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Synthetic organic esters – Guidelines for maintenance and use in electrical equipment

Esters organiques synthétiques – Lignes directrices pour la maintenance et l'utilisation dans les matériels électriques

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SYNTHETIC ORGANIC ESTERS – GUIDELINES FOR MAINTENANCE AND USE IN ELECTRICAL EQUIPMENT –

FOREWORD

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IEC 61203 has been prepared by IEC technical committee 10: Fluids for electrotechnical applications. It is an International Standard.

This second edition cancels and replaces the first edition published in 1992. This edition constitutes a technical revision.

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

a) Expanded list of Normative references.
b) Fluid tests split into routine tests, complimentary tests and special investigative tests.
c) Equipment which can be affected by this document are now grouped in categories for easier application of the monitoring Table 5.
d) Table 2 (new) lists the in-service fluid tests and methods, which will be mentioned in this document.

e) Table 3 (new) lists the suggested test requirements for synthetic esters after filling in new equipment.

f) Table 4 (new) gives advice on the recommended frequency of testing.

g) Table 5 (new) is much more detailed as to the recommended action limits for each type of equipment and advice for the type of follow-up actions required.

h) Clause 9 (new) goes into detail describing each of the recommended tests.

i) Annex A (new) give information about the interaction of moisture and synthetic esters.

j) Annex B (new) gives information about retrofilling mineral oil transformers, reconditioning and reclaiming of synthetic esters.

k) Annex C (new) gives information about the use of synthetic esters in tap-changers.

l) Annex D (new) gives information on materials compatibility with synthetic esters.

m) Expanded Bibliography.

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

Draft	Report on voting
10/1259/FDIS	10/1265/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

Synthetic esters are increasingly being used in transformers and electrical equipment employed in electrical power generation, transmission, distribution and industrial applications.

Synthetic esters are used in transformers over a wide range of voltage classes. These can be sealed or free breathing. Synthetic esters should only be used in transformers where the internal insulation system has been designed to run with these liquids, given the different electrical performance of synthetic ester as compared to mineral oil. Retrofilling mixtures are not covered in the normative part of this document. See Annex B for more information. When in doubt, contact the transformer or liquid manufacturer for more information.

Monitoring and maintaining liquid quality is essential to ensure the reliable operation of synthetic ester filled electrical equipment. Codes of practice for this purpose have been established by electrical power authorities, power companies and industries in many countries. A review of current experience reveals a wide variation of procedures and criteria. It is possible, however, to compare the value and significance of standardized liquid tests and to recommend uniform criteria for the evaluation of test data.

If a certain amount of liquid deterioration (by degradation or contamination) is exceeded, there is inevitably some erosion of safety margin and the question of the risk of premature failure should be considered. While the quantification of the risk can be very difficult, a first step involves the identification of potential effects of increased deterioration. The underlying philosophy of this document is to provide users with as broad a base of understanding of liquid quality deterioration as is available, so that they can make informed decisions on inspection and maintenance practices.

Synthetic esters are, by most regulations, deemed to be regulated or controlled (or both) waste. If spills occur, these can be subject to regulatory requirements with regard to their specific location.

This document, while technically sound, is mainly intended to serve as a common basis for the preparation of more specific and complete codes of practice by users in the light of local circumstances. Sound engineering judgement needs to be exerted in seeking the best compromise between technical requirements and economic factors.

Although there is significant experience going back more than 40 years, that experience has been mostly limited to the use of synthetic esters at distribution voltages, typically up to 72,5 kV. Experience in large power transformers is increasing but is currently limited to a smaller number of recently installed units. While the collection of operating data allows for the development of this document, care is important when applying the recommended values in particular at voltages at or above 72,5 kV.

WARNING – Health and safety

This document does not purport to address all the safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate health and safety practices and determine the applicability of regulatory limitations prior to use.

The synthetic esters which are the subject of this document can be subject to regulatory requirements and requirements in supplier's safety data sheets.

WARNING – Environment

This document is applicable to synthetic esters, chemicals and used sample containers. The disposal of these items can be subject to regulatory requirements with regard to their impact on the environment.

SYNTHETIC ORGANIC ESTERS – GUIDELINES FOR MAINTENANCE AND USE IN ELECTRICAL EQUIPMENT –

1 Scope

This document provides procedures and supervision for the use and maintenance of synthetic esters in transformers and other electrical equipment.

This document is applicable to synthetic esters, originally supplied conforming to IEC 61099 and other applicable standards in transformers, switchgear and electrical apparatus where liquid sampling is practical and where the normal operating conditions specified in the equipment specifications apply.

This document is also intended to assist the power equipment operator in evaluating the condition of the synthetic ester and in maintaining it in a serviceable condition. It also provides a common basis for the preparation of more specific and complete local codes of practice.

This document includes recommendations on tests and evaluation procedures and outlines methods for reconditioning and reclaiming the liquid, when necessary.

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 60475, *Method of sampling insulating liquids*

IEC 60666, *Detection and determination of specified additives in mineral insulating oils*

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

IEC 60970, *Insulating liquids – Methods for counting and sizing particles*

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

IEC 61125, *Insulating liquids – Test methods for oxidation stability – Test method for evaluating the oxidation stability of insulating liquids in the delivered state*

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