Irish Standard
I.S. EN 60296:2012

Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear (IEC 60296:2012 (EQV))

I.S. EN 60296:2012

Incorporating amendments/corrigenda issued since publication:

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I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

S.R. xxx: Standard Recommendation - recommendation based on the consensus of an expert panel and subject to public consultation.

SWiFT xxx: A rapidly developed recommendatory document based on the consensus of the participants of an NSAI workshop.

This document replaces:	*This document is based on:*	*Published:*
EN 60296:2004 + corr Sept 2004	EN 60296:2012	20 April, 2012

This document was published under the authority of the NSAI and comes into effect on: 27 April, 2012	ICS number: 29.040

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60296

April 2012

ICS 29.040

Supersedes EN 60296:2004 + corr. Sep.2004

English version

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.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre 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, Turkey 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

Ref. No. EN 60296:2012 E

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.

Publication	Year	Title	EN/HD	Year
-	-	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 d) 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	-

Publication	Year	Title	EN/HD	Year
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 - Hydrometermethod	EN ISO 3675	-
ISO 12185	-	Crude petrolelum 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.

Clause	Special national condition
7.1	**Austria** 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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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60296 has been prepared by IEC technical committee 10: Fluids for electrotechnical applications.

This fourth edition cancels and replaces the third edition, published in 2003. This edition constitutes a technical revision.

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

– 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.

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

FDIS	Report on voting
10/878/FDIS	10/885/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.

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 62701[1].

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 δ) 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*

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1 In preparation.