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**Tekočine za elektrotehniko – Nerabljena mineralna izolacijska olja za transformatorje in omrežne stikalne naprave (IEC 60296:2003)**

Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear (IEC 60296:2003)

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EUROPEAN STANDARD

**EN 60296**

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2004

ICS 29.180; 29.040.10; 29.130

Incorporates Corrigendum September 2004

English version

**Fluids for electrotechnical applications –  
Unused mineral insulating oils for transformers and switchgear  
(IEC 60296:2003)**

Fluides pour applications  
électrotechniques –  
Huiles minérales isolantes neuves  
pour transformateurs et appareillages  
de connexion  
(CEI 60296:2003)

Flüssigkeiten für elektrotechnische  
Anwendungen –  
Neue Isolieröle für Transformatoren  
und Schaltgeräte  
(IEC 60296:2003)

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SIST EN 60296:2005

This European Standard was approved by CENELEC on 2004-03-16. 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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

**CENELEC**

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

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of document 10/566/FDIS, future edition 3 of IEC 60296, prepared by IEC TC 10, Fluids for electrotechnical applications, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60296 on 2004-03-16.

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) 2005-01-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2007-04-01

Annexes ZA and ZB have been added by CENELEC.

The contents of the corrigendum of September 2004 have been included in this copy.

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## Endorsement notice

The text of the International Standard IEC 60296:2003 was approved by CENELEC as a European Standard without any modification.

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## 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 Where 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 60076-2 (mod)	- <sup>1)</sup>	Power transformers Part 2: Temperature rise	EN 60076-2	1997 <sup>2)</sup>
IEC 60156	- <sup>1)</sup>	Insulating liquids - Determination of the breakdown voltage at power frequency - Test method	EN 60156	1995 <sup>2)</sup>
IEC 60247	- <sup>1)</sup>	Measurement of relative permittivity, dielectric dissipation factor and d.c. resistivity of insulating liquids	-	-
IEC 60422	- <sup>1)</sup>	Supervision and maintenance guide for mineral insulation oils in electrical equipment	-	-
IEC 60475	- <sup>1)</sup>	Method of sampling liquid dielectrics	-	-
IEC 60628	- <sup>1)</sup>	Gassing of insulating liquids under electrical stress and ionization	HD 488 S1	1987 <sup>2)</sup>
IEC 60666	- <sup>1)</sup>	Detection and determination of specified anti-oxidant additives in insulating oils	HD 415 S1	1981 <sup>2)</sup>
IEC 60814	- <sup>1)</sup>	Insulating liquids - Oil-impregnated paper and pressboard - Determination of water by automatic coulometric Karl Fischer titration	EN 60814	1997 <sup>2)</sup>
IEC 61125	- <sup>1)</sup>	Unused hydrocarbon-based insulating liquids - Test methods for evaluating the oxidation stability	EN 61125	1993 <sup>2)</sup>
IEC 61198	- <sup>1)</sup>	Mineral insulating oils - Methods for the determination of 2-furfural and related compounds	EN 61198	1994 <sup>2)</sup>

1) Undated reference.

2) Valid edition at date of issue.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61619	- <sup>1)</sup>	Insulating liquids - Contamination by polychlorinated biphenyls (PCBs) - Method of determination by capillary column gas chromatography	EN 61619	1997 <sup>2)</sup>
IEC 61620	- <sup>1)</sup>	Insulating liquids - Determination of the dielectric dissipation factor by measurement of the conductance and capacitance - Test method	EN 61620	1999 <sup>2)</sup>
IEC 61868	- <sup>1)</sup>	Mineral insulating oils - Determination of kinematic viscosity at very low temperatures	EN 61868	1999 <sup>2)</sup>
IEC 62021-1	- <sup>1)</sup>	Insulating liquids - Determination of acidity Part 1: Automatic potentiometric titration	EN 62021-1	2003 <sup>2)</sup>
ISO 2719	- <sup>1)</sup>	Petroleum products and lubricants - Determination of Flash Point Pensky-Martens closed cup method	EN ISO 2719	2002 <sup>2)</sup>
ISO 3016	- <sup>1)</sup>	Petroleum Oils - Determination of pour point	-	-
ISO 3104	- <sup>1)</sup>	Petroleum products - Transparent and opaque liquids - Determination of kinematic viscosity and calculation of dynamic viscosity	EN ISO 3104	1996 <sup>2)</sup>
ISO 3675	- <sup>1)</sup>	Crude petroleum and liquid petroleum products - Laboratory determination of density - Hydrometer method	EN ISO 3675	1998 <sup>2)</sup>
ISO 6295	- <sup>1)</sup>	Petroleum products - Mineral oils - Determination of interfacial tension of oil against water - Ring method	-	-
ISO 12185	- <sup>1)</sup>	Crude petroleum and petroleum products - Determination of density - Oscillating U-tube method	EN ISO 12185	1996 <sup>2)</sup>
ISO 14596	- <sup>1)</sup>	Petroleum products - Determination of sulfur content - Wavelength-dispersive X-ray fluorescence spectrometry	EN ISO 14596	1998 <sup>2)</sup>

## 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.

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

#### **Austria**

7.1      For reasons of exposed geographical location and cold weather conditions (snow) transformers are not always accessible for supervision and maintenance, which could lead to unforeseen longer service intervals. Therefore the restricted limits referred to are to be followed as general specification for oxidation stability (see Table 2, Note 1).

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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# INTERNATIONAL STANDARD

# IEC 60296

Third edition  
2003-11

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**Fluids for electrotechnical applications –  
Unused mineral insulating oils  
for transformers and switchgear**

**iTeh STANDARD PREVIEW**  
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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland  
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: [inmail@iec.ch](mailto:inmail@iec.ch) Web: [www.iec.ch](http://www.iec.ch)



Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

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## 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 third edition cancels and replaces the second edition, published in 1982 and its amendment 1 (1986), and constitutes a technical revision.

Main changes with regard to previous edition include: the three classes of previous edition have been replaced by only two: transformer oil and low temperature switchgear oil, but a new concept, the lowest cold start energizing temperature, has been included; new properties have been added (i.e. charging tendency); values for properties have been revised.