SLOVENSKI STANDARD
oSIST prEN IEC 60684-2:2024

01-september-2024

Gibke izolacijske cevi - 2. del: Preskusne metode

Flexible insulating sleeving - Part 2: Methods of test

Isolierschläuche - Teil 2: Prüfverfahren

Gaines isolantes souples - Partie 2: Méthodes d'essai

Ta slovenski standard je istoveten z: **prEN IEC 60684-2:2024**

---

iTeh Standards
(https://standards.iteh.ai)
Document Preview
oSIST prEN IEC 60684-2:2024
https://standards.iteh.ai/catalog/standards/sist/...-pren-iec-60684-2-2024

ICS:

29.035.20	Plastični in gumeni izolacijski materiali	Plastics and rubber insulating materials

oSIST prEN IEC 60684-2:2024 **en**

2003-01.Slovenski inštitut za standardizacijo. Razmnoževanje celote ali delov tega standarda ni dovoljeno.

iTeh Standards
(https://standards.iteh.ai)
Document Preview

oSIST prEN IEC 60684-2:2024
https://standards.iteh.ai/catalog/standards/sist/663bf326-8de0-4f45-8baa-32ac9c0e45fe/osist-pren-iec-60684-2-2024

oSIST prEN IEC 60684-2:2024

15/1034/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER: **IEC 60684-2 ED4**	
DATE OF CIRCULATION: **2024-07-26**	CLOSING DATE FOR VOTING: **2024-10-18**
SUPERSEDES DOCUMENTS: **15/958/CD, 15/966A/CC**	

IEC TC 15 : SOLID ELECTRICAL INSULATING MATERIALS

SECRETARIAT: United States of America	SECRETARY: Mr Solomon Chiang
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 112	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 ☐ NOT 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.

iTeh Standards
(https://standards.iteh.ai)
Document Preview
oSIST prEN IEC 60684-2:2024
https://standards.iteh.ai/catalog/standards/sist/663bf326-8de0-4f45-8baa-32ac9c0e45fe/osist-pren-iec-60684-2-2024

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Recipients of this document are invited to submit, with their comments, notification of any relevant “In Some Countries” clauses to be included should this proposal proceed. Recipients are reminded that the CDV stage is the final stage for submitting ISC clauses. (See AC/22/2007 or NEW GUIDANCE DOC).

TITLE:

Flexible insulating sleeving – Part 2: Methods of test

PROPOSED STABILITY DATE: 2030

NOTE FROM TC/SC OFFICERS:

TC15 WG5 has reviewed CC from CD and already provided comment resolution in the revised CC. This is the CDV. Solomon TC 15 Secretary 04/06/2024

Copyright © 2024 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

oSIST prEN IEC 60684-2:2024

CONTENTS

iTeh Standards
(https://standards.iteh.ai)
Document Preview
oSIST prEN IEC 60684-2:2024
https://standards.iteh.ai/catalog/standards/sist/6b3bf326-8de0-4f45-8baa-52ac9e0e451e/osist-pren-iec-60684-2-2024

oSIST prEN IEC 60684-2:2024

iTeh Standards
(https://standards.iteh.ai)
Document Preview
oSIST prEN IEC 60684-2:2024
https://standards.iteh.ai/catalog/standards/sist/663bf326-8de0-4f45-8baa-32ac9c0e45fe/osist-pren-iec-60684-2-2024

oSIST prEN IEC 60684-2:2024

iTeh Standards
(https://standards.iteh.ai)
Document Preview

oSIST prEN IEC 60684-2:2024
https://standards.iteh.ai/catalog/standards/sist/663bf326-8de0-4f45-8baa-32ac9c0e45fe/osist-pren-iec-60684-2-2024

oSIST prEN IEC 60684-2:2024

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FLEXIBLE INSULATING SLEEVING –

Part 2: Methods of test

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

iTeh Standards
(https://standards.iteh.ai)
Document Preview
https://standards.iteh.ai/catalog/standards/sist/[illegible]-sist-pren-iec-60684-2-2024

International Standard IEC 60684-2 has been prepared by IEC technical committee 15: Solid electrical insulating materials.

oSIST prEN IEC 60684-2:2024

This fourth edition cancels and replaces the third edition published in 2011, and constitutes a minor revision and technical updating. The main changes from the previous edition are as follows:

Major update of normative references

Revised clause 3, with amendment of methods for measurements of bore and wall thickness.

Revised clause 9, to clarify that the longitudinal change test is done on expanded sleeving.

Revised clause 26, additional method D for flame propagation testing.

Revised clause 54, additional method for preparation of samples for adhesive peel test.

Addition of clause 61, abrasion test method.

Addition of clause 62, volume resistivity for semi-conducting materials

Addition of clause 63, outgassing

Addition of clause 64, resistance to weathering

iTeh Standards
(https://standards.iteh.ai)
Document Preview

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

FDIS	Report on voting

oSIST prEN IEC 60684-2:2024
https://standards.iteh.ai/catalog/standards/sist/6663b326-8de0-4f45-8baa-32ac9c0e451e/osist-pren-iec-60684-2-2024

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.

A list of all the parts in the IEC 60684 series, under the general title *Flexible insulating sleeving*, can be found on the IEC website.

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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

oSIST prEN IEC 60684-2:2024

INTRODUCTION

This International Standard is one of a series which deals with flexible insulating sleeving. The series consists of three parts:

Part 1: Definitions and general requirements (IEC 60684-1)

Part 2: Methods of test (IEC 60684-2)

Part 3: Specifications for individual types of sleeving (IEC 60684-3)

iTeh Standards
(https://standards.iteh.ai)
Document Preview

oSIST prEN IEC 60684-2:2024
https://standards.iteh.ai/catalog/standards/sist/663bf326-8de0-4f45-8baa-32ac9c0e45fe/osist-pren-iec-60684-2-2024

oSIST prEN IEC 60684-2:2024

FLEXIBLE INSULATING SLEEVING –

Part 2: Methods of test

1 General

1.1 Scope

This part of IEC 60684 gives methods of test for flexible insulating sleeving, including heat-shrinkable sleeving, intended primarily for insulating electrical conductors and connections of electrical apparatus, although they may be used for other purposes.

The tests specified are designed to control the quality of the sleeving but it is recognized that they do not completely establish the suitability of sleeving for impregnation or encapsulation processes or for other specialized applications. Where necessary, the test methods in this part will need to be supplemented by appropriate impregnation or compatibility tests to suit the individual circumstances.

1.2 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.

IEC 60068-2-20:2021, *Environmental testing – Part 2-20: Tests – Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

IEC 62631-3-1:2016 Dielectric and resistive properties of solid insulating materials - Part 3-1: Determination of resistive properties (DC methods) - Volume resistance - General method

IEC 60212:2010, *Standard conditions for use prior to and during the testing of solid electrical insulating materials*

IEC 60216 (all parts), *Electrical insulating materials – Thermal endurance properties*

IEC 60216-4-1:2006, *Electrical insulating materials – Thermal endurance properties – Part 4-1: Ageing ovens – Single-chamber ovens*

IEC 60216-4-2:2000, *Electrical insulating materials – Thermal endurance properties – Part 4-2: Ageing ovens – Precision ovens for use up to 300 °C*

IEC 60243-1: 2013, *Electrical strength of insulating materials – Test methods – Part 1: Tests at power frequencies*

IEC 62631-2-1:2018, *Dielectric and resistive properties of solid insulating materials - Part 2-1: Relative permittivity and dissipation factor - Technical Frequencies (0,1 Hz - 10 MHz) - AC Methods*

iTeh Standards
(https://standards.iteh.ai)
Document Preview
oSIST prEN IEC 60684-2:2024
https://standards.iteh.ai/catalog/standards/sist/663bf326-8de0-4f45-8baa-32ac9c0e451e/osist-pren-iec-60684-2-2024

oSIST prEN IEC 60684-2:2024

IEC 60426:2007, *Electrical insulating materials – Determination of electrolytic corrosion caused by insulating materials – Test methods*

IEC 60587:2007, *Electrical insulating materials used under severe ambient conditions – Test methods for evaluating resistance to tracking and erosion*

IEC 60589:1977, *Methods of test for the determination of ionic impurities in electrical insulating materials by extraction with liquids*

IEC 60684-3 (all parts), *Flexible insulating sleeving – Part 3: Specifications for individual types of sleeving*

IEC 60695-6-30:1996, *Fire hazard testing – Part 6: Guidance and test methods on the assessment of obscuration hazards of vision caused by smoke opacity from electrotechnical products involved in fires – Section 30: Small scale static method – Determination of smoke opacity – Description of the apparatus*

IEC/TS 60695-11-21 2005, *Fire hazard testing - Part 11-21: Test flames - 500 W vertical flame test method for tubular polymeric materials*

IEC 60754-1:2011+AMD1:2019, *Tests on gases evolved during combustion of materials from cables – Part 1: Determination of the amount of halogen acid gas*

IEC 60754-2**:2011+AMD1:2019**, *Test on gases evolved during combustion of electric cables – Part 2: Determination of degree of acidity of gases evolved during the combustion of materials taken from electric cables by measuring pH and conductivity*
Amendment 1 (1997)

iTeh Standards (https://standards.iteh.ai) Document Preview

ISO 5-1:2009, *Photography and graphic technology – Density measurements – Part 1: Geometry and functional notation*

oSIST prEN IEC 60684-2:2024
https://standards.iteh.ai/catalog/standards/sist/663bf326-8de0-4f45-8baa-32ac9c0e45fe/osist-pren-iec-60684-2-2024

ISO 5-2:2009, *Photography and graphic technology – Density measurements – Part 2: Geometric conditions for transmittance density*

ISO 5-3:2009, *Photography and graphic technology – Density measurements – Part 3: Spectral conditions*

ISO 5-4:2009, *Photography and graphic technology – Density measurements – Part 4: Geometric conditions for reflection density*

ISO 37:2005, *Rubber, vulcanized or thermoplastic – Determination of tensile stress-strain properties*

ISO 62:2008, *Plastics – Determination of water absorption*

ISO 105-A02:2020, *Textiles – Tests for colour fastness – Part A02: Grey scale for assessing change in colour*

ISO 105-B01:2014, *Textiles – Tests for colour fastness – Part B01: Colour fastness to light: Daylight*

ISO 182-1:1990, *Plastics – Determination of the tendency of compounds and products based on vinyl chloride homopolymers and copolymers to evolve hydrogen chloride and any other acidic products at elevated temperature – Part 1: Congo red method*

oSIST prEN IEC 60684-2:2024

ISO 182-2:1990, *Plastics – Determination of the tendency of compounds and products based on vinyl chloride homopolymers and copolymers to evolve hydrogen chloride and any other acidic products at elevated temperature – Part 2: pH method*

ISO 974:2000, *Plastics – Determination of the brittleness temperature by impact*

ISO 1431-1:2004, *Rubber, vulcanized or thermoplastic – Resistance to ozone cracking – Part 1: Static and dynamic strain test*

ISO 13943: 2008, *Fire safety – Vocabulary*

ISO 4589-2:2017, *Plastics – Determination of burning behaviour by oxygen index – Part 2: Ambient-temperature test*

ISO 4589-3:2017, *Plastics – Determination of burning behaviour by oxygen index – Part 3: Elevated-temperature test*

ASTM E595 15-2021, *Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment*

ISO 4892-3:2016, Plastics – *Methods of exposure to laboratory light sources – Part 3: Fluorescent UV lamps*

2 Test conditions

iTeh Standards
(https://standards.iteh.ai)
Document Preview

2.1 Unless otherwise specified, all tests shall be made under standard ambient conditions according to IEC 60212; i.e., at a temperature between 15 °C and 35 °C and at ambient relative humidity.

In cases of dispute, the tests shall be carried out at a temperature of 23 °C ± 2 K and at (50 ± 5) % relative humidity.

oSIST prEN IEC 60684-2:2024
https://standards.iteh.ai/catalog/standards/sist/663bf926-8de0-4f45-8baa-32ac9e0e45fd/osist-pren-iec-60684-2-2024

2.2 When heating at elevated temperature is specified for a test procedure, the specimen shall be maintained for the prescribed period in a uniformly heated oven complying with IEC 60216-4-1.

2.3 Where a test at low temperature is specified, the specification sheets of IEC 60684-3 may require it to be carried out at *–t* °C or lower. In such cases the operator may carry out the test at the specified temperature or any lower temperature which is convenient. If, however, at a temperature below that specified the specimen fails to meet the requirements, the test shall be repeated at the specified temperature, subject to a tolerance of ± 3 K as specified in IEC 60212. If the specimen then passes, it shall be considered to have met the requirements.

3 Measurements of bore, wall thickness and concentricity

NOTE Within this standard, the terms "bore" and "internal diameter" are interchangeable.

3.1 Bore

3.1.1 Number of test specimens

Three specimens shall be tested.

3.1.2 General method

Plug or taper gauges of appropriate diameter or an optical method shall be used to establish that the bore lies between the maximum and minimum specified values. The gauge shall enter the bore

oSIST prEN IEC 60684-2:2024

without causing expansion of the sleeving. A lubricant in powder form will assist when some types of sleeving are being measured.
Measurements shall be made to the nearest 0,05 mm for sizes 10 mm and below and to the nearest 0,1 mm for sizes above 10 mm. For shrink sleeving use a tapered gauge to measure the unshrunk minimum diameter. For bore sizes 2 mm and below and inner coated sleevings a micrometer microscope shall be used and measurements shall be made to the nearest 0,05 mm.

Cut short lengths between 2 mm and 20 mm and ensure the ends are cut square. If during the preparation of these short lengths for heat shrink sleeving they are distorted, re-condition for (5 ± 1) min at the temperature specified in the part 3 sheet for recovery.

3.1.3 Relaxed bore of expandable braided sleeving

Select a 250 mm long steel mandrel of the same diameter as the specified minimum relaxed bore of the sleeving.

Insert the mandrel completely into the sleeving so that 50 mm of sleeving projects beyond the mandrel at the cut end.

At the opposite end, wrap wire around the sleeving just beyond the end of the mandrel to prevent the mandrel penetrating further into the sleeving.

Smooth the sleeving firmly onto the mandrel from the secured end towards the cut end and twist the sleeving so that it traps the end of the mandrel. Secure by wrapping with wire.

Mark 200 mm gauge lines centrally on the sleeving using a marking medium which does not degrade the sleeving, e.g., typewriter correction fluid.

Release the cut end and allow sleeving to relax.

Measure the distance between gauge lines in millimetres.

If this measurement is 195 mm or greater, then the sleeving is of the maximum relaxed bore diameter.

iTeh Standards
(https://standards.iteh.ai)
Document Preview
https://standards.iteh.ai/catalog/standards/sist/663bf326-8de0-4f45-8baa-32ac9c0e45fe/osist-pren-iec-60684-2-2024

If this measurement is less than 195 mm, repeat the determination with progressively larger mandrels until the measurement is equal to or larger than 195 mm.

3.1.4 Expanded bore of expandable braided sleeving

Select a plug gauge of the same diameter as the specified minimum expanded bore.

Grip the sleeving 50 mm below the cut end.

Open the cut end of the sleeving for 10 mm and insert the plug gauge.

Attempt to push the plug gauge further into the undisturbed gripped sleeving.

If the plug gauge enters further without undue force, the sleeving is of the minimum expanded bore.

If the plug gauge does not enter further without undue force, repeat the determination with progressively smaller mandrels.

3.1.5 Result

Report all measured values as the result.

oSIST prEN IEC 60684-2:2024

3.2 Wall thickness for textile sleeving

3.2.1 Number of test specimens

Three specimens shall be tested.

3.2.2 Procedure

A plug gauge or mandrel shall be inserted so that it enters freely but has a diameter not less than 80 % of the bore. The overall dimension shall then be measured using a micrometer having flat anvils of approximately 6 mm in diameter. In making this measurement, the pressure applied by the micrometer shall be just sufficient to close the sleeving on to the inserted plug gauge or mandrel. The wall thickness shall be calculated by halving the difference between the overall dimension and the plug gauge or mandrel diameter.

3.2.3 Result

Report all measured values for wall thickness as the result.

3.3 Minimum/maximum wall thickness and concentricity for extruded sleeving

3.3.1 Number of test specimens

Three specimens shall be tested.

3.3.2 Wall thickness

This standard does not give mandatory methods for making this measurement. By means of a suitable number of tests, locate the points on the wall corresponding to the minimum and maximum wall thickness. All measurements shall be measured to the nearest 0,01 mm. In cases of dispute a calibrated micrometer microscope shall be used capable of measuring to the nearest 0,001 mm.

NOTE The following methods of measurement have proved suitable: optical profile projector, optical comparator, a suitable micrometer. In the event of a dispute, use one of the optical methods. A microscope micrometer has been found suitable for measuring small bore sizes and for determining the inner and outer wall thicknesses of dual wall sleeving. **When using a pin micrometer care should be taken not to compress the wall.**

3.3.2.1 Wall correction for Heat Shrink sleeving

When specified in the appropriate IEC 60684-3 sheet, use the following formula when the sleeving is fully shrunk.

Smin (corrected min wall thickness) = (Smin x d1) / d1max

Smax (corrected max wall thickness) = (Smax x d1) / d1max

Where:

d1 = measured recovered internal diameter

d1max = Specified maximum recovered internal diameter in part 3 sheet

Smax = measured maximum wall thickness

Smin = measured minimum wall thickness

3.3.3 Concentricity

Calculate the concentricity of each specimen of the sleeving by use of the following equation:

$$\text{concentricity (\%)} = \frac{\text{minimum wall thickness}}{\text{maximum wall thickness}} \; 100$$