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

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CONTENTS

FOREWORD 3
INTRODUCTION 5
1 Scope 6
2 Normative references 6
3 Terms and definitions 7
4 Thermal ageing test apparatus 9
4.1 General description 9
4.2 Construction of the test apparatus 9
4.2.1 Ageing cells 9
4.2.2 Immersion heaters 10
4.2.3 Power supply 10
4.2.4 Control circuit system 10
4.2.5 Gas blanketing system 10
4.2.6 Safety system 10
4.3 Monitoring and data collection 11
5 Construction of the test object 11
5.1 General 11
5.2 Determination of component volumes 11
5.3 Test object 11
5.3.1 General 11
5.3.2 Conductor assembly 11
5.3.3 Liquid component 12
5.3.4 Other components 13
6 Test procedures 13
6.1 General 13
6.2 Preparation of the test objects 13
6.2.1 General 13
6.2.2 Reference test object 13
6.2.3 Candidate test object 14
6.3 Diagnostic tests 14
6.3.1 General 14
6.3.2 Solid insulation 14
6.3.3 Liquid insulation 15
6.4 Thermal ageing 15
6.4.1 Recommended solid-component ageing temperatures 15
6.4.2 Recommended liquid ageing temperatures 16
6.4.3 Reference EIS ageing temperatures 16
6.4.4 Ageing procedures of the candidate EIS 16
6.5 End-point testing 16
7 Analysis of data 17
7.1 End-point criteria 17
7.1.1 General 17
7.1.2 End-of-life of the liquid component 17
7.1.3 End-of-life of the solid component 17
7.1.4 Extrapolation of data 17
7.2 Report 17

Annex A (informative) Component volume ratio spreadsheet example 19
Bibliography 20

Figure 1 – Ageing cell cross-section 10
Figure 2 – Example of an insulation package for a transformer winding 12

Table 1 – Reference EIS ageing temperatures 14
Table 2 – Typical diagnostic tests for cellulosic materials 15
Table 3 – Typical diagnostic tests for liquids 15
Table 4 – Recommended ageing temperatures and periods for expected thermal class as designated in IEC 60085:2007 [12] 15
Table A.1 – Examples of component volume ratio calculations 19

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

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC TS 62332-1:2011. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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 ~~should~~ 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 ~~fairly~~ significantly age the liquid will result in extremely long ageing times for the solid. Accelerated ageing temperatures which ~~fairly~~ 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.

~~This technical specification has been prepared in conjunction with TC 14, Power transformers. Any comments or suggestions from other technical committees to make this technical specification more general are welcome.~~

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 ~~stress is the dominant~~ 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 60085:2007, *Electrical insulation – Thermal evaluation and designation*~~

~~IEC 60156, *Insulating liquids – Determination of the breakdown voltage at power frequency – Test method*~~

~~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*~~

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

~~IEC 60247, *Insulating liquids – Measurement of relative permittivity, dielectric dissipation factor (tan δ) and d.c. resistivity*~~

~~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*~~

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 60450, *Measurement of the average viscometric degree of polymerization of new and aged cellulosic electrically insulating materials*~~

IEC 60505~~:2004~~, *Evaluation and qualification of electrical insulation systems*[1]

~~IEC 60554-2, *Cellulosic papers for electrical purposes – Part 2: Methods of test*~~

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[1] ~~A fourth edition of IEC 60505 is currently in preparation.~~

~~IEC 60567, *Oil-filled electrical equipment – Sampling of gases and of oil for analysis of free and dissolved gases – Guidance*~~

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

~~IEC 60763-2, *Specification for laminated pressboard – Part 2: Methods of test*~~

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

~~IEC 61198, *Mineral insulating oils – Methods for the determination of 2-furfural and related compounds*~~

~~IEC 61620, *Insulating liquids – Determination of dielectric dissipation factor by measurement of the conductance and capacitance – Test method*~~

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

~~IEC 62021-1, *Insulating liquids – Determination of acidity – Part 1: Automatic potentiometric titration*~~

~~ISO 287, *Paper and board – Determination of moisture content of a lot – Oven-drying method*~~

~~ISO 1924 (all parts), *Paper and board – Determination of tensile properties*~~

~~ISO 2049, *Petroleum products – Determination of colour (ASTM scale)*~~

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60505 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://www.iso.org/obp

3.1
electrical insulation system
EIS
insulating structure containing one or more electrical insulating materials (EIMs) together with associated conducting parts employed in an electrotechnical device

~~NOTE EIMs with different temperature indices (ATE RTE according to IEC 60216-5) may be combined to form an EIS, which has a thermal class that may be higher or lower than that of any of the individual components according to IEC 60505.~~

~~[IEC 60505:2004, definition 3.1.1]~~

Note 1 to entry: EIMs with different temperature indices (temperature index (TI), temperature index by analytical test (TIA) or relative thermal index (RTI)) as specified in IEC 60216-5 [10]) can be combined to form an EIS, which