

Electrostatics —

Part 2-3: Methods of test for determining the resistance and resistivity of solid planar materials used to avoid electrostatic charge accumulation

The European Standard EN 61340-2-3:2000 has the status of a British Standard

ICS 29.020

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

BSI
Documents

AVA

Document Sharing Hub

National foreword

This British Standard is the official English language version of EN 61340-2-3:2000. It is identical with IEC 61340-2-3:2000.

The UK participation in its preparation was entrusted to Technical Committee GEL/101, Electrostatics, 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 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.

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.

Cross-references

Attention is drawn to the fact that CEN and CENELEC Standards normally include an annex which lists normative references to international publications with their corresponding European publications. 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.

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.

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 22, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

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 2000

© BSI 08-2000

Amendments issued since publication

Amd. No.	Date	Comments

ISBN 0 580 36196 9

EUROPEAN STANDARD

EN 61340-2-3

NORME EUROPÉENNE

EUROPÄISCHE NORM

May 2000

ICS 17.220.99;29.020

English version

Electrostatics

Part 2-3: Methods of test for determining the resistance and resistivity of solid planar materials used to avoid electrostatic charge accumulation (IEC 61340-2-3:2000)

Electrostatique

Partie 2-3: Méthodes d'essais pour la détermination de la résistance et de la résistivité des matériaux plans solides destinés à éviter les charges électrostatiques
(CEI 61340-2-3:2000)

Elektrostatik

Teil 2-3: Prüfverfahren zur Bestimmung des Widerstandes und des spezifischen Widerstandes von festen planen Werkstoffen, die zur Vermeidung elektrostatischer Aufladung verwendet werden
(IEC 61340-2-3:2000)

This European Standard was approved by CENELEC on 2000-04-01. 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 electrotechnical committees 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

© 2000 CENELEC - All rights of exploitation in any form and by any means reserved worldwide for CENELEC members.

Ref. No. EN 61340-2-3:2000 E



Documents

Document Sharing Hub

Foreword

The text of document 101/71/FDIS, future edition 1 of IEC 61340-2-3, prepared by IEC TC 101, Electrostatics, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61340-2-3 on 2000-04-01.

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) 2001-01-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2003-04-01

Annexes designated "normative" are part of the body of the standard.
In this standard, annex ZA is normative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61340-2-3:2000 was approved by CENELEC as a European Standard without any modification.

CONTENTS

	Page
INTRODUCTION	4
Clause	
1 Scope	5
2 Normative references	5
3 Definitions	6
4 Conditioning and test environment	6
5 Selection of test method	7
6 Resistance measurements of solid conductive materials	7
7 Resistance measurements of solid insulating materials	7
8 Resistance measurements of electrostatic dissipative materials (used to avoid electrostatic charge accumulation)	7
8.1 Instrumentation	8
8.2 Electrode assemblies	8
8.3 Sample preparation and handling	9
8.4 System verification fixtures for surface resistance	10
8.5 System verification for volume resistance measurements	10
8.6 Test procedures	11
9 Conversion to resistivity values	12
9.1 Surface resistivity ρ_s	13
9.2 Volume resistivity ρ_v	13
10 Repeatability and reproducibility	13
11 Report	14
Figure 1 – Assembly for the measurement of surface and volume resistance	15
Figure 2 – Basic connections of the electrodes for surface resistance measurements	15
Figure 3 – Basic connections of the electrodes for volume resistance measurements	16
Figure 4 – Assembly for the measurement of resistance-to-ground/groundable point and point-to-point resistance	16
Figure 5 – Lower resistance range verification fixture for surface resistance measurements	17
Figure 6 – Upper resistance range verification fixture for surface resistance measurements	18
Figure 7 – Principle of resistance to groundable point measurements	19
Figure 8 – Principle of point-to-point measurements	19
Figure 9 – Configuration for the conversion to surface or volume resistivity	20
Bibliography	21
Annex ZA (normative) Normative references to international publications with their corresponding European publications	22

INTRODUCTION

Measurements of resistances and related calculations of resistivities belong to the fundamental objectives of electrical measuring techniques along with measurements of voltage and current.

Resistivity is the electrical characteristic having the widest range, extending over some thirty orders of magnitude from the most conductive metal to almost perfect insulators.

The basis is Ohm's law and is valid for d.c. current and instantaneous values of a.c. current in electron conductors (metals, carbon, etc.). Values of resistance measurements using a.c. current can be influenced by capacitive/inductive reactance, depending on the frequency. Thus, existing national and international standards dealing with resistance measurements of solid materials normally require the application of d.c. current.

Most non-metal materials such as plastics are classified as polymers and ion conductors. The transport of charges can be dependent upon the applied electrical field strength during the measurement. Beside the measuring current, there exists a charging current that polarizes and/or electrostatically charges the material, indicated by an asymptotic decay of the measuring current with time and causing an apparent change in resistance. If this effect is observed, it will be advisable to repeat the measurement immediately after a definite electrification time has elapsed using the reverse polarity for the measuring current and averaging both obtained values.

ELECTROSTATICS –

Part 2-3: Methods of test for determining the resistance and resistivity of solid planar materials used to avoid electrostatic charge accumulation

1 Scope

This International Standard describes test methods for the determination of the electrical resistance and resistivity of solid materials in the range from $10^4 \Omega$ to $10^{12} \Omega$ used to avoid electrostatic charge accumulation.

It takes account of existing IEC/ISO standards and other published information, and gives recommendations and guidelines on the appropriate method.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 61340. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 61340 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60093:1980, *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*

IEC 60167:1964, *Methods of test for the determination of the insulation resistance of solid insulating materials*

IEC 60212:1971, *Standard conditions for use prior to and during the testing of solid electrical insulating materials*

IEC 60260:1968, *Test enclosures of non-injection type for constant relative humidity*

ISO 1853:1998, *Conducting and antistatic rubbers – Measurement of resistivity*

ISO 2951:1974, *Vulcanized rubber – Determination of insulation resistance*

ISO 3915:1981, *Plastics – Measurement of resistivity of conductive plastics*

3 Definitions

For the purpose of this part of IEC 61340, the following definitions apply:

3.1

volume resistance (Ω)

the ratio of a d.c. voltage (V) applied between two electrodes placed on two (opposite) surfaces of a specimen and the steady-state current (A) between the electrodes

3.2

volume resistivity (Ωm)

the ratio of a d.c. field strength (V/m) and the steady-state current density (A/m²) within the material. In practice, it is equivalent to the volume resistance of a cube with unit length, having the electrodes at two opposite surfaces

NOTE Volume resistivity is not an appropriate characteristic for materials that are electrically inhomogeneous.

3.3

surface resistance (Ω)

the ratio of a d.c. voltage (V) applied between two electrodes on a surface of a specimen and the current (A) between the electrodes

3.4

surface resistivity (Ω)

the surface resistivity is equivalent to the surface resistance of a square area, having the electrodes at two opposite sides

NOTE The SI unit of surface resistivity (Ω) is sometimes referred to as Ω/sq (ohms per square).

3.5

measuring electrode

a conductor of defined shape, size and configuration being in contact with the specimen to be measured

4 Conditioning and test environment

The electrostatic behaviour of materials is influenced by environmental conditions, such as relative humidity and temperature.

For this reason, measurements shall be performed under controlled conditions. The selection of the appropriate conditions for testing shall be decided according to the type of material (product specification) and the intended application, based on the most severe conditions (e.g. lowest humidity) expected to occur during usage. Specimens shall be conditioned and measured in the same climate, if not specified differently.

Preconditioning can be necessary in order to eliminate the effects of stress appearing after the moulding process of some plastic materials or as a drying treatment before the test procedure starts. The preconditioning shall normally be handled in a different environment.

Adequate devices are a desiccator in an oven or a climate chamber preferably equipped with forced circulation and interchange of air. Additional guidance may be taken from IEC 60212 and IEC 60260.