SLOVENSKI STANDARD

SIST EN 60505:2005

julij 2005

Vrednotenje in kvalificiranje električnih izolacijskih sistemov

Evaluation and qualification of electrical insulation systems

ICS 29.080.30

Referenčna številka
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EUROPEAN STANDARD

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EN 60505

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English version

Evaluation and qualification of electrical insulation systems
(IEC 60505:2004)

Evaluation et qualification des systèmes d'isolation électrique
(CEI 60505:2004)

Bewertung und Kennzeichnung von elektrischen Isoliersystemen
(IEC 60505:2004)

This European Standard was approved by CENELEC on 2004-10-01. 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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, 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

Ref. No. EN 60505:2004 E

Foreword

The text of document 98/217/FDIS, future edition 3 of IEC 60505, prepared by IEC TC 98, Electrical insulation systems (EIS), was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60505 on 2004-10-01.

This European Standard supersedes EN 60505:2000.

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)	2005-08-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2007-10-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60505:2004 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 standards indicated:

IEC 60068-1	NOTE	Harmonized as EN 60068-1:1994 (not modified).
IEC 60068-2	NOTE	Harmonized in HD 323.2 and EN 60068-2 series (not modified).
IEC 60068-2-10	NOTE	Harmonized as HD 323.2.10 S3:1988 (not modified).
IEC 60112	NOTE	Harmonized as EN 60112:2003 (not modified).
IEC 60212	NOTE	Harmonized as HD 437 S1:1984 (not modified).
IEC 60216	NOTE	Harmonized in HD 611 and EN 60216 series (not modified).
IEC 60587	NOTE	Harmonized as HD 380 S2:1987 (not modified).
IEC 60721	NOTE	Harmonized in HD 478 and EN 60721 series (not modified).
IEC 62114	NOTE	Harmonized as EN 62114:2001 (not modified).
ISO 62	NOTE	Harmonized as EN ISO 62:1999 (not modified).
ISO 175	NOTE	Harmonized as EN ISO 175:2000 (not modified).
ISO 4611	NOTE	Harmonized as EN ISO 4611:1999 (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

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

Publication	Year	Title	EN/HD	Year
IEC 60068-2-1	- [1)]	Environmental testing Part 2: Tests - Tests A: Cold	EN 60068-2-1	1993 [2)]
IEC 60068-2-2	- [1)]	Part 2: Tests - Tests B: Dry heat	EN 60068-2-2	1993 [2)]
IEC 60068-2-14	- [1)]	Part 2: Tests - Test N: Change of temperature	EN 60068-2-14	1999 [2)]
IEC 60068-2-27	- [1)]	Part 2: Tests - Test Ea and guidance: Shock	EN 60068-2-27	1993 [2)]
IEC 60216-3	- [1)]	Electrical insulating materials - Thermal endurance properties Part 3: Instructions for calculating thermal endurance characteristics	EN 60216-3	2002 [2)]
IEC 60216-5	- [1)]	Part 5: Determination of relative thermal endurance index (RTE) of an insulating material	EN 60216-5	2003 [2)]
IEC 60493-1	- [1)]	Guide for the statistical analysis of ageing test data Part 1: Methods based on mean values of normally distributed test results	-	-
IEC 60544-1	- [1)]	Electrical insulating materials - Determination of the effects of ionizing radiation Part 1: Radiation interaction and dosimetry	EN 60544-1	1994 [2)]
IEC 60664	Series	Insulation coordination for equipment within low-voltage systems	EN 60664	Series
IEC 60727-1	- [1)]	Evaluation of electrical endurance of electrical insulation systems Part 1: General considerations and evaluation procedures based on normal distributions	-	-

1) Undated reference.

2) Valid edition at date of issue.

NORME INTERNATIONALE

INTERNATIONAL STANDARD

CEI
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Troisième édition
Third edition
2004-10

Evaluation et qualification des systèmes d'isolation électrique

Evaluation and qualification of electrical insulation systems

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Международная Электротехническая Комиссия

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For price, see current catalogue

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

EVALUATION AND QUALIFICATION OF ELECTRICAL INSULATION SYSTEMS

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.

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International Standard IEC 60505 has been prepared by IEC technical committee 98: Electrical insulation systems (EIS).

This third edition cancels and replaces the second edition, published in 1999 and constitutes a technical revision.

The main changes with respect to the previous edition concern the amalgamation of the following standards, which, with the exception of IEC 60727-1, will be withdrawn when this third edition is published:

IEC 60791:1984, Performance evaluation of insulation systems based on experience and functional tests

IEC 60792-1:1985, The multi-factor functional testing of electrical insulation systems – Part 1: Test procedures

IEC 60941:1988, Mechanical endurance functional tests for electrical insulation systems

IEC 61356:1995, Functional evaluation of electrical systems – Principles for test procedures when comparative testing is not feasible

IEC 61359:1995, Evaluation and identification of electric insulation systems – Environment evaluation

IEC 60727-1: 1982, Evaluation of electrical endurance of electrical insulation systems – Part 1: General considerations and evaluation procedures based on normal distributions

Elements of IEC 60727-1 that are not amalgamated will be considered in the next edition of that standard.

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

FDIS	Report on voting
98/217/FDIS	98/225/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 maintenance result 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.

INTRODUCTION

The service life of electrical equipment is frequently determined by the life of its electrical insulation system (EIS) or systems. The life of an electrical insulation system can be affected by electrical, thermal, mechanical or environmental stresses acting either individually or in combination.

Intended, estimated or proven service life times are essential parameters for describing the life of electrical insulation systems. In the early days of electrotechnical engineering, life figures were rather vague. The limitation of the life of the insulation under thermal stress was one of the first indicators of the effect of ageing in some equipment in service. As experience in using EIS increased, it was appreciated that there was a need to select specific materials having satisfactory life time at a given temperature, to enable the required service life to be achieved and to allow for the calculation of the thermal capability of equipment.

IEC 60085 standardized a number of maximum temperature values and presented a list of electrical insulating materials (EIM) related to these temperatures (classes) which, when used for EIS, would “ensure an economical life for the insulation in a wide range of apparatus".

This was a clearly defined attempt to qualify EIS on the basis of (service) experience or tests and a quantification of an EIS life in terms of time. The limitation of this approach, based entirely on thermal stressing, was recognized and there was a demand for an improved life concept. This requirement and the impossibility of using the material tables in IEC 60085 at a time when many new, synthetic materials were being produced which did not fit neatly into the existing thermal classification, led to a worldwide effort to improve the situation. This led to the elaboration of the present standard, which serves as a guide to anyone developing standards and technical documents.

The user of this standard may evaluate existing test methods and provide correlation with his equipment. Therefore, the user of this standard is responsible for demonstrating the validity of the existing test method in accordance with the principles of this standard.

To determine the prospective life is a fundamental task when developing and designing an EIS. Estimated service life of an EIS needs to be established for several reasons:

– for type testing when introducing a new EIS into production;
– for quality assurance of production; and
– for estimating the remaining life for maintenance purposes.

EVALUATION AND QUALIFICATION OF ELECTRICAL INSULATION SYSTEMS

1 Scope

This International Standard establishes the basis for estimating the ageing of electrical insulation systems (EIS) under conditions of either electrical, thermal, mechanical, environmental stresses or combinations of these (multifactor stresses).

It specifies the principles and procedures that should be followed, during the development of EIS functional test and evaluation procedures, to establish the estimated service life for a specific EIS.

This standard is for use by all IEC technical committees responsible for equipment having an EIS.

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 60068-2-1, *Environmental testing – Part 2: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2: Tests – Test B: Dry heat*

IEC 60068-2-14, *Environmental testing – Part 2: Tests – Test N: Change of temperature*

IEC 60068-2-27, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock*

IEC 60216-3, *Electrical insulating materials – Thermal endurance properties – Part 3: Instructions for calculating thermal endurance characteristics*

IEC 60216-5, *Electrical insulating materials – Thermal endurance properties – Part 5: Determination of relative thermal endurance index (RTE) of an insulating material*

IEC 60493-1, *Guide for the statistical analysis of ageing test data – Part 1: Methods based on mean values of normally distributed test results*

IEC 60544-1, *Electrical insulating materials – Determination of the effects of ionizing radiation– Part 1: Radiation interaction and dosimetry*

IEC 60664 (all parts), *Insulation coordination for equipment within low-voltage systems*

IEC 60727-1, *Evaluation of electrical endurance of electrical insulation systems – Part 1: General considerations and evaluation procedures based on normal distributions*

3 Terms and definitions

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

3.1 General terms

3.1.1
electrical insulation system
EIS
insulating structure containing one or more electrical insulating materials (EIM) together with associated conducting parts employed in an electrotechnical device

3.1.2
electrical insulating material
EIM
material with negligibly low electric conductivity, used to separate conducting parts at different electrical potentials

[IEV 212-01-01:1990, modified]

3.1.3
reference EIS
established EIS evaluated on the basis of either a known service experience record or a known comparative functional evaluation

3.1.4
candidate EIS
EIS under evaluation to determine its service capability (with regard to electrical, thermal, mechanical, environmental or multifactor stresses)

3.1.5
intended life
design life of an EIS under service conditions

3.1.6
estimated life
expected service life derived from either service experience or the results of tests performed in accordance with appropriate evaluation procedures, or both, as established by the responsible organization or technical committee

3.1.7
evaluation
establishment of relationships between service requirements and life data obtained from service experience analysis or from the results of functional tests

3.2 Terms related to service stresses and ageing

3.2.1
ageing stress
electrical, thermal, mechanical or environmental stress whose action on an EIS causes irreversible property changes

3.2.2
potentially destructive stress

factor of influence in service which can cause the failure of the aged EIS, alone or in combination with other stresses

3.2.3
factor of influence
stress imposed by conditions of operation, environment or test that affects ageing or life of an EIS

NOTE The term "factor of influence" denotes external factors (such as ambient temperature) inducing stress in the EIS as different from stress factors being part of the duty cycle of the equipment (e.g. temperature rise due to load).

3.2.4
service conditions
combination of factors of influence and duty that are to be expected in a specific application of an electrical device

3.2.5
reference operating conditions
service conditions of the equipment to which the test conditions of the functional test procedure are related

3.2.6
service requirements
specified factors of influence, intended performance and duty of an electrical device

3.2.7
service experience
the quantitative and/or qualitative record during service, with or without failure of an EIS

3.2.8
ageing
irreversible changes of the properties of an EIS due to action by one or more factors of influence

NOTE 1 Some changes (e.g. hydrolytic changes) can be partly reversible if the ambient conditions change.

NOTE 2 Ageing leads to degradation of the EIS.

3.2.9
ageing factor
factor of influence that causes ageing

3.2.10
intrinsic ageing
irreversible changes of fundamental properties of an EIS caused by the action of ageing factors on the EIS

3.2.11
extrinsic ageing
irreversible changes of properties of an EIS caused by action of ageing factors on unintentionally introduced imperfections in the EIS

3.2.12
interaction
modifications of the type or degree of ageing produced by the combination of two or more factors of influence relative to their ageing effect if acting individually on separate objects