IEC TS 62332-1

Edition 3.0 2026-05

TECHNICAL SPECIFICATION

Electrical insulation systems (EIS) - Thermal evaluation of combined liquid and solid components -
Part 1: General requirements

ICS 29.080.30

ISBN 978-2-8327-1242-9

IEC TS 62332-1:2026-05(en)

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Electrical insulation systems (EIS) - Thermal evaluation of combined liquid and solid components - Part 1: General requirements

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 TS 62332-1 has been prepared by IEC technical committee 112: Evaluation and qualification of electrical insulating materials and systems. It is a Technical Specification.

This third edition cancels and replaces the second edition published in 2011. This edition constitutes a technical revision.

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

a) Modifications have been made based on an extensive test series conducted using this methodology based on the first edition. This included updating expected times and temperatures to use in order to get useful results, as well as making the range of equipment covered more broad. The method now covers electrotechnical devices using different sealing systems, as well as devices using enamel covered wires.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
112/716/DTS	112/723/RVDTS

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 Technical Specification 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 62332 series, published under the general title *Electrical insulation systems (EIS) -Thermal evaluation of combined liquid and solid components*, 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.

INTRODUCTION

This document specifies a method for the thermal evaluation of electrical insulation systems (EISs) for electrotechnical products with combined liquid and solid components. This document covers general test requirements. It is intended that subsequent parts will cover specific product test requirements.

Prior to this document, the procedure for determining the thermal endurance of insulation systems for liquid-immersed products involved one of two processes: firstly, sealed-tube ageing and, secondly, ageing of full-scale models.

The ageing of full-scale models is impractical, especially for larger products, such as power transformers. Similarly, the use of sealed-tube ageing is not practical when testing components having drastically different thermal capabilities. For example, testing of a system with a solid material with an RTI of 200 °C with a liquid having a 130 °C thermal capability cannot be performed efficiently. Accelerated ageing temperatures which significantly age the liquid will result in extremely long ageing times for the solid. Accelerated ageing temperatures which significantly age the solid will result in extreme, or even hazardous, ageing of the liquid.

This document specifies an accelerated thermal ageing procedure and model that allows for the solid materials to be aged at temperatures separate from the liquid ageing temperatures, all in the same apparatus. The model acts more in the true-life ageing mode of insulation systems, where solid insulation near the active parts is exposed to much higher temperatures than the major volume of liquid in the equipment. The model contains all the primary EIS elements, and in relative component ratios which compare with actual electrotechnical products.

The model has a dual temperature capability that allows independent control of the temperatures of the solid and liquid components by the use of separate circuits. A detailed bibliography is provided.

Further useful information can be found in IEC 60076-6 [1], IEC 60076-7 [2], IEC 60076-14 [3], IEC 60641-2 [4], [5], [6], [7] and[8].

1 Scope

This document specifies a dual-temperature test procedure for the thermal evaluation and qualification of electrical insulation systems (EISs).

This document is applicable to EISs containing solid and liquid components where the thermal ageing factor is dominant, without restriction to voltage class.

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 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 60296, *Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear*

IEC 60422, *Mineral insulating oils in electrical equipment - Supervision and maintenance guidance*

IEC 60505, *Evaluation and qualification of electrical insulation systems*

Bibliography

[1] IEC 60076-6, *Power transformers - Part 6: Reactors*

[2] IEC 60076-7, *Power transformers - Part 7: Loading guide for oil-immersed power transformers*

[3] IEC 60076-14, *Power transformers - Part 14: Design and application of liquid-immersed power transformers using high-temperature insulation materials*

[4] IEC 60641-2, *Pressboard and presspaper for electrical purposes - Part 2: Methods of tests*

[5] IEEE Standard 1276-1998, Guide for application of high temperature insulation materials in liquid-immersed power transformers

[6] WICKS, R., Insulation Systems for Liquid-Immersed Transformers - New Materials Require New Methods for Evaluation, Proceedings Electrical Insulation Conference pp348-358, Montreal, Canada June 2009

[7] McNUTT, W.J., PROVOST, R.L. WHEARTY, R.J., Thermal life evaluation of high temperature insulation systems and hybrid insulation systems in mineral oil, IEEE Transactions on Power Delivery Vol. 11 No. 3 p1391-1399 July 1996

[8] WICKS, R., BATES, L., MAREK, R., PREVOST, T., Dual-Temperature Model Aging of Insulation Systems for Liquid-Immersed Transformers, 76th Annual International Doble Client Conference, Boston, MA USA April 2009

[9] IEC 60505:2011, *Evaluation and qualification of electrical insulation systems*

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

[11] IEC 60505, *Evaluation and qualification of electrical insulation systems*

[12] IEC 60085:2007, *Electrical insulation - Thermal evaluation and designation*

[13] IEC 61857-1:2008, *Electrical insulation systems- Procedures for thermal evaluation - Part 1: General requirements - Low voltage*

[14] IEC 60554-2, *Cellulosic papers for electrical purposes - Part 2: Methods of test*

[15] ISO 287, *Paper and board - Determination of moisture content of a lot - Oven-drying method*

[16] IEC 60243-1, *Electrical strength of insulating materials - Test methods - Part 1: Tests at power frequencies*

[17] IEC 60250, *Recommended methods for the determination of the permittivity and dielectric dissipation factor of electrical insulating materials at power, audio and radio frequencies including metre wavelengths*

[18] ISO 1924 series, *Paper and board - Determination of tensile properties*

[19] IEC 60763-2, *Specification for laminated pressboard - Part 2: Methods of test*

[20] IEC 60450, *Measurement of the average viscometric degree of polymerization of new and aged cellulosic electrically insulating materials*

[21] ISO 2049, *Petroleum products - Determination of colour (ASTM scale)*

[22] IEC 60156, *Insulating liquids - Determination of the breakdown voltage at power frequency - Test method*

[23] IEC 62961, *Insulating liquids - Test methods for the determination of interfacial tension of insulating liquids - Determination with the ring method*

[24] ASTM D971-99a, *Standard test method for interfacial tension of oil against water by the ring method*

[25] IEC 62021-1, *Insulating liquids - Determination of acidity - Part 1: Automatic potentiometric titration*

[26] IEC 60247, *Insulating liquids - Measurement of relative permittivity, dielectric dissipation factor (tan δ) and d.c. resistivity*

[27] IEC 61620, *Insulating liquids - Determination of dielectric dissipation factor by measurement of the conductance and capacitance - Test method*

[28] IEC 60814, *Insulating liquids - Oil-impregnated paper and pressboard - Determination of water by automatic coulometric Karl Fischer titration*

[29] IEC 60567, *Oil-filled electrical equipment - Sampling of gases and of oil for analysis of free and dissolved gases - Guidance*

[30] IEC 60599, *Mineral oil-impregnated electrical equipment in service - Guide to the interpretation of dissolved and free gases analysis*

[31] IEC 61198, *Mineral insulating oils- Methods for the determination of 2-furfural and related compounds*

[32] IEC 60422, *Mineral insulating oils in electrical equipment - Supervision and maintenance guidance*

[33] IEC 60216-2:2005, *Electrical insulating materials - Thermal endurance properties - Part 2: Determination of thermal endurance properties of electrical insulating materials - Choice of test criteria*

_____