

INTERNATIONAL STANDARD

IEC 60296

Third edition
2003-11

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

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*This **English-language** version is derived from the original **bilingual** publication by leaving out all French-language pages. Missing page numbers correspond to the French-language pages.*



Reference number
IEC 60296:2003(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

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Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

P

For price, see current catalogue

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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.

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

FDIS	Report on voting
10/566/FDIS	10/569/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 2008. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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Withdawn

INTRODUCTION

General caution – Health, safety and environmental protection

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

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Withdrawing

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

1 Scope

This International Standard covers specifications and test methods for unused mineral insulating oils. 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 as an insulant and for heat transfer. These oils are obtained by distillation and refining of crude petroleum.

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

This standard is applicable only to unused mineral insulating oils.

Reclaimed oils are beyond the scope of this standard.

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

NOTE Mineral insulating oils complying with the requirements of this standard, of the same class and containing no additives (see 3.4), are considered to be compatible with one another and can be mixed in any proportion. This does not apply to oils containing additives. Where the user wishes to mix such oils, a check is recommended to be made to ensure that the mixture meets the requirements of this standard.

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 60076-2, *Power transformers – Part 2: Temperature rise*

IEC 60156, *Insulating liquids – Determination of the breakdown voltage at power frequency – Test method*

IEC 60247, *Measurement of relative permittivity, dielectric dissipation factor and d.c. resistivity of insulating liquids*

IEC 60422, *Supervision and maintenance guide for mineral insulating oils in electrical equipment*

IEC 60475, *Method of sampling liquid dielectrics*

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

IEC 60666, *Detection and determination of specified anti-oxidant additives in insulating oils*

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

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

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*

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 6295, *Petroleum products – Mineral oils – Determination of interfacial tension of oil against water – Ring 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*

3 Terms and definitions

For the purposes of this document, the following definitions apply:

3.1

transformer oil

mineral insulating oil for transformers and similar electrical equipment where normal oxidation resistance is required

3.2

low temperature switchgear oil

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

3.3**additive**

suitable chemical substance which is deliberately added to a mineral insulating oil in order to improve certain characteristics

NOTE Examples include antioxidants, pour point depressants, electrostatic charging tendency depressants such as benzotriazole (BTA), anti-foam agents, refining process improvers, etc.

3.4**antioxidant additive**

additive incorporated in an insulating oil to improve oxidation stability

NOTE A large number of antioxidant additives are available. For this standard, these are limited to those identified in IEC 60666.

3.5**uninhibited oil**

mineral insulating oil, containing no antioxidant additives, but which may contain other additives

3.6**trace inhibited oil**

mineral insulating oil containing up to 0,08 % antioxidant additive together with other additives as mentioned in 3.4

3.7**inhibited oil**

mineral insulating oil containing a minimum of 0,08 % and a maximum of 0,40 % antioxidant additive together with other additives as mentioned in 3.3

3.8**unused mineral insulating oil**

mineral insulating oil as delivered by the supplier

NOTE Such an oil has not been used in, nor been in contact with electrical equipment or other equipment not required for manufacture, storage or transport. The manufacturer and supplier of unused oil will have taken all reasonable precautions to ensure that there is no contamination with polychlorinated biphenyls or terphenyls (PCB, PCT), used, reclaimed or dechlorinated oil or other contaminants.

3.9**reclaimed oil**

mineral insulating oil used in electrical equipment which has been subjected to chemical and/or physical processing to eliminate soluble and insoluble contaminants

NOTE A blend of unused and reclaimed oil in any proportion is regarded as being reclaimed.

4 Properties of oil

Characteristics are listed in Tables 1 and 2 and in Clause 7.

4.1 Functional properties

Properties of oil which have impact on its function as an insulating and cooling liquid.

NOTE Functional properties include viscosity, density, pour point, water content, breakdown voltage and dielectric dissipation factor.