Mineral insulating oils in electrical equipment - Supervision and maintenance guidance (IEC 60422:2013)

EESTI STANDARDIKESKUS
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NATIONAL FOREWORD

See Eesti standard EVS-EN 60422:2013 sisaldab Euroopa standardi EN 60422:2013 ingliskeelset teksti.	This Estonian standard EVS-EN 60422:2013 consists of the English text of the European standard EN 60422:2013.
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.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 03.05.2013.	Date of Availability of the European standard is 03.05.2013.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

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Mineral insulating oils in electrical equipment - Supervision and maintenance guidance

(IEC 60422:2013)

Huiles minérales isolantes dans les matériels électriques - Lignes directrices pour la maintenance et la surveillance
(CEI 60422:2013)

Isolieröle auf Mineralölbasis in elektrischen Betriebsmitteln - Leitlinie zur Überwachung und Wartung
(IEC 60422:2013)

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CENELEC

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

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Foreword

The text of document 10/894/FDIS, future edition 4 of IEC 60422, prepared by IEC TC 10 "Fluids for electrotechnical applications" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60422:2013.

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)	2013-11-14
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2016-02-14

This document supersedes EN 60422:2006.

EN 60422:2013 represents a major revision of EN 60422:2006, in order to bring in line this standard with latest development of oil condition monitoring, containing new limits for oil parameters, suggested corrective actions in the tables and new test methods.

The action limits for all oil tests have been revised and changes made where necessary to enable users to use current methodology and comply with requirements and regulations affecting safety and environmental aspects.

In addition, EN 60422:2013 incorporates changes introduced in associated standards since EN 60422:2006 was published.

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 60422:2013 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 60567	NOTE	Harmonised as EN 60567.
IEC 60599	NOTE	Harmonised as EN 60599.
IEC 61198	NOTE	Harmonised as EN 61198.
ISO 12185	NOTE	Harmonised as EN ISO 12185.

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
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 60296	2012	Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear	EN 60296	2012
IEC 60475	-	Method of sampling insulating liquids	EN 60475	-
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 + corr. September	1992 1992	Unused hydrocarbon-based insulating liquids - Test methods for evaluating the oxidation stability	EN 61125	1993
IEC 61619	-	Insulating liquids - Contamination by polychlorinated biphenyls (PCBs) - Method of determination by capillary column gas chromatography	EN 61619	-
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	2012	Test method 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	2012
EN 14210	-	Surface active agents - Determination of interfacial tension of solutions of surface active agents by the stirrup or ring method	-	-

Publication	Year	Title	EN/HD	Year
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 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 4406	1999	Hydraulic fluid power - Fluids - Method for coding the level of contamination by solid particles	-	-
ASTM D971	-	Standard test method for interfacial tension of oil against water by the ring method	-	-
ASTM D1275	2006	Standard test method for corrosive sulfur in electrical insulating oils	-	-
DIN 51353	-	Testing of insulating oils; detection of corrosive sulfur; silver strip test	-	-

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INTRODUCTION

Insulating mineral oils are used in electrical equipment employed in the generation, transmission, distribution and use of electrical energy, so that the amount of oil in service, worldwide, amounts to hundreds of millions of kilograms.

Monitoring and maintaining oil quality is essential to ensure the reliable operation of oil-filled electrical equipment. Codes of practice for this purpose have been established by electrical power authorities, power companies and industries in many countries.

A review of current experience reveals a wide variation of procedures and criteria. It is possible, however, to compare the value and significance of standardized oil tests and to recommend uniform criteria for the evaluation of test data.

If a certain amount of oil deterioration (by degradation or contamination) is exceeded, there is inevitably some erosion of safety margins and the question of the risk of premature failure should be considered. While the quantification of the risk can be very difficult, a first step involves the identification of potential effects of increased deterioration. The philosophy underlying this standard is to furnish users with as broad a base of understanding of oil quality deterioration as is available, so that they can make informed decisions on inspection and maintenance practices.

Unused mineral oils are limited resources and should be handled with this in mind. Used mineral oils are, by most regulations, deemed to be controlled waste. If spills occur this may have a negative environmental impact especially if the oil is contaminated by persistent organic pollutants such as polychlorinated biphenyls (PCBs).

This International Standard, whilst technically sound, is mainly intended to serve as a common basis for the preparation of more specific and complete codes of practice by users in the light of local circumstances. Sound engineering judgement will have to be exerted in seeking the best compromise between technical requirements and economic factors.

Reference should also be made to instructions from the equipment manufacturer.

General caution

This International Standard does not purport to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate health and safety practices and determine the applicability of regulatory limitations prior to use.

The mineral oils and oil additives which are the subject of this standard should be handled with due regard to personal hygiene. Direct contact with the eyes may cause slight irritation. In the case of eye contact, irrigation with copious quantities of clean running water should be carried out and medical advice sought. For more information, refer to the safety data sheet provided by the manufacturer. 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.

Environment

This standard is applicable to mineral oils, chemicals and used sample containers.

Attention is drawn to the fact that, at the time of writing this standard, some mineral oils in service are known to be contaminated to some degree by PCBs.

Because of this, safety countermeasures should be taken to avoid risks to workers, the public and the environment during the life of the equipment, by strictly controlling spills and emissions. Disposal or decontamination of these oils should be carried out strictly according to local regulations. Every precaution should be taken to prevent release of mineral oil into the environment.

MINERAL INSULATING OILS IN ELECTRICAL EQUIPMENT – SUPERVISION AND MAINTENANCE GUIDANCE

1 Scope

This International Standard gives guidance on the supervision and maintenance of the quality of the insulating oil in electrical equipment.

This standard is applicable to mineral insulating oils, originally supplied conforming to IEC 60296, in transformers, switchgear and other electrical apparatus where oil sampling is reasonably practicable and where the normal operating conditions specified in the equipment specifications apply.

This standard is also intended to assist the power equipment operator to evaluate the condition of the oil and maintain it in a serviceable condition. It also provides a common basis for the preparation of more specific and complete local codes of practice.

The standard includes recommendations on tests and evaluation procedures and outlines methods for reconditioning and reclaiming oil and the decontamination of oil contaminated with PCBs.

NOTE The condition monitoring of electrical equipment, for example by analysis of dissolved gases, furanic compounds or other means, is outside the scope of this standard.

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 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 60296:2012, *Fluids for electrotechnical applications – Unused mineral insulating oils for transformers and switchgear*

IEC 60475, *Method of sampling liquid dielectrics*

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 61125:1992, *Unused hydrocarbon based insulating liquids – Test methods for evaluating the oxidation stability*

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

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 62697-1:2012, *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)*

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

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 4406:1999, *Hydraulic fluid power – Fluids – Method for coding the level of contamination by solid particles*

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

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

ASTM D1275:2006, *Standard Test Method for Corrosive Sulfur in Electrical Insulating Oils*

DIN 51353: *Testing of insulating oils; Detection of corrosive sulphur; Silver strip test*

3 Terms and definitions

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

3.1
local regulations
regulations pertinent to the particular process in the country concerned

Note 1 to entry: Such regulations may be defined by local, regional or national legislation or even the owner or operator of the equipment itself. They are always to be considered as the most stringent of any combination thereof. It is the responsibility of each user of this standard to familiarize themselves with the regulations applicable to their situation. Such regulations may refer to operational, environmental or health and safety issues. A detailed risk assessment will usually be required.