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Responsible committee: GEL/10 Fluids for electrotechnical applications

Interested committees:

Title: BS EN 61203 Ed.2.0 Synthetic organic esters for electrical purposes - Guide for maintenance of transformer esters in equipment

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

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- ii) affects other national standard(s)
- iii) requires additional national guidance or information

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

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10/1105/RR

IEC TC 10 : FLUIDS FOR ELECTROTECHNICAL APPLICATIONS

SECRETARIAT:

Italy

SECRETARY:

Mr Massimo Pompili

OF INTEREST TO THE FOLLOWING COMMITTEES:

TC 14, SC 17A, TC 20, SC 36A, TC 38, TC 99, TC 112

PROPOSED HORIZONTAL STANDARD:

☐

Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC☐ ENVIRONMENT☒ QUALITY ASSURANCE☒ SAFETY

This document is still under study and subject to change. It should not be used for reference purposes.

Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Synthetic organic esters for electrical purposes - Guide for maintenance of transformer esters in equipment

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SYNTHETIC ESTERS –
GUIDELINES FOR MAINTENANCE AND USE IN ELECTRICAL EQUIPMENT****FOREWORD**

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International Standard IEC 61203 has been prepared by IEC technical committee 10: Fluids for electrotechnical applications. The text of this standard is based on the following documents:

FDIS	Report on voting
XX/XX/FDIS	XX/XX/RVD

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 stability 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.

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The National Committees are requested to note that for this publication the stability date is 20XX.

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

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 both distribution and power transformers over a wide range of voltage classes. These may be sealed or free breathing. Synthetic esters should only be used in power transformers where the internal insulation system has been designed to run with these fluids, given the different electrical performance of synthetic ester as compared to mineral oil. When in doubt, contact the transformer or fluid 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 margins 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 philosophy underlying this standard is to furnish 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 and/or controlled waste. If spills occur, the user shall refer to the regulations applicable to their specific location and requirements set by their local authorities.

This International Standard, 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 will have 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 with the use of synthetic esters at distribution voltages, typically up to 72.5kV. 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 development of this standard, care shall be used when applying the recommended values in particular at voltages at or above 72.5kV.

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 shall be handled in compliance with local regulations and supplier's safety datasheets.

This document is applicable to synthetic esters, chemicals and used sample containers. The disposal of these items should be carried out according to local regulations regarding their impact on the environment.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SYNTHETIC ESTERS – GUIDELINES FOR MAINTENANCE AND USE IN ELECTRICAL EQUIPMENT

1 Scope

This document provides procedures and supervision that are required for the use and maintenance of synthetic ester liquid 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 to evaluate the condition of the synthetic ester and maintain it in a serviceable condition. It also provides a common basis for the preparation of more specific and complete local codes of practice.

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

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

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

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

IEC 60475, *Method of sampling liquid dielectrics*

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

IEC 60599, *Mineral oil-filled electrical equipment in service - Guidance on the interpretation of dissolved and free gases analysis*

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 61125:1992, *Unused hydrocarbon based insulating liquids – Test methods for evaluating the oxidation stability*

IEC 61619, *Insulating liquids – Contamination by polychlorinated biphenyls (PCBs) – Method of determination by capillary column gas chromatography*

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

- 81 IEC 62961 - *Insulating liquids – Test methods for the determination of interfacial tension of insulating*
82 *liquids - Determination with the ring method*
- 83 ISO 2049, *Petroleum products – Determination of colour (ASTM scale)*
- 84 ISO 2592, *Petroleum products - Determination of flash and fire points - Cleveland open cup method*
- 85 ISO 3016, *Petroleum products – Determination of pour point*
- 86 ISO 3104, *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity*
87 *and calculation of dynamic viscosity*
- 88 ISO 3675, *Crude petroleum and liquid petroleum products -- Laboratory determination of density*
89 *-- Hydrometer method*
- 90 ISO 4406, *Hydraulic fluid power – Fluids – Method for coding the level of contamination by solid particles*
- 91 ISO 12185, *Crude Petroleum and Petroleum Products - Determination of Density - Oscillating U-Tube*
92 *Method*
- 93 ASTM D1544, *Standard Test Method for Colour of Transparent Liquids (Gardner Color Scale)*
- 94 ASTM D3455, *Standard Test Methods for Compatibility of Construction Material with Electrical Insulating*
95 *Oil of Petroleum Origin*
- 96 ASTM D6922, *Standard Test Method for Determination of Homogeneity and Miscibility in Automotive*
97 *Engine Oils*
- 98 ASTM D7042, *Standard Test Method for Dynamic Viscosity and Density of Liquids by Stabinger*
99 *Viscometer (and the Calculation of Kinematic Viscosity)*
- 100 ASTM D7155, *Standard Practice for Evaluating Compatibility of Mixtures of Turbine Lubricating Oils.*
- 101 ASTM D7647, *Standard Test Method for Automatic Particle Counting of Lubricating and Hydraulic Fluids*
102 *Using Dilution Techniques to Eliminate the Contribution of Water and Interfering Soft Particles by Light*
103 *Extinction*
- 104 ASTM D7752, *Standard Practice for Evaluating Compatibility of Mixtures of Hydraulic Fluids*
- 105 IEEE C57.637, *Guide for the Reclamation of Mineral Insulating Oil and Criteria for Its Use.*

106 3 Terms and definitions

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

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

- 109 - IEC Electropedia: available at <http://www.electropedia.org/>
 - 110 - ISO Online browsing platform: available at <http://www.iso.org.obp>
- 111

112 Note 1 to entry: ASTM and IEEE terminology are available on:

- 113 - ASTM D2864: Standard Terminology Relating to Electrical Insulating Liquids and Gases
 - 114 - IEEE C57.12.80 Standard Terminology for Power and Distribution Transformers
- 115

116 3.1 local regulations

117 Regulations pertinent to the particular process in the country concerned

118 Note 1 to Entry: These regulations may be defined by local, regional, or national legislation or even by the owner or
119 operator of the equipment itself. They are always to be considered as the most stringent of any combination thereof. It
120 is the responsibility of each user of this standard to familiarize themselves with the regulations applicable to their
121 situation. These regulations refer to operational, environmental or health and safety issues. A detailed risk
122 assessment will usually be required.

3.2 routine tests (Group 1)

Minimum tests required to monitor the liquid and to ensure that it is suitable for continued service

Note 1 to Entry: If the results obtained from these tests do not exceed recommended action limits usually no further tests are considered necessary until the next regular period for inspection but, under certain perceived conditions, complementary tests may be deemed prudent.

3.3 complementary tests (Group 2)

Additional tests, which may be performed to obtain further specific information about the quality of the synthetic ester, and may be performed to assist in the evaluation of the synthetic ester for continued use in service

3.4 special investigative tests (Group 3)

Tests performed mainly to determine the suitability of the synthetic ester for the type of equipment in use and to ensure compliance with environmental and operational considerations

4 Categories of equipment

In order to take into account, the different user requirements, equipment has been placed in various categories as shown in Table 1 below.

Table 1 - Categories of equipment

Category	Transformers and Reactors
Category A	Power transformers / reactors with a nominal system voltage above 170 kV and below 400 kV. Also, power transformers of any rated voltage where continuity of supply is vital and similar equipment for special applications operating under onerous conditions.
Category B	Power transformers / reactors with a nominal system voltage above 72,5 kV and up to and including 170 kV (other than those in Category A).
Category C	Power transformers / reactors for MV/LV application e.g. nominal system voltages up to and including 72,5 kV (distribution transformers) and traction transformers (other than those in Category A).
Instrument Protection Transformers	
Category D	Instrument / protection transformers with a nominal system voltage above 170 kV.
Category E	Instrument / protection transformers with a nominal system voltage up to and including 170 kV.
Tap-changers	
Category F	Diverter tanks of On-Load Tap-Changers (OLTC), including combined selector/diverter tanks.
NOTE 1 Separated selector tanks of on-load tap-changers belong to the same category as the associated transformer. NOTE 2 Regardless of size or voltage, a risk assessment may justify condition-monitoring techniques usually appropriate to a higher classification. NOTE 3 For practical and economic reasons, some electrical utilities may decide that their small transformers up to 1 MVA and 36 kV are not included in this classification. Routine monitoring programmes may not be considered economical for this type of equipment. Where a monitoring programme is required for these transformers, the guidelines given for category C should be adequate. NOTE 4 Due to the very limited number of actual applications, recommended limits are not yet available for Categories D and E. Therefore, these categories are here reported only for IEC 60422 consistency and possibly limits will be added at the next revision if feedback will exist. NOTE 5 Regarding Category F, limit values are specified for breakdown voltage (BDV) and water content. For all other parameters, the values have been adopted from the category as the associated transformer.	