SLOVENSKI STANDARD

SIST EN 60567:2006

januar 2006

Z oljem polnjena električna oprema – Vzorčenje plinov in olja ter analiziranje prostih in raztopljenih plinov – Napotek (IEC 60567:2005)

(istoveten EN 60567:2005)

Oil-filled electrical equipment – Sampling of gases and of oil for analysis of free and dissolved gases – Guidance (IEC 60567:2005)

ICS 29.040.10

Referenčna številka
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EUROPEAN STANDARD **EN 60567**

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English version

Oil-filled electrical equipment – Sampling of gases and of oil for analysis of free and dissolved gases – Guidance
(IEC 60567:2005)

Matériels électriques immergés – Echantillonnage de gaz et d'huile pour analyse des gaz libres et dissous – Lignes directrices (CEI 60567:2005)

Ölgefüllte elektrische Betriebsmittel – Probennahme von Gasen und von Öl für die Analyse freier und gelöster Gase – Anleitung (IEC 60567:2005)

This European Standard was approved by CENELEC on 2005-09-01. 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

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Foreword

The text of document 10/621/FDIS, future edition 3 of IEC 60567, prepared by IEC TC 10, Fluids for electrotechnical applications, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60567 on 2005-09-01.

This European Standard supersedes EN 60567:1992.

The main changes with respect to EN 60567:1992 are listed below.

Since the publication of EN 60567:1992, a number of new gas extraction methods have been developed and are commercially available, such as mercury-free versions of the standard Toepler and partial degassing methods, which are referenced to in Annex C of this new edition. The head space method, based on a new concept for the extraction of gases from oil is introduced as a full method, and reference is made to a simplified version of it also in Annex C (shake test method). More sensitive chromatographic techniques have also been developed and are presented in this new edition of the standard.

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)	2006-06-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2008-09-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60567:2005 was approved by CENELEC as a European Standard without any modification.

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.

Publication	Year	Title	EN/HD	Year
IEC 60296	- [1)]	Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear	EN 60296 + corr. September	2004 [2)] 2004
IEC 60599	- [1)]	Mineral oil-impregnated electrical equipment in service - Guide to the interpretation of dissolved and free gases analysis	EN 60599	1999 [2)]
ISO/IEC 17025	- [1)]	General requirements for the competence of testing and calibration laboratories	EN ISO/IEC 17025	2005 [2)]
ISO 5725	Series	Accuracy (trueness and precision) of measurement methods and results	-	-

1) Undated reference.

2) Valid edition at date of issue.

NORME INTERNATIONALE

INTERNATIONAL STANDARD

CEI
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60567

Troisième édition
Third edition
2005-06

Matériels électriques immergés – Echantillonnage de gaz et d'huile pour analyse des gaz libres et dissous – Lignes directrices

Oil-filled electrical equipment – Sampling of gases and of oil for analysis of free and dissolved gases – Guidance

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Международная Электротехническая Комиссия

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For price, see current catalogue

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

OIL-FILLED ELECTRICAL EQUIPMENT – SAMPLING OF GASES AND OF OIL FOR ANALYSIS OF FREE AND DISSOLVED GASES – GUIDANCE

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 60567 has been prepared by IEC technical committee 10: Fluids for electrotechnical applications.

This third edition cancels and replaces the second edition published in 1992. This edition constitutes a technical revision.

The main changes with respect to the previous edition are listed below.

Since the publication of the second edition of this standard, a number of new gas extraction methods have been developed and are commercially available, such as mercury-free versions of the standard Toepler and partial degassing methods, which are referenced to in Annex C of the present edition. The head space method, based on a new concept for the extraction of gases from oil is introduced as a full method in this third edition, and reference is made to a simplified version of it also in Annex C (shake test method). More sensitive chromatographic techniques have also been developed since the last edition, and are presented in this third edition.

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

FDIS	Report on voting
10/621/FDIS	10/630/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 maintenance result 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

Gases may be formed in oil-filled electrical equipment due to natural ageing but also, to a much greater extent, as a result of faults.

Operation with a fault may seriously damage the equipment, and it is valuable to be able to detect the fault at an early stage of development.

Where a fault is not severe, the gases formed will normally dissolve in the oil, with a small proportion eventually diffusing from the liquid into any gas phase above it. Extracting dissolved gas from a sample of the oil and determining the amount and composition of this gas is a means of detecting such faults, and the type and severity of any fault may often be inferred from the composition of the gas and the rate at which it is formed.

In the case of a sufficiently severe fault, free gas will pass through the oil and collect in the gas-collecting (Buchholz) relay if fitted; if necessary, this gas may be analysed to assist in determining the type of fault that has generated it. The composition of gases within the bubbles changes as they move through the oil towards the gas-collecting relay.

This can be put to good use, as information on the rate of gas production may often be inferred by comparing the composition of the free gases collected with the concentrations remaining dissolved in the liquid.

The interpretation of the gas analyses is the subject of IEC 60599.

These techniques are valuable at all stages in the life of oil-filled equipment. During acceptance tests on transformers in the factory, comparison of gas-in-oil analyses before, during and after a heat run test can show if any hot-spots are present, and similarly analysis after dielectric testing can add to information regarding the presence of partial discharges or sparking. During operation in the field, the periodic removal of an oil sample and analysis of the gas content serve to monitor the condition of transformers and other oil-filled equipment.

The importance of these techniques has led to the preparation of this standard to the procedures to be used for the sampling, from oil-filled electrical equipment, of gases and oils containing gases, and for subsequent analysis.

NOTE Methods described in this standard apply to mineral insulating oils, since experience to date bas been almost entirely with such oils. The methods may also be applied to other insulating liquids, in some cases with modifications.

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.

Mercury presents an environmental and health hazard. Any spillage should immediately be removed and be properly disposed of. Consult local regulations for mercury use and handling. Mercury-free methods may be requested in some countries.

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 of this standard, many mineral oils in service are known to be contaminated to some degree by PCBs. As this is the case, safety countermeasures must 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 must be carried out strictly according to local regulations. Every precaution should be taken to prevent release of mineral oil into the environment.

OIL-FILLED ELECTRICAL EQUIPMENT – SAMPLING OF GASES AND OF OIL FOR ANALYSIS OF FREE AND DISSOLVED GASES – GUIDANCE

1 Scope

This International Standard deals with the techniques for sampling free gases from gas-collecting relays and for sampling oil from oil-filled equipment such as power and instrument transformers, reactors, bushings, oil-filled cables and oil-filled tank-type capacitors. Three methods of sampling free gases and three methods of sampling oil are described; the choice between the methods often depends on the apparatus available and on the quantity of oil needed for analysis.

Before analysing the gases dissolved in oil, they must first be extracted from the oil. Three basic methods are described, one using extraction by vacuum (Toepler and partial degassing), another by displacement of the dissolved gases by bubbling the carrier gas through the oil sample (stripping), and the last one by partition of gases between the oil sample and a small volume of the carrier gas (head space). The gases are analysed quantitatively after extraction by gas chromatography; a method of analysis is described. Free gases from gas-collecting relays are analysed without preliminary treatment.

The preferred method for assuring the performance of the gas extraction and analysis equipment, considered together as a single system, is to degas samples of oil prepared in the laboratory and containing known concentrations of gases ("gas-in-oil standards") and quantitatively analyse the gases extracted. Two methods of preparing gas-in-oil standards are described.

For daily calibration checks of the chromatograph, it is convenient to use a standard gas mixture containing a suitable known amount of each of the gas components to be in a similar ratio to the commons ratios of the gases extracted from transformer oils.

The techniques described take account, on the one hand, of the problems peculiar to analyses associated with acceptance testing in the factory, where gas contents of oil are generally very low and, on the other hand, of the problems imposed by monitoring equipment in the field, where transport of samples may be by un-pressurized air freight and where considerable differences in ambient temperature may exist between the plant and the examining laboratory.

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

IEC 60599, *Mineral oil-impregnated electrical equipment in service – Guide to the interpretation of dissolved and free gases analysis*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 5725 (all parts), *Accuracy, trueness and precision of measurement methods and results*

3 Sampling of gases from gas-collecting (Buchholz) relays

3.1 General remarks

It is important to bear in mind that receiving a qualitative and a representative sample is crucial for obtaining a reliable diagnosis of the electrical equipment. Even the most sophisticated extraction or diagnosis methods cannot overcome faulty samples.

Gas samples from relays should be taken from the equipment with the minimum delay after gas accumulation has been signalled. Changes in composition caused by the selective re-absorption of components may occur if free gases are left in contact with oil.

Certain precautions are necessary when taking gas samples. The connection between the sampling device and the sampling vessel must avoid the ingress of air. Temporary connections should be as short as possible. Any rubber or plastic tubing used should have been proved to be impermeable to gases.

Gas samples should be properly labelled (see Clause 5) and analysed without undue delay to minimize hydrogen loss (for example, within a maximum period of one week).

Oxygen, if present in the gas, may react with any oil drawn out with the sample. Reaction is delayed by excluding light from the sample, for example, by wrapping the vessel in aluminium foil or suitable opaque material.

Of the three methods described below, the syringe method is recommended. The other two methods are alternatives to be used exclusively in case of serious hindrance.

Sampling into a sampling tube by liquid displacement using transformer oil as a sealing liquid is simple, but the different solubilities of the gas components may need to be taken into account if the gas quantity is such that some oil remains in the tube.

The vacuum method requires skill to avoid contaminating the sample by leakage of air into the system. It is particularly true where the gas to be sampled may be at less than atmospheric pressure (for example, some sealed transformers).

3.2 Sampling of free gases by syringe

3.2.1 Sampling equipment

See Figure 1.

a) Impermeable oil-resistant plastic or rubber tubing (3) provided with a connecter to fit onto a suitable sampling connection of the gas-collecting relay. To avoid cross-contamination, the tubing should be used only once.