

Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear

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NATIONAL FOREWORD

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Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
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**Fluids for electrotechnical applications -
Unused mineral insulating oils for transformers and switchgear
(IEC 60296:2012)**

Fluides pour applications
électrotechniques -
Huiles minérales isolantes neuves pour
transformateurs et appareillages de
connexion
(CEI 60296:2012)

Flüssigkeiten für elektrotechnische
Anwendungen -
Neue Isolieröle auf Mineralölbasis für
Transformatoren und Schaltgeräte
(IEC 60296:2012)

This European Standard was approved by CENELEC on 2012-03-26. 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.

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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 10/878/FDIS, future edition 4 of IEC 60296, prepared by IEC/TC 10 "Fluids for electrotechnical applications" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60296:2012.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2012-12-26
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-03-26

This document supersedes EN 60296:2004 + corrigendum September 2004.

EN 60296:2012 includes the following significant technical changes with respect to EN 60296:2004:

- specifications for corrosive sulphur compounds that can lead to copper sulphide deposition in transformers (in non-passivated and passivated oils);
- definitions of additives in oil; and
- re-insertion of a missing note on oxidation.

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

Endorsement notice

The text of the International Standard IEC 60296:2012 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 60867 NOTE Harmonized as EN 60867.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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>
-	-	Surface active agents - Determination of interfacial tension of solutions of surface active agents by the stirrup or ring method	EN 14210	-
IEC 60076-2	-	Power transformers - Part 2: Temperature rise for liquid-immersed transformers	EN 60076-2	-
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 δ) and d.c. resistivity	EN 60247	-
IEC 60422	-	Mineral insulating oils in electrical equipment - Supervision and maintenance guidance	EN 60422	-
IEC 60475	-	Method of sampling insulating liquids	EN 60475	-
IEC 60628	1985	Gassing of insulating liquids under electrical stress and ionization	HD 488 S1	1987
IEC 60666	-	Detection and determination of specified additives in mineral insulating oils	EN 60666	-
IEC 60814	-	Insulating liquids - Oil-impregnated paper and pressboard - Determination of water by automatic coulometric Karl Fischer titration	EN 60814	-
IEC 60970	-	Insulating liquids - Methods for counting and sizing particles	EN 60970	-
IEC 61125 + corr. September + A1	1992 1992 2004	Unused hydrocarbon-based insulating liquids - Test methods for evaluating the oxidation stability	EN 61125 + A1	1993 2004
IEC 61198	-	Mineral insulating oils - Methods for the determination of 2-furfural and related compounds	EN 61198	-
IEC 61619	-	Insulating liquids - Contamination by polychlorinated biphenyls (PCBs) - Method of determination by capillary column gas chromatography	EN 61619	-
IEC 61620	-	Insulating liquids - Determination of the dielectric dissipation factor by measurement of the conductance and capacitance - Test method	EN 61620	-
IEC 61868	-	Mineral insulating oils - Determination of kinematic viscosity at very low temperatures	EN 61868	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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	-
IEC 62535	2008	Insulating liquids - Test method for detection of potentially corrosive sulphur in used and unused insulating oil	EN 62535	2009
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	-
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	-
ISO 14596	-	Petroleum products - Determination of sulfur content - Wavelength-dispersive X-ray fluorescence spectrometry	EN ISO 14596	-
ASTM D971	-	Standard test method for interfacial tension of oil against water by the ring method	-	-
ASTM D7150	-	Standard test method for the determination of gassing characteristics of insulating liquids under thermal stress at low temperature	-	-
DIN 51353	-	Testing of insulating oils; detection of corrosive sulfur; silver strip test	-	-
IP 346	-	Determination of polycyclic aromatics in lubricant base oils and asphaltene free petroleum fractions - Dimethylsulfoxide refractive method	-	-
IP 373	-	Determination of the sulphur content of light and middle distillates - Oxidative microcoulometry	-	-

Annex ZB (normative)

Special national conditions

Special national condition: National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions.

NOTE If it affects harmonization, it forms part of the European Standard / Harmonization Document.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

<u>Clause</u>	<u>Special national condition</u>
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7.1	Austria
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The restricted limits of Chapter 7.1 "Higher oxidation stability and low sulphur content" are to be followed as general specification for oxidation stability (See Table 2).

Because of exposed geographical location and cold weather conditions (snow) transformers are not always accessible for service, which sometimes leads to unforeseen longer service intervals and therefore higher oxidation stability of transformer oil is required.

For the same reason and to have an additional criterion for evaluation of oil quality, Interfacial Tension (IFT) is to be used as a general requirement (Table 2, Footnote f)"

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INTRODUCTION

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.

The mineral insulating oils which are the subject of this standard should be handled with due regard to personal hygiene. Direct contact with the eyes may cause irritation. In the case of eye contact, irrigation with copious quantities of clean running water should be carried out and medical advice 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.

This standard is applicable to mineral insulating oils, chemicals and used sample containers. The disposal of these items should be carried out according to local regulations with regard to their impact on the environment. Every precaution should be taken to prevent release of mineral insulating oil into the environment.

FLUIDS FOR ELECTROTECHNICAL APPLICATIONS – UNUSED MINERAL INSULATING OILS FOR TRANSFORMERS AND SWITCHGEAR

1 Scope

This International Standard is applicable to specifications and test methods for unused mineral insulating oils (see Clause 3 for definitions). It applies to oil delivered to the agreed point and time of delivery, intended for use in transformers, switchgear and similar electrical equipment in which oil is required for insulation and heat transfer. These oils are obtained by refining, modifying and/or blending of petroleum products and other hydrocarbons.

Oils with and without additives are both within the scope of this standard.

This standard is applicable only to unused mineral insulating oils.

Recycled oils are beyond the scope of this standard.

NOTE Definitions and specifications for recycled oils will be covered by IEC 62701¹.

This standard does not apply to mineral insulating oils used as impregnants in cables or capacitors.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60076-2, *Power transformers – Part 2: Temperature rise for liquid-immersed transformers*

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

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*

¹ In preparation.

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*
Amendment 1 (2004)

IEC 61198, *Mineral insulating oils – Methods for the determination of 2-furfural and related compounds*

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

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

IEC 61868, *Mineral insulating oils – Determination of kinematic viscosity at very low temperatures*

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*

IEC 62535:2008, *Insulating liquids – Test method for detection of potentially corrosive sulphur in used and unused insulating oils*

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*

ISO 14596, *Petroleum products – Determination of sulfur content – Wavelength-dispersive X-ray fluorescence spectrometry*

ASTM D971, *Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method*

ASTM D7150, *Standard Test Method for the Determination of Gassing Characteristics of Insulating Liquids Under Thermal Stress at Low temperature*

DIN 51353, *Testing of insulating oils; detection of corrosive sulfur; Silver strip test*

EN 14210, *Surface active agents – Determination of interfacial tension of solutions of surface active agents by the stirrup or ring method*

IP 346, *Determination of polycyclic aromatics in lubricant base oils and asphaltene free petroleum fractions – Dimethylsulfoxide refractive method*

IP 373, *Determination of the sulphur content of light and middle distillates – Oxidative microcoulometry*

3 Terms and definitions

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

3.1

transformer oil

mineral insulating oil for transformers and similar electrical equipment

3.2

low temperature switchgear oil

mineral insulating oil for oil-filled switchgear for outdoor application in very cold climatic conditions

3.3

mineral insulating oil

insulating oil obtained by refining, modifying and/or blending of petroleum products and other hydrocarbons

Note 1 to entry This does not include insulating liquids such as esters, synthetic aromatics or silicone fluids.

3.4

additive

chemical substance that is added to mineral insulating oil in order to improve certain characteristics

Note 1 to entry Examples include antioxidants, metal passivators, metal deactivators, electrostatic charging tendency depressants, gas absorbers, pour point depressants, anti-foam agents and refining process improvers.

3.5

antioxidant additive

additive incorporated in mineral insulating oil that improves oxidation stability

Note 1 to entry A large number of additives which improve oxidation stability, including inhibitors, peroxide decomposers, metal passivators and metal deactivators, are available and may be used in oils if declared (see 6.11.1 and 6.11.2).

3.5.1

inhibitor

antioxidant additives of the phenolic-or amine- type, such as DBPC and DBP described in IEC 60666

Note 1 to entry DBPC = 2,6-di-tert-butyl-para-cresol; DBP = 2,6-di-tert-butyl-phenol.

3.5.2

other antioxidant additive

antioxidant additive of the sulphur- or phosphorous- type

3.5.3

passivator

metal passivator additive used primarily as electrostatic charging depressant, but which may also improve oxidation stability

Note 1 to entry Metal passivators are sometimes described as metal deactivators or corrosion inhibitors.

3.6

uninhibited oil

mineral insulating oil containing no inhibitor