

Dielectric and resistive properties of solid insulating materials - Part 3-2: Determination of resistive properties (DC methods) - Surface resistance and surface resistivity

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN IEC 62631-3-2:2023 sisaldab Euroopa standardi EN IEC 62631-3-2:2023 ingliskeelset teksti. Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas. Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 08.12.2023. Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.	This Estonian standard EVS-EN IEC 62631-3-2:2023 consists of the English text of the European standard EN IEC 62631-3-2:2023. This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation. Date of Availability of the European standard is 08.12.2023. The standard is available from the Estonian Centre for Standardisation and Accreditation.
---	---

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 17.220.99, 29.035.01

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardimis- ja Akrediteerimiskeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardimis-ja Akrediteerimiskeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardimis-ja Akrediteerimiskeskusega: Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation and Accreditation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation and Accreditation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation and Accreditation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

English Version

Dielectric and resistive properties of solid insulating materials -
Part 3-2: Determination of resistive properties (DC methods) -
Surface resistance and surface resistivity
(IEC 62631-3-2:2023)

Propriétés diélectriques et résistives des matériaux isolants
solides - Partie 3-2: Détermination des propriétés résistives
(méthodes en courant continu) - Résistance superficielle et
résistivité superficielle
(IEC 62631-3-2:2023)

Dielektrische und resistive Eigenschaften fester Isolierstoffe
- Teil 3-2: Bestimmung resistiver Eigenschaften
(Gleichspannungsverfahren) - Oberflächenwiderstand und
spezifischer Oberflächenwiderstand
(IEC 62631-3-2:2023)

This European Standard was approved by CENELEC on 2023-11-20. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 112/612/FDIS, future edition 2 of IEC 62631-3-2, prepared by IEC/TC 112 "Evaluation and qualification of electrical insulating materials and systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62631-3-2:2023.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2024-08-20
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2026-11-20

This document supersedes EN 62631-3-2:2016 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 62631-3-2:2023 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60893-2	NOTE Approved as EN 60893-2
IEC 61212-2	NOTE Approved as EN 61212-2
IEC 62011-2	NOTE Approved as EN 62011-2
ISO 10350 (series)	NOTE Approved as EN ISO 10350 (series)
ISO 10350-1	NOTE Approved as EN ISO 10350-1
ISO 10350-2	NOTE Approved as EN ISO 10350-2
ISO 14526 (series)	NOTE Approved as EN ISO 14526 (series)
ISO 14527 (series)	NOTE Approved as EN ISO 14527 (series)
ISO 14528 (series)	NOTE Approved as EN ISO 14528 (series)
ISO 14529 (series)	NOTE Approved as EN ISO 14529 (series)
ISO 14530 (series)	NOTE Approved as EN ISO 14530 (series)
ISO 15252 (series)	NOTE Approved as EN ISO 15252 (series)
ISO 15512	NOTE Approved as EN ISO 15512

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Dielectric and resistive properties of solid insulating materials –
Part 3-2: Determination of resistive properties (DC methods) – Surface
resistance and surface resistivity**

**Propriétés diélectriques et résistives des matériaux isolants solides –
Partie 3-2: Détermination des propriétés résistives (méthodes en courant
continu) – Résistance superficielle et résistivité superficielle**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -

webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 300 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 19 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Dielectric and resistive properties of solid insulating materials –
Part 3-2: Determination of resistive properties (DC methods) – Surface
resistance and surface resistivity**

**Propriétés diélectriques et résistives des matériaux isolants solides –
Partie 3-2: Détermination des propriétés résistives (méthodes en courant
continu) – Résistance superficielle et résistivité superficielle**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 17.220.99, 29.035.01

ISBN 978-2-8322-7549-8

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	6
4 Significance.....	8
5 Method of test	8
5.1 General.....	8
5.2 Voltage	9
5.3 Equipment	9
5.3.1 General	9
5.3.2 Accuracy	9
5.3.3 Voltage source	10
5.3.4 Electrode arrangements.....	10
5.4 Test circuit.....	14
5.5 Calibration	15
5.6 Test specimen	15
5.6.1 Recommended dimensions of test specimen and electrode arrangements	15
5.6.2 Manufacturing of test specimen	15
5.6.3 Number of test specimens	16
5.6.4 Application of conductive means.....	16
5.6.5 Conditioning and pre-treatment of test specimen	16
5.7 Test procedure.....	17
6 Calculation of surface resistivity	17
6.1 For electrode arrangements A, B, D and E	17
6.2 For electrode arrangement C	17
7 Test report.....	18
8 Repeatability and reproducibility	18
Annex A (informative) Specimen dimensions and electrode arrangements	19
Annex B (informative) Comparative verification study on surface resistivities using different electrode arrangements (type C and type E)	20
B.1 General.....	20
B.2 Inter-laboratory trial conditions.....	20
B.2.1 General	20
B.2.2 Test specimens	20
B.2.3 Electrode types, conductive materials and test voltage	20
B.2.4 Test conditions	21
B.3 Summary of the test results	21
B.4 Inter-laboratory trial outcomes and suggestions for IEC 62631-3-2	22
B.5 Detailed inter-laboratory results	22
B.5.1 General	22
B.5.2 Laboratories results by different groups of electrode types and conductive materials for the different test specimens	23
B.5.3 Laboratory 2 results comparing different electrode types and conductive materials	29
B.5.4 Laboratory 3 results – Electrode type C with and without use of conductive silver paint	31

Bibliography.....	33
Figure 1 – Electrode arrangement A (example)	11
Figure 2 – Electrode arrangement B (example)	12
Figure 3 – Electrode arrangement C (example)	13
Figure 4 – Connection diagram of measurement with two- and three-terminal electrode arrangements.....	15
Figure B.1 – Surface resistivity equations for the used electrodes.....	21
Table 1 – Typical electrode dimensions for electrode arrangement C	13
Table A.1 – Recommended test specimen dimensions and electrode arrangements for specific products.....	19
Table B.1 – Test specimens characteristics	20
Table B.2 – Test conditions per specific participant.....	21
Table B.3 – Summary of the test results.....	22
Table B.4 – Polybutylene terephthalate (PBT) test specimen results – Electrode type C with conductive rubber	23
Table B.5 – Polyamide 66 (PA66) test specimen results – Electrode type C with conductive rubber	24
Table B.6 – Polybutylene terephthalate (PBT) test specimen results – Electrode type C with conductive silver paint	25
Table B.7 – Polyamide 66 (PA66) test specimen results – Electrode type C with conductive silver paint	26
Table B.8 – Polybutylene terephthalate (PBT results) test specimen results – Electrode type E with conductive silver paint	27
Table B.9 – Polyamide 66 (PA66) test specimen results – Electrode type E with conductive silver paint	28
Table B.10 – Laboratory 2 results – Polybutylene terephthalate (PBT) – Different electrodes and conductive materials	29
Table B.11 – Laboratory 2 results – Polyamide 66 (PA66) – Different electrodes and conductive materials	30
Table B.12 – Laboratory 3 results – Polybutylene terephthalate (PBT) – Electrode type C with and without conductive silver paint.....	31
Table B.13 – Laboratory 3 results – Polyamide 66 (PA66) – Electrode type C with and without conductive silver paint	32

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**DIELECTRIC AND RESISTIVE PROPERTIES
OF SOLID INSULATING MATERIALS –****Part 3-2: Determination of resistive properties (DC methods) –
Surface resistance and surface resistivity**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62631-3-2 has been prepared by IEC technical committee 112: Evaluation and qualification of electrical insulating materials and systems. It is an International Standard.

This second edition cancels and replaces the first edition published in 2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) descriptions of the electrode arrangements have been clarified;
- b) new descriptions of the conductive means have been added;

- c) a new informative Annex B summarizing the results of the comparative verification study on surface resistivities using different electrode arrangements has been added.

The text of this International Standard is based on the following documents:

Draft	Report on voting
112/612/FDIS	112/619/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 62631 series, published under the general title *Dielectric and resistive properties of solid insulating materials*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

DIELECTRIC AND RESISTIVE PROPERTIES OF SOLID INSULATING MATERIALS –

Part 3-2: Determination of resistive properties (DC methods) – Surface resistance and surface resistivity

1 Scope

This part of IEC 62631 describes methods of test for the determination of surface resistance and surface resistivity of electrical insulation materials by applying DC voltage.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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

IEC 62631-3-1, *Dielectric and resistive properties of solid insulating materials – Part 3-1: Determination of resistive properties (DC methods) – Volume resistance and volume resistivity – General method*

IEC 62631-3-3, *Dielectric and resistive properties of solid insulating materials – Part 3-3: Determination of resistive properties (DC methods) – Insulation resistance*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

electrode arrangement

electrical conductive bodies on the surface of a test specimen

Note 1 to entry: The arrangement of electrodes should include procedures to ascertain sufficient contact to the surface (e.g. by means of conducting paint) or the use of adequate mechanical system applying the necessary contact force to the test specimen's surface or both.