SLOVENSKI STANDARD
oSIST prEN IEC 62631-3-12:2023

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Dielektrične in uporovne lastnosti trdnih izolacijskih materialov - 3-12. del: Ugotavljanje uporovnih lastnosti (metode z enosmernim tokom) - Prehodna upornost in specifična prehodna upornost, metoda za ulivanje smol

Dielectric and resistive properties of solid insulating materials - Part 3-12: Determination of resistive properties (DC Methods) - Volume resistance and volume resistivity, method for casting resins

Ta slovenski standard je istoveten z: **prEN IEC 62631-3-12:2023**

ICS:

17.220.99	Drugi standardi v zvezi z elektriko in magnetizmom	Other standards related to electricity and magnetism
29.035.01	Izolacijski materiali na splošno	Insulating materials in general

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112/608/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 62631-3-12 ED1**	
DATE OF CIRCULATION: **2023-05-19**	CLOSING DATE FOR VOTING: **2023-08-11**
SUPERSEDES DOCUMENTS: **112/530/CD, 112/544B/CC**	

IEC TC 112 : EVALUATION AND QUALIFICATION OF ELECTRICAL INSULATING MATERIALS AND SYSTEMS

SECRETARIAT: Germany	SECRETARY: Mr Bernd Komanschek
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 15	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY

☒ SUBMITTED FOR CENELEC PARALLEL VOTING

Attention IEC-CENELEC parallel voting

The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.

The CENELEC members are invited to vote through the CENELEC online voting system.

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TITLE:

Dielectric and resistive properties of solid insulating materials - Part 3-12: Determination of resistive properties (DC Methods) - Volume resistance and volume resistivity, method for casting resins

PROPOSED STABILITY DATE: 2027

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

DIELECTRIC AND RESISTIVE PROPERTIES OF SOLID INSULATING MATERIALS –

Part 3-12: Determination of resistive properties (DC Methods) Volume resistance and volume resistivity, method for casting resins

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International Standard IEC 62631-3-12 has been prepared by IEC technical committee 112.

The text of this standard is based on the following documents:

FDIS	Report on voting
112/XX/FDIS	112/XX/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The National Committees are requested to note that for this publication the stability date is 2027.

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

95 # INTRODUCTION

96 Many segments of the electrotechnical industry need volume resistance and volume resistivity data of
97 solid insulating materials. This part of the 62631-3 series is focused on the method for casting resins.
98 Clear guidelines are needed to give the user of this standard a uniform approach to sample preparation
99 and test procedures.

100

DIELECTRIC AND RESISTIVE PROPERTIES OF SOLID INSULATING MATERIALS –

Part 3-12: Determination of resistive properties (DC Methods) Volume resistance and volume resistivity, method for casting resins

1 Scope

This part of IEC 62631 covers method of test for the determination of volume resistance and volume resistivity of electrical insulation materials by applying DC-voltage. It covers casting resins described in IEC 60455-3-1, IEC 60455-3-2, IEC 60455-3-3, IEC 60455-3-4, IEC 60455-3-8 and similar products.

For other specific types of materials other standards or the general method described in IEC 62631-3-1 may be more suitable.

2 Normative references

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

IEC 60455-3-1, *Resin based reactive compounds used for electrical insulation - Part 3: Specifications for individual materials - Sheet 1: Unfilled epoxy resinous compounds*

IEC 60455-3-2, *Resin based reactive compounds used for electrical insulation - Part 3: Specifications for individual materials - Sheet 2: Quartz filled epoxy resinous compounds*

IEC 60455-3-3, *Resin based reactive compounds used for electrical insulation - Part 3: Specifications for individual materials - Sheet 3: Unfilled polyurethane compounds*

IEC 60455-3-4, *Resin based reactive compounds used for electrical insulation - Part 3: Specifications for individual materials - Sheet 4: Filled polyurethane compounds*

IEC 60455-3-8, *Resin based reactive compounds used for electrical insulation - Part 3: Specifications for individual materials - Sheet 8: Resins for cable accessories*

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

ISO 2808, Paints and varnishes - Determination of film thickness

3 Terms and definitions

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

3.1
Volume resistance

part of the insulation resistance which is due to conduction through the volume.

Note to entry - expressed in the unit of Ω.

3.2
Volume resistivity

the ratio of the potential gradient (parallel to the current in a material) to the current density

Note 1 to entry - expressed in the unit of ohmmeter (Ω·m)

Note 2 to entry – For insulating materials the volume resistivity is usually determined by means of measuring electrodes arranged on a sheet of the material.

Note 3 to entry – According to IEC 60050-121: Electromagnetism, “conductivity” is defined as “scalar or tensor quantity the product of which by the electric field strength in a medium is equal to the electric current density” and “resistivity” as “the

inverse of the conductivity when this inverse exists". Measured in this way, the volume resistivity is an average of the resistivity over possible heterogeneities in the volume incorporated in the measurement; it includes the effect of possible polarization phenomena at the electrodes.

3.3
Stray current

leakage current in the earth or in metallic structures buried in the ground and resulting from their intended or unintended earthing

4 Significance

The materials applicable to this test are used to cast electrical or electronic equipment to fix the construction, protect it from humidity, dirt and other environmental influence. Main field applications are electric motors, transformers, electronic devices and similar appliances.

Additional electrical insulation is desirable but not essential. In many cases mechanical support, thermal and chemical resistance are more important. Especially the changes in resistivity with temperature and/or humidity are of great importance and need to be known when designing the equipment for operation conditions.

When a direct voltage is applied between electrodes in contact with a specimen, the current through it decreases asymptotically towards a steady-state value. The decrease of current with time may be due to dielectric polarisation and the sweep of mobile ions to the electrodes. For materials having volume resistivity less than about 10^{10} Ωm the steady state is generally reached within 1 min and the resistance is determined after this time of electrification. For materials with higher volume resistivity the current may continue decreasing for several minutes, hours, days or even weeks. However, the result is taken after one minute.

NOTE: For very high electric field strengths different behaviour may occur.

5 Method of test

5.1 General

The method described in this standard is used for casting resins. For other specific types of materials other standards or the general method described in IEC 62631-3-1 may be more suitable.

For a casting resin the absolute value of volume resistance or resistivity is of minor interest. More important is the change of this value as a function of temperature or after immersion into water.

5.2 Power supply, Voltage

A source of very steady direct voltage is required. This may be provided either by batteries or by rectified and stabilized power supply. The degree of stability required is such that the change in current due to any change in voltage is negligible compared with the current to be measured.

NOTE: The ripple of the voltage source is important. A typical value for 100 V is $<5 \times 10^{-5}$ peak to peak.

If not otherwise stipulated, a voltage of 500 V is to be used. Other test voltages may be 10 V, 100 V or 1000 V.

To avoid migration effects during measurement, the field strength shall be less than 3000 V/mm.

5.3 Equipment

5.3.1 Accuracy

The measuring device shall be capable of determining the unknown resistance with an overall accuracy of at least:

- ± 10 % for resistances below 10^{10} Ω
- ± 20 % for resistances between 10^{10} Ω and 10^{14} Ω

- ± 50 % for values higher than 10^{14} Ω

5.3.2 Guarding

For routine measurements, especially in production control to determine the specified minimum values, guarding is not necessary. This allows smaller and simplified specimens.

If the exact absolute value is of interest, or value above 10^{12} Ω, or in case of doubts, guarding is recommended. Further information related to guarding can be found in IEC 62631-3-1.

5.3.3 Electrodes

For simple measurements a permanent electrode (e.g. conductive silver paint) may be used.

In case of measurements before and after a treatment (e.g. immersion into water) a removable electrode shall be used. Further information related to electrodes can be found in IEC 62631-3-1.

5.3.4 Calibration

The equipment shall be calibrated in the magnitude of the volume resistance measured.

NOTE: Calibration resistors in the range up to 100 TΩ are commercially available.

5.4 Test specimen

Unless otherwise specified, a casted plate of resin with a length and a width of at least 60 mm shall be used.

The casting resin shall be mixed in accordance with the manufacturer instructions, degassed and poured into a mold. A closed mold is preferred, however if an open mold is necessary, precautions have to be taken to obtain flat, smooth and plan parallel surfaces.

The thickness of the resin after curing shall be determined by one of the procedures specified in ISO 2808. The thickness shall be not less than 0,5 mm.

5.5 Procedure for volume resistivity as function of temperature

The following procedure describes an established method used for quality control and is meant as an example. Any other method in line with the general requirements may be used. However, measuring parameters (time, temperatures, environmental influences etc.) can vary widely and are dependent on the purpose of the measurement and the intended use of the material.

5.5.1 Equipment

The following equipment shall be used:

- Tera-ohmmeter according to 5.3,
- Metal cylinder to be used as voltage electrode (top electrode) of at least 40 mm diameter having a mass to provide a pressure of about 0,015 MPa;
- Conductive silver paint

5.5.2 Test set up

Three specimens shall be tested. The thickness of each specimen shall be measured at least at 5 points within the test area before application of the electrodes. Conductive silver paint is applied on the test area on both sides and dried according to the paint manufacturers recommendations.

The specimen shall be placed on a flat solid electrically conductive surface in an oven. The conductive surface shall have contact to the electrode on the bottom side, be grounded and used as one electrode.

The metal cylinder is placed on the test area on top of the silver paint and used as the other electrode.