

**Insulating liquids - Specifications for unused  
synthetic organic esters for electrical purposes**

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

Käesolev Eesti standard EVS-EN 61099:2010 sisaldab Euroopa standardi EN 61099:2010 ingliskeelset teksti.

Standard on kinnitatud Eesti Standardikeskuse 31.12.2010 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas.

Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 12.11.2010.

Standard on kättesaadav Eesti standardiorganisatsioonist.

This Estonian standard EVS-EN 61099:2010 consists of the English text of the European standard EN 61099:2010.

This standard is ratified with the order of Estonian Centre for Standardisation dated 31.12.2010 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation.

Date of Availability of the European standard text 12.11.2010.

The standard is available from Estonian standardisation organisation.

ICS 29.040

### Standardite reprodutseerimis- ja levitamisoigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonilisse süsteemi või edastamine ükskõik millises vormis või millisel teel on keelatud ilma Eesti Standardikeskuse poolt antud kirjaliku loata.

Kui Teil on küsimusi standardite autorikaitse kohta, palun võtke ühendust Eesti Standardikeskusega:  
Aru 10 Tallinn 10317 Eesti; [www.evs.ee](http://www.evs.ee); Telefon: 605 5050; E-post: [info@evs.ee](mailto:info@evs.ee)

English version

**Insulating liquids -  
Specifications for unused synthetic organic esters for electrical purposes  
(IEC 61099:2010)**

Liquides isolants -  
Spécifications relatives aux esters  
organiques de synthèse neufs destinés  
aux matériels électriques  
(CEI 61099:2010)

Isolierflüssigkeiten -  
Anforderungen an neue synthetische  
organische Ester für elektrotechnische  
Zwecke  
(IEC 61099:2010)

This European Standard was approved by CENELEC on 2010-11-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

**CENELEC**

European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**Management Centre: Avenue Marnix 17, B - 1000 Brussels**

## Foreword

The text of document 10/813/FDIS, future edition 2 of IEC 61099, prepared by IEC TC 10, Fluids for electrotechnical applications, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61099 on 2010-11-01.

This European Standard supersedes EN 61099:1992.

The main changes with respect to EN 61099:1992 relate to the aim of giving a more updated specification of synthetic organic esters when used as insulating liquids.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

- |  |       |            |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2011-08-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn   | (dow) | 2013-11-01 |

Annex ZA has been added by CENELEC.

---

## Endorsement notice

The text of the International Standard IEC 61099:2010 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61203	NOTE Harmonized as EN 61203.
-----------	------------------------------

---

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60156	-	Insulating liquids - Determination of the breakdown voltage at power frequency - Test method	EN 60156	-
IEC 60247	-	Insulating liquids - Measurement of relative permittivity, dielectric dissipation factor (tan $\delta$ ) and d.c. resistivity	EN 60247	-
IEC 60475	-	Method of sampling liquid dielectrics	-	-
IEC 60628	1985	Gassing of insulating liquids under electrical stress and ionization	HD 488 S1	1987
IEC 60814	-	Insulating liquids - Oil-impregnated paper and pressboard - Determination of water by automatic coulometric Karl Fischer titration	EN 60814	-
IEC 61039	-	Classification of insulating liquids	EN 61039	-
IEC 61125	1992	Unused hydrocarbon-based insulating liquids - Test methods for evaluating the oxidation stability	EN 61125	1993
IEC 61620	-	Insulating liquids - Determination of the dielectric dissipation factor by measurement of the conductance and capacitance - Test method	EN 61620	-
IEC 62021-1	-	Insulating liquids - Determination of acidity - Part 1: Automatic potentiometric titration	EN 62021-1	-
IEC 62021-2	-	Insulating liquids - Determination of acidity - Part 2: Colourimetric titration	EN 62021-2	-
ISO 2211	-	Liquid chemical products - Measurement of colour in Hazen units (platinum-cobalt scale)	-	-
ISO 2592	-	Determination of flash and fire points - Cleveland open cup method	EN ISO 2592	-
ISO 2719	-	Determination of flash point - Pensky-Martens closed cup method	EN ISO 2719	-
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	EN ISO 3104	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO 3675	-	Crude petroleum and liquid petroleum products - Laboratory determination of density - Hydrometer method	EN ISO 3675	-
ISO 12185	-	Crude petroleum and petroleum products - Determination of density - Oscillating U-tube method	EN ISO 12185	-
OECD 301	1992	OECD guidelines for the testing of chemicals - Ready Biodegradability	-	-

## CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references .....	6
3 Terms and definitions .....	7
4 General remarks.....	7
5 Health, safety and environment (HSE) properties (liquid properties related to safe handling and environment protection).....	8
5.1 Flash point and fire point.....	8
5.2 Biodegradation.....	8
5.3 Toxicity .....	8
6 Classification, identification, general delivery requirements, sampling, packaging and disposal.....	8
6.1 Classification.....	8
6.2 Identification and general delivery requirements, sampling, packaging and disposal.....	8
6.3 Storage .....	8
6.4 Representative sampling .....	9
6.5 Disposal and spillages.....	9
7 Properties of synthetic organic esters.....	9
7.1 Physical properties, significance and test methods.....	9
7.1.1 Colour .....	9
7.1.2 Appearance .....	9
7.1.3 Density.....	9
7.1.4 Kinematic viscosity.....	9
7.1.5 Flash point and fire point.....	9
7.1.6 Pour point.....	9
7.1.7 Crystallization.....	9
7.1.8 Water content.....	9
7.1.9 Acidity .....	9
7.1.10 Oxidation stability .....	10
8 Electrical properties.....	10
8.1 Breakdown voltage.....	10
8.2 Dielectric dissipation factor, permittivity and d.c. resistivity.....	10
8.3 Gassing tendency.....	10
9 Specifications for synthetic organic esters used in transformers .....	10
Annex A (informative) Determination of crystallization .....	12
Annex B (informative) Specifications for synthetic organic esters used in capacitors.....	13
Bibliography.....	14

## 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.



# 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 ( $\tan \delta$ ) 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)*

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.