

# SLOVENSKI STANDARD

## SIST EN 60216-1:2002

01-oktober-2002

Nadomešča:

SIST HD 611.1 S1:1998

SIST HD 611.4.1 S1:1998

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**Električni izolacijski materiali - Lastnosti toplotne vzdržljivosti - 1. del: Postopki staranja in vrednotenje preskusnih rezultatov (IEC 60216-1:2001)**

Electrical insulating materials - Properties of thermal endurance - Part 1: Ageing procedures and evaluation of test results (IEC 60216-1:2001)

iTeh STANDARD PREVIEW

Elektroisolerstoffe - Eigenschaften hinsichtlich des thermischen Langzeitverhaltens - Teil 1: Warmlagerungsverfahren und Auswertung von Prüfergebnissen (IEC 60216-1:2001)

[SIST EN 60216-1:2002](https://standards.iteh.ai/catalog/standards/sist/74e7cc56-e83d-403d-91de-81dc3a2e7cca/sist-en-60216-1-2002)

Matériaux isolants électriques - Propriétés d'endurance thermique - Partie 1: Méthodes de vieillissement et évaluation des résultats d'essai (CEI 60216-1:2001)

**Ta slovenski standard je istoveten z: EN 60216-1:2001**

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**ICS:**

|           |                                  |                                 |
|-----------|----------------------------------|---------------------------------|
| 29.035.01 | Izolacijski materiali na splošno | Insulating materials in general |
|-----------|----------------------------------|---------------------------------|

**SIST EN 60216-1:2002**

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EUROPEAN STANDARD

**EN 60216-1**

NORME EUROPÉENNE

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October 2001

ICS 17.220.99;29.035.01

Supersedes HD 611.1 S1:1992

English version

**Electrical insulating materials -  
Properties of thermal endurance  
Part 1: Ageing procedures and evaluation of test results  
(IEC 60216-1:2001)**

Matériaux isolants électriques -  
Propriétés d'endurance thermique  
Partie 1: Méthodes de vieillissement et  
évaluation des résultats d'essai  
(CEI 60216-1:2001)

Elektroisolierstoffe -  
Eigenschaften hinsichtlich des  
thermischen Langzeitverhaltens  
Teil 1: Warmlagerungsverfahren und  
Auswertung von Prüfergebnissen  
(IEC 60216-1:2001)

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This European Standard was approved by CENELEC on 2001-10-01. 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, Malta, 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**

## Foreword

The text of document 15E/153/FDIS, future edition 5 of IEC 60216-1, prepared by SC 15E, Methods of test, of IEC TC 15, Insulating materials, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60216-1 on 2001-10-01.

This European Standard supersedes HD 611.1 S1:1992.

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) 2002-07-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2004-10-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annex ZA is normative and annexes A, B and C are informative.

Annex ZA has been added by CENELEC.

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The text of the International Standard IEC 60216-1:2001 was approved by CENELEC as a European Standard without any modification.

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

| <u>Publication</u> | <u>Year</u> | <u>Title</u>   | <u>EN/HD</u>  | <u>Year</u> |
|--------------------|-------------|--|---------------|-------------|
| IEC 60050-212      | 1990        | International Electrotechnical Vocabulary (IEV)<br>Chapter 212: Insulating solids, liquids and gases                               | -             | -           |
| IEC 60212          | 1971        | Standard conditions for use prior to and during the testing of solid electrical insulating materials                               | HD 437 S1     | 1984        |
| IEC 60216-2        | 1990        | Guide for the determination of thermal endurance properties of electrical insulating materials<br>Part 2: Choice of test criteria  | HD 611.2 S1   | 1992        |
| IEC 60216-3        | 1)          | Part 3: Instructions for calculating thermal endurance characteristics   | -             | -           |
| IEC 60216-4-1      | 1990        | Part 4: Ageing ovens -- Section 1: Single-chamber ovens  | HD 611.4.1 S1 | 1992        |
| IEC 60493-1        | 1974        | Guide for the statistical analysis of ageing test data - Part 1: Methods based on mean values of normally distributed test results | -             | -           |
| ISO 291            | 1997        | Plastics - Standard atmospheres for conditioning and testing   | -             | -           |
| ISO 2578           | 1993        | Plastics<br>Determination of time-temperature limits after prolonged exposure to heat  | EN ISO 2578   | 1998        |
| ISO 11346          | 1997        | Rubber, vulcanized or thermoplastic<br>Estimation of life-time and maximum temperature of use from an Arrhenius plot               | -             | -           |

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1) To be published.

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NORME  
INTERNATIONALE  
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CEI  
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60216-1

Cinquième édition  
Fifth edition  
2001-07

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**Matériaux isolants électriques –  
Propriétés d'endurance thermique –**

**Partie 1:  
Méthodes de vieillissement et  
évaluation des résultats d'essai**

(standards.iteh.ai)

**Electrical insulating materials –  
Properties of thermal endurance –**

**Part 1:  
Ageing procedures and  
evaluation of test results**

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Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

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For price, see current catalogue

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICAL INSULATING MATERIALS –  
PROPERTIES OF THERMAL ENDURANCE –****Part 1: Ageing procedures and evaluation of test results**

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60216-1 has been prepared by subcommittee 15E: Methods of test, of IEC technical committee 15: Insulating materials.

This fifth edition cancels and replaces the fourth edition published in 1990 and constitutes a technical revision.

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

|              |                  |
|--------------|------------------|
| FDIS         | Report on voting |
| 15E/153/FDIS | 15E/155/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 3.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next revision.

Annexes A, B and C are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

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

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## INTRODUCTION

The listing of the thermal capabilities of electrical insulating materials, based on service experience, was found to be impractical, owing to the rapid development of polymer and insulation technologies and the long time necessary to acquire appropriate service experience. Accelerated ageing and test procedures were therefore required to obtain the necessary information. The IEC 60216 series has been developed to formalize these procedures and the interpretation of their results.

Physico-chemical models postulated for the ageing processes led to the almost universal assumption of the Arrhenius equations to describe the rate of ageing. Out of this arose the concept of the temperature index (TI) as a single-point characteristic based upon accelerated ageing data. This is the numerical value of the temperature in °C at which the time taken for deterioration of a selected property to reach an accepted end-point is that specified (usually 20 000 h).

**NOTE** The term Arrhenius is widely used (and understood) to indicate a linear relationship between the logarithm of a time and the reciprocal of the thermodynamic (absolute or kelvin) temperature. The correct usage is restricted to such a relationship between a reaction rate constant and the thermodynamic temperature. The common usage is employed throughout this standard.

The large statistical scatter of test data which was found, together with the frequent occurrence of substantial deviations from the ideal behaviour, demonstrated the need for tests to assess the validity of the basic physico-chemical model. The application of conventional statistical tests, as set out in IEC 60493, fulfilled this requirement, resulting in the "confidence limit", (TC) of TI, but the simple, single-point TI was found inadequate to describe the capabilities of materials. This led to the concept of the "Thermal Endurance Profile" (TEP) given in the second edition of this part of IEC 60216, incorporating the temperature index, its variation with specified ageing time, and a confidence limit.

### SIST EN 60216-1:2002

A complicating factor is that the properties of a material subjected to thermal ageing may not all deteriorate at the same rate, and different end-points may be relevant for different applications. Consequently, a material may be assigned more than one temperature index, derived, for example, from the measurement of different properties and the use of different end-point times.

A useful addition to the standard was the relative temperature index (RTI) obtained by simultaneous ageing of a known reference material with the test material, eliminating some of the uncertainties associated with, for example, oven temperature control.

It was subsequently found that the statistical confidence index included in the TEP was not widely understood or used. However, the statistical tests were considered essential, particularly after minor modifications to make them relate better to practical circumstances: the concept of the halving interval (HIC) was introduced to indicate the rate of change of ageing time with temperature. TEP was then abandoned, with the TI and HIC being reported in a way which indicated whether or not the statistical tests had been fully satisfied. At the same time, the calculation procedures were made more comprehensive, enabling full statistical testing of data obtained using a diagnostic property of any type, including the particular case of partially incomplete data. The calculation procedures (by now quite complex) were made more acceptable by the provision of computer programmes suitable for low-price personal computers.

At the time of preparation of the present edition, it was decided that RTI should be made the subject of a separate standard.

Simultaneously with the development of the IEC 60216 series, other standards were being developed in ISO, intended to satisfy a similar requirement for plastics and rubber materials. These are ISO 2578 and ISO 11346 respectively, which use less rigorous statistical procedures and more restricted experimental techniques. It is hoped that the wide availability of the computer facilities mentioned above and the inclusion of a section of simplified procedures will remove the need for these separate standards.

IEC 60216, which deals with the determination of thermal endurance properties of electrical insulating materials is composed of several parts:

- Part 1: Ageing procedures and evaluation of test results;
- Part 2: Choice of test criteria;
- Part 3: Instruction for calculating thermal endurance characteristics;
- Part 4-1: Ageing ovens – Section 1: Single-chamber ovens;
- Part 4-2: Ageing ovens – Precision ovens for use up to 300 °C;
- Part 4-3: Ageing ovens – Multi-chamber ovens;
- Part 5: Guidelines for the application of thermal endurance characteristics.

NOTE This series may be extended. For revisions and new parts, see the current catalogue of IEC publications for an up-to-date list.

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