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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Test methods for compatibility of construction materials with electrical insulating liquids

Méthodes d'essai pour évaluer la compatibilité des matériaux de construction avec les isolants électriques liquides

IEC 63177:2024-05(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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TEST METHODS FOR COMPATIBILITY OF CONSTRUCTION MATERIALS WITH ELECTRICAL INSULATING LIQUIDS

FOREWORD

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The text of this International Standard is based on the following documents:

Draft	Report on voting
112/630/FDIS	112/640/RVD

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 International Standard 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.

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- withdrawn, or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

The objective of the document is to clarify the evaluation methodology for the compatibility between construction materials and electrical insulating liquids. It provides recommendations for manufacturers of liquid-immersed transformers and tap-changers, liquid-impregnated capacitors, and liquid-cooled rotating machines used in electrical vehicles and oil pumps. The recommendations focus on screening appropriate construction materials ensuring compatibility between solid and liquid materials for use with different liquids under varying operating conditions. Additionally, the document contains tests that should be carried out on liquids and construction materials. These tests occur after a conditioning procedure at the desired temperature and for reference samples.

In the past, limited construction materials and liquids based on mineral oil served the industry needs. Since the industry needs have been advanced with new applications and driven by higher flash points and improved reliability of performance for liquid-filled electrical equipment, it is necessary to be able to evaluate high temperature electrical insulation systems, using silicone oils, synthetic esters, natural esters, and other potential suitable insulating liquids.

At the same time, liquid-cooled rotating machines used in electrical vehicles and oil pumps also increase the possibility for construction materials to be exposed to different liquids, driven by better thermal conductive performance. To avoid mechanical, electrical and sealing failure for construction materials, such as gasket materials, impregnating resins, prefabricates, etc., the test methods described in this document can be applied for different liquid-immersed electrical equipment, including liquid-immersed transformers and tap-changers, liquid-impregnated capacitors and liquid-cooled rotating machines used in electrical vehicles and oil pumps.

The evaluation process specified in this document focuses on the chemical compatibility between construction materials and liquids, but does not provide a long-term thermal or aging evaluation. In addition, threshold values for functional parameters of each material are not specified, as they depend on the requirements of the specific application.

Clause 1 to Clause 5 contain definitions and describe the preparation of suitable solid and liquid test samples.

Clause 6 describes the test procedure (e.g. temperatures, test duration and cycles) and lists the characteristic parameters to be evaluated. This allows an estimate of the basic compatibility of typical construction materials with insulating liquids.

An application example is given in Annex A.

TEST METHODS FOR COMPATIBILITY OF CONSTRUCTION MATERIALS WITH ELECTRICAL INSULATING LIQUIDS

1 Scope

This document specifies the test method for the compatibility of construction materials with electrical insulating liquids for use in electrical equipment, such as liquid-immersed transformers and tap-changers, liquid-impregnated capacitors, and liquid-cooled rotating machines used in electrical vehicles and oil pumps. This document is applicable to mineral insulating liquids, natural esters, silicone insulating liquids, synthetic organic esters, modified esters, capacitor fluids based on synthetic aromatic hydrocarbons and e-transmission fluids used in electrical vehicles and oil pumps. The compatibility tests are not sufficient for a full qualification of construction materials for a given application without additional tests requested by the appropriate IEC Technical Committee or equipment manufacturers.

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

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

IEC 60296:2020, *Fluids for electrotechnical applications – Mineral insulating oils for electrical equipment*

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

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

IEC 60836:2015, *Specifications for unused silicone insulating liquids for electrotechnical purposes*

IEC 60851-4:2016, *Winding wires – Test methods – Part 4: Chemical properties*

IEC 60867, *Insulating liquids – Specifications for unused liquids based on synthetic aromatic hydrocarbons*

IEC 61099, *Insulating liquids – Specifications for unused synthetic organic esters for electrical purposes*

IEC 62021-3:2014, *Insulating liquids – Determination of acidity – Part 3: Test methods for non-mineral insulating oils*

IEC 62770:2013, *Fluids for electrotechnical applications – Unused natural esters for transformers and similar electrical equipment*