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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Insulating liquids – Specifications for unused synthetic organic esters for electrical purposes

Liquides isolants – Spécifications relatives aux esters organiques de synthèse neufs destinés aux matériels électriques

IEC 61099:2010

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

INSULATING LIQUIDS – SPECIFICATIONS FOR UNUSED SYNTHETIC ORGANIC ESTERS FOR ELECTRICAL PURPOSES

FOREWORD

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International Standard IEC 61099 has been prepared IEC technical committee 10: Fluids for electrotechnical applications.

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

The main changes with respect to the previous edition relate to the aim of giving a more updated specification of synthetic organic esters when used as insulating liquids.

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The text of this standard is based on the following documents:

FDIS	Report on voting
10/813/FDIS	10/821/RVD

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

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- withdrawn,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.

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INTRODUCTION

Health and safety

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

Unused synthetic esters which are the subject of this standard should be handled with due care with regard to personal hygiene. Direct contact with eyes may cause slight irritation. In the case of eye contact, irrigation with copious quantities of clean running water should be carried out and medical attention sought.

Some of the tests specified in this standard involve the use of processes that could lead to a hazardous situation. Attention is drawn to the relevant standard for guidance.

Environment

The disposal of synthetic esters, chemicals and sample containers mentioned in this standard should be carried out in accordance with local regulations with regard to their environmental impact. Precautions should be taken to prevent the release of synthetic esters into the environment.

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INSULATING LIQUIDS – SPECIFICATIONS FOR UNUSED SYNTHETIC ORGANIC ESTERS FOR ELECTRICAL PURPOSES

1 Scope

This International Standard covers the specification and test methods for unused synthetic organic esters.

It applies to synthetic organic esters, delivered to the agreed point and time of delivery intended, for use in transformers, switchgear and similar related equipment in which synthetic organic esters are required as an insulant and for heat transfer. These unused synthetic organic esters are obtained by chemical processing and physical treatments of fatty acids and polyols.

NOTE Maintenance of synthetic organic esters in equipment is covered in a separate standard (IEC 61203).

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 δ) and d.c. resistivity*

IEC 60475, *Method of sampling liquid dielectrics*

IEC 60628:1985, *Gassing of insulating liquids under electrical stress and ionization*

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

IEC 61039, *Classification of insulating liquids*

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

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

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

IEC 62021-2, *Insulating liquids – Determination of acidity – Part 2: Colourimetric titration*

ISO 2211, *Liquid chemical products – Measurement of colour in Hazen units (platinum-cobalt scale)*

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ISO 2592, *Determination of flash and fire-points – Cleveland open cup method*

ISO 2719, *Determination of flash-point – Pensky Martens closed cup method*

ISO 3016, *Petroleum products – Determination of pour-point*

ISO 3104, *Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity*

ISO 3675, *Crude petroleum and liquid petroleum products – Laboratory determination of density – Hydrometer method*

ISO 12185, *Crude petroleum and petroleum products – Determination of density – Oscillating U-tube method*

OECD 301:1992, *OECD guideline for testing of chemicals – Ready biodegradability*

3 Terms and definitions

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

3.1
unused synthetic organic esters
liquid based on synthetic organic esters as delivered by the supplier

3.2
additive
suitable chemical substance/s which is/are deliberately added to a synthetic organic ester in order to improve certain characteristics, e.g. pour point, viscosity, foaming, oxidation stability

NOTE If additives are used, these should be mentioned by the supplier to the user, if requested. This may involve issues of confidentiality in an agreement. Additives, if used, need to comply with local regulations.

4 General remarks

The unused synthetic organic esters to which this standard applies are liquids which contain only carbon, hydrogen and oxygen. They are prepared from mono- or polyhydric alcohols and mono- or polybasic aliphatic or aromatic acids. Commercial products may be based on single esters or a mixture of esters and may contain oxidation inhibitors and other additives.

Unused synthetic organic esters selected for use in transformers have high flash and fire points and are therefore relatively difficult to ignite. They may, however, have slightly higher viscosities than mineral insulating oils.

Unused synthetic organic esters are more hygroscopic than mineral oils and this aspect will need to be considered in their use and maintenance.

NOTE Such a liquid, by definition, has not been used in, nor been in contact with, electrical equipment or other equipment not required for manufacture, storage or transport. The manufacturers and suppliers of unused synthetic organic esters will have taken all reasonable precautions to ensure that the liquid is not contaminated with polychlorinated biphenyls or terphenyls (PCB, PCT); used, reclaimed or dechlorinated oils; or other contaminants.

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5 Health, safety and environment (HSE) properties (liquid properties related to safe handling and environment protection)

5.1 Flash point and fire point

The safe operation of electrical equipment requires an adequately high fire point that is measured in accordance with ISO 2592 (Cleveland open cup). Flash point is measured with ISO 2719 (Pensky-Martens closed cup procedure).

5.2 Biodegradation

Unused synthetic organic esters as supplied in electrical applications are of interest because of their higher fire points and better environmental compatibility, relative to petroleum derived insulating mineral oil. Specific tests need to be undertaken to demonstrate biodegradability of these liquids. Tests include OECD 301 / OPPTS 835.3110 (US EPA). The biodegradability of unused synthetic ester fluids can be classified using OECD 301 according to the IEC 61039.

5.3 Toxicity

Unused synthetic organic esters are considered non-toxic and suppliers shall supply assays that define the product as non-toxic.

NOTE Toxicity of unused synthetic organic ester can be assessed with test methods such as modified Ames assay or other suitable internationally recognized assays.

6 Classification, identification, general delivery requirements, sampling, packaging and disposal

6.1 Classification

For the purpose of this standard, unused synthetic ester insulating liquids are classified into a single class: less flammable synthetic organic ester liquids.

6.2 Identification and general delivery requirements, sampling, packaging and disposal

Requirements shall be as follows:

a) Unused synthetic organic esters are normally delivered in bulk, in rail tank cars, tank containers or packed in drums or intermediate bulk containers. These shall be clean and suitable for this purpose to avoid any contamination.

b) Liquid drums and sample containers shall carry at least the following markings:
   - supplier's designation;
   - classification;
   - liquid net weight.

c) Unused synthetic organic ester delivery shall be accompanied by a document from the supplier specifying at least: supplier's designation, liquid classification and quality certificate. At the purchaser's request, the supplier shall indicate the presence of any additive.

6.3 Storage

Storage should preferably be indoors and in suitable closed containers to prevent ingress of contamination. In the event of accidental contamination by water and/or solid particles during storage, the liquid can normally be restored to an acceptable quality by vacuum treatment followed by filtration or by using solid drying agents such as molecular sieves, followed by filtration.

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