pre-treatment is superfluous for garments not intended for cleaning (e.g. for single use garments).

4.3.2 Specimen or garment

Five test specimens shall be cut each of size between the overall dimensions of the electrodes and of the base plate either from the roll material or cut from the garment. If an uncut garment shall be tested, then measurements shall be made at five different suitable places on the garment. The specimen shall not contain seams. Handle the specimens only at the edges to avoid contamination.

The specimens shall be from the same production lots of the materials that have been used for the manufacture of the delivery sample of the protective clothing.

4.3.3 Conditioning and testing atmosphere

The specimen shall be conditioned for at least 24 h prior to testing and shall be tested in the following atmosphere:

air temperature: (23 ± 1) °C;
relative humidity: (25 ± 5) %.

NOTE The surface resistance of materials can depended to a large degree on relative humidity. The lower the relative humidity the higher the surface resistance.

4.4 Procedure

4.4.1 Cleaning

Clean the lower surfaces of the electrodes and the upper surface of the base plate by wiping with a paper tissue which has been moistened with one of the cleaning agents (see 4.2.4).

The electrodes shall be dried to the air.

4.4.2 Insulation test of the flat base plate

Carry out a blank test using the procedure given in 4.4.3 but with no specimen in position. Calculate the resistivity of the insulating material and check that it meets the requirements of 4.2.2.

4.4.3 Testing

Place the test specimen on the base plate with the surface to be tested uppermost and rest the electrode assembly on top of the specimen. Connect the electrodes as shown in Figure 1.

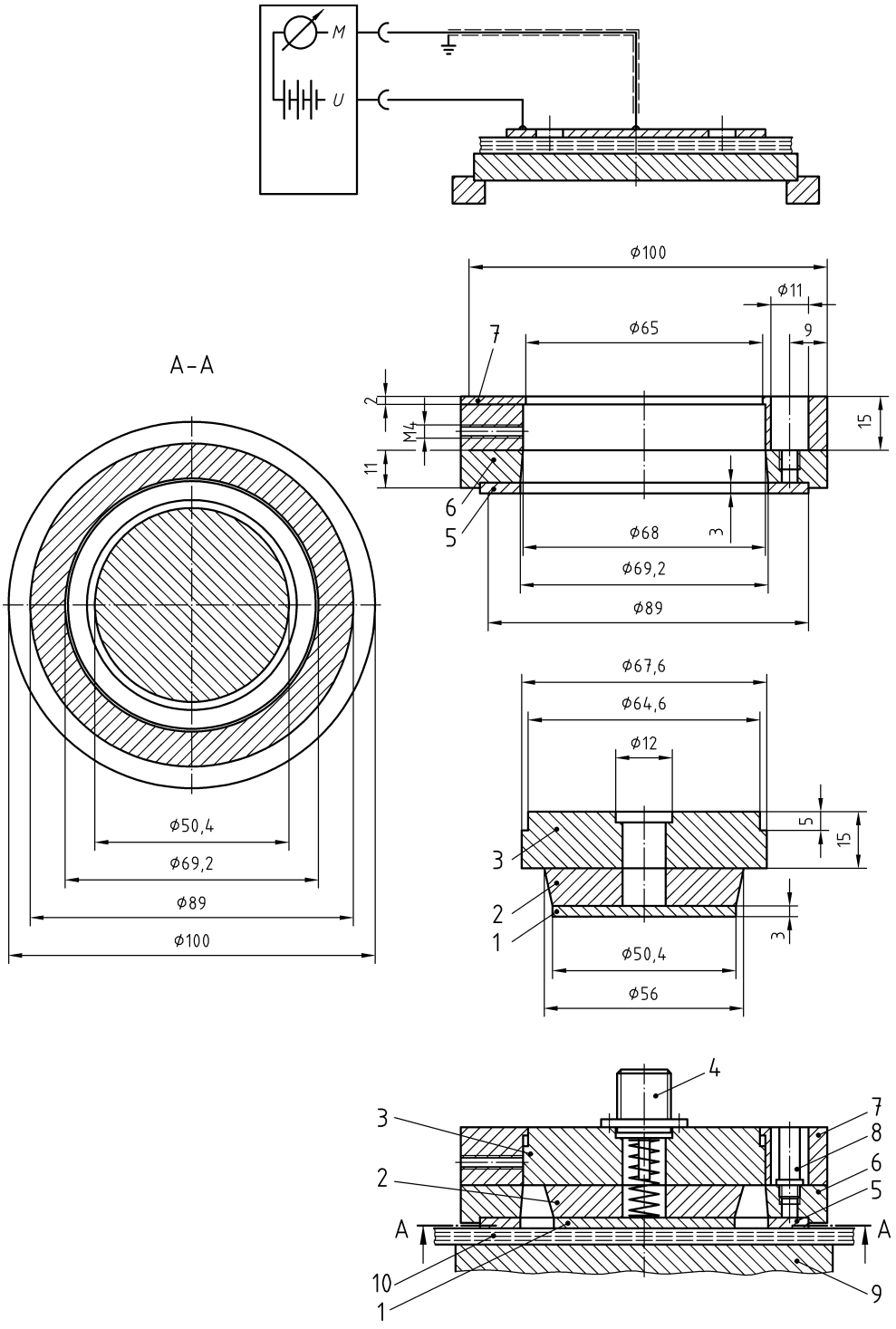
Apply a potential of (100 ± 5) V and after (15 ± 1) s determine the resistance using the ohmmeter. If the resistance is less than $10^5\ \Omega$ an appropriate low voltage may be applied and shall be mentioned in the test report.

If necessary, resistances of below $10^5\ \Omega$ may be determined by measuring the current through a suitable ammeter connected in series with the specimen and calculating the ratio of the applied potential to the current.

Repeat this procedure on the four other test specimens or on four different places on the garment.

4.4.4 Test setup

Dimensions in millimetres



Key

1 test electrode
2 insulating disc
3 guard plate
4 coaxial plug-in connection
5 annular electrode
6 insulating ring
7 screening ring
8 connector
9 base plate
10 sample

Figure 1 — Assembly, dimensions and measuring circuit of electrodes

4.5 Calculation and expression of results

Calculate the surface resistivity ρ in ohm (Ω) for each of the five values of resistance using the equation:

$$\rho = k \times R$$

where

ρ is the calculated surface resistivity, in ohm (Ω);

R is the measured resistance, in ohm (Ω);

k is the geometrical factor of the electrode, for this electrode the factor is 19,8.

NOTE 1 The factor k is calculated using the following equation:

$$k = 2\pi / \log_e(r_2/r_1)$$

where

r_1 is the radius of the inner electrode, in millimetres;

r_2 is the inner radius of the outer electrode, in millimetres.

Determine the geometrical mean of these five values.

NOTE 2 The described method has shown a spreading of results between different test houses up to a factor of 10. When the measured surface resistance lies under 10^{10} Ω the spreading of results is less.

NOTE 3 The geometrical mean is the 5^{th} root of the product of the five measured values.

5 Test report

The test report should include at least the following information:

a) reference to this European Standard, EN 1149-1;

b) date of testing;

c) atmosphere for conditioning and testing;

d) description and number of test samples and specimens;

e) the individual and geometrical mean values of surface resistance and surface resistivity of each sample tested;

f) any observations or deviations from this European Standard.

Annex A
(informative)

Significant technical changes between this European Standard and the previous edition

This European Standard includes the following significant technical changes compared to the previous edition:

a) Requirements for electrostatic dissipative protective clothing are outside the scope of the standard;

b) Clause 4 “Requirements” including performance and design requirements has been deleted;

c) Clause 5 “Test report” has been added;

d) Annex A “Explanation” has been deleted.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 89/686/EEC relating to Personal Protective Equipment

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 89/686/EEC.

Once this standard is cited in the Official Journal of the European Communities under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard, together with the relevant requirements given in the product standards, confers, within the limits of the scope of this standard, a presumption of conformity with the Essential Requirement 2.6 of Annex II of that Directive.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

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