SVENSK STANDARD SS-EN IEC 60296

Fastställd	Utgåva	Sida	Ansvarig kommitté
2021-06-16	3	1 (1+44)	SEK TK 10

Isoleroljor –
Specifikation för isolerolja för elektrisk utrustning

Fluids for electrotechnical applications –
Mineral insulating oils for electrical equipment

Som svensk standard gäller europastandarden EN IEC 60296:2020. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 60296:2020.

Nationellt förord

Europastandarden EN IEC 60296:2020

består av:

– **europastandardens ikraftsättningsdokument,** utarbetat inom CENELEC
– **IEC 60296, Fifth edition, 2020 - Fluids for electrotechnical applications - Mineral insulating oils for electrical equipment**

utarbetad inom International Electrotechnical Commission, IEC.

Tidigare fastställd svensk standard SS-EN 60296, utgåva 2, 2012, gäller ej fr o m 2023-07-31.

ICS 29.040.10

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 60296

August 2020

ICS 29.040.10

Supersedes EN 60296:2012 and all of its amendments and corrigenda (if any)

English Version

Fluids for electrotechnical applications - Mineral insulating oils for electrical equipment (IEC 60296:2020)

Fluides pour applications électrotechniques - Huiles minérales isolantes pour matériel électrique (IEC 60296:2020)

Flüssigkeiten für elektrotechnische Anwendungen - Isolieröle auf Mineralölbasis für elektrische Betriebsmittel (IEC 60296:2020)

This European Standard was approved by CENELEC on 2020-07-31. 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. EN IEC 60296:2020 E

SEK Svensk Elstandard

SS-EN IEC 60296, utg 3:2021

European foreword

The text of document 10/1117/FDIS, future edition 5 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 IEC 60296:2020.

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) 2021-05-01
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2023-07-31

This document supersedes EN 60296:2012 and all of its amendments and corrigenda (if any).

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

Endorsement notice

The text of the International Standard IEC 60296:2020 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60076-2	NOTE	Harmonized as EN 60076-2
IEC 60590	NOTE	Harmonized as HD 382 S1
IEC 60867	NOTE	Harmonized as EN 60867
ISO 2592	NOTE	Harmonized as EN ISO 2592

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
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 d) and d.c. resistivity	EN 60247	-
IEC 60422	2013	Mineral insulating oils in electrical equipment - Supervision and maintenance guidance	EN 60422	2013
IEC 60475	-	Method of sampling insulating liquids	EN 60475	-
IEC 60567	2011	Oil-filled electrical equipment - Sampling of gases and analysis of free and dissolved gases - Guidance	EN 60567	2011
IEC 60628	1985	Gassing of insulating liquids under electrical stress and ionization	HD 488 S1	1987
IEC 60666	2010	Detection and determination of specified additives in mineral insulating oils	EN 60666	2010
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	2018	Insulating liquids - Test methods for oxidation stability - Test method for evaluating the oxidation stability of insulating liquids in the delivered state	EN IEC 61125	2018

Publication	Year	Title	EN/HD	Year
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	-
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
IEC 62697-1	-	Test methods for quantitative determination of corrosive sulfur compounds in unused and used insulating liquids - Part 1: Test method for quantitative determination of dibenzyldisulfide (DBDS)	EN 62697-1	-
IEC 62961	-	Insulating liquids - Test methods for the determination of interfacial tension of insulating liquids - Determination with the ring method	EN IEC 62961	-
ISO 2049	-	Petroleum products - Determination of colour (ASTM scale)	-	-
ISO 2719	-	Determination of flash point - Pensky-Martens closed cup method	EN ISO 2719	-
ISO 3016	-	Petroleum and related products from natural or synthetic sources - Determination of pour point	EN ISO 3016	-
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 3819	-	Laboratory glassware - Beakers	EN ISO 3819	-

Publication	Year	Title	EN/HD	Year
ISO 8754	-	Petroleum products - Determination of sulphur content - Energy-dispersive X-ray fluorescence spectrometry	EN ISO 8754	-
ISO 12185	-	Crude petroleum and petroleum products - Determination of density - Oscillating U-tube method	EN ISO 12185	-
ISO 14596	-	Petroleum products - Determination of sulphur content - Wavelength-dispersive X-ray fluorescence spectrometry	EN ISO 14596	-
ASTM D 1500	-	Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)	-	-
ASTM D 6591	-	Standard Test Method for Determination of Aromatic Hydrocarbon Types in Middle Distillates - High Performance Liquid Chromatography Method with Refractive Index Detection	-	-
ASTM D 7042	-	Standard Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)	-	-
ASTM D 7896	-	Standard Test Method for Thermal Conductivity, Thermal Diffusivity and Volumetric Heat Capacity of Engine Coolants and Related Fluids by Transient Hot Wire Liquid Thermal Conductivity Method	-	-
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	-	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FLUIDS FOR ELECTROTECHNICAL APPLICATIONS – MINERAL INSULATING OILS FOR ELECTRICAL EQUIPMENT

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 fifth edition cancels and replaces the fourth edition published in 2012. This edition constitutes a technical revision.

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

– This International Standard is applicable to specifications and test methods for unused and recycled mineral insulating oils in the delivered state.
– Within the transformer insulating oils, two groups, Type A and Type B, are defined, based on their performance.
– A new method for stray gassing under thermo-oxidative stress of mineral insulating oils, which has been tested in a joint round robin test (RRT) between CIGRE D1 and IEC technical committee 10, has been included.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
10/1117/FDIS	10/1118/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document 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 document. At this date, the document will be

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

WARNING – This document does not purport to address all the safety problems associated with its use. It is the responsibility of the user of this document 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 document should be handled in compliance with local regulations and suppliers safety data-sheets.

This document 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.

FLUIDS FOR ELECTROTECHNICAL APPLICATIONS – MINERAL INSULATING OILS FOR ELECTRICAL EQUIPMENT

1 Scope

This document provides specifications and test methods for unused and recycled mineral insulating oils (see Clause 3 for definitions). It applies to mineral oil delivered according to the contractual agreement, intended for use in transformers, switchgear and similar electrical equipment in which oil is required for insulation and heat transfer. Both unused oil and recycled oil under the scope of this document have not been used in, nor been in contact with electrical equipment or other equipment not required for manufacture, storage or transport.

Unused oils are obtained by refining, modifying and/or blending of petroleum products and other hydrocarbons from virgin feedstock.

Recycled oils are produced from oils previously used as mineral insulating oils in electrical equipment that have been subjected to re-refining or reclaiming (regeneration) by processes employed offsite. Such oils will have originally been supplied in compliance with a recognized unused mineral insulating oil specification. This document does not differentiate between the methods used to recycle mineral insulating oil. Oils treated on-site (see IEC 60422) are not within the scope of this document.

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

This document does not apply to mineral insulating oils used as impregnating medium in cables or capacitors.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 δ) and d.c. resistivity*

IEC 60422:2013, *Mineral insulating oils in electrical equipment – Supervision and maintenance guidance*

IEC 60475, *Method of sampling liquid dielectrics*

IEC 60567:2011, *Oil-filled electrical equipment – Sampling of gases and analysis of free and dissolved gases – Guidance*

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

IEC 60666:2010, *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*

IEC 60970*, Insulating liquids – Methods for counting and sizing particles*

IEC 61125:2018, *Insulating liquids – Test methods for oxidation stability – Test method for evaluating the oxidation stability of insulating liquids in the delivered state*

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*

IEC 62697-1, *Test methods for quantitative determination of corrosive sulfur compounds in unused and used insulating liquids – Part 1: Test method for quantitative determination of dibenzyldisulfide (DBDS)*

IEC 62961, *Insulating liquids – Test methods for the determination of interfacial tension of insulating liquids – Determination with the ring method*

ISO 2049, *Petroleum products, Determination of colour (ASTM scale)*

ISO 2719, *Determination of flash point – Pensky-Martens closed cup method*

ISO 3016, *Petroleum and related products from natural or synthetic sources – 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 3819, *Laboratory glassware –Beakers*

ISO 8754, *Petroleum products – Determination of sulphur content – Energy-dispersive X-ray fluorescence spectrometry*

ISO 12185, *Crude petroleum and petroleum products – Determination of density – Oscillating U-tube method*

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

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

ASTM D1500, *Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)*

ASTM D6591, *Standard Test Method for Determination of Aromatic Hydrocarbon Types in Middle Distillates – High Performance Liquid Chromatography Method with Refractive Index Detection*

ASTM D7042, *Standard Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)*

ASTM D7896, *Standard Test Method for Thermal Conductivity, Thermal Diffusivity and Volumetric Heat Capacity of Engine Coolants and Related Fluids by Transient Hot Wire Liquid Thermal Conductivity Method*

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

IP 346, *Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fractions – Dimethyl sulfoxide extraction refractive index method*