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colour inside

Mineral oil-filled electrical equipment in service – Guidance on the interpretation of dissolved and free gases analysis

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MINERAL OIL-FILLED ELECTRICAL EQUIPMENT IN SERVICE – GUIDANCE ON THE INTERPRETATION OF DISSOLVED AND FREE GASES ANALYSIS

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This commented version (CMV) of the official standard IEC 60599:2022 edition 4.0 allows the user to identify the changes made to the previous IEC 60599:2015 edition 3.0. Futhermore, comments from IEC TC 10 experts are provided to explain the reasons of the most relevant changes, or to clarify any part of the content.

A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text. Experts' comments are identified by a blue-background number. Mouse over a number to display a pop-up note with the comment.

This publication contains the CMV and the official standard. The full list of comments is available at the end of the CMV.

IEC 60599 has been prepared by IEC technical committee 10: Fluids for electrotechnical applications. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2015. This edition constitutes a technical revision.

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

a) revision of Clause A.5 on bushings, at the request of IEC subcommittee 36A, in order to transfer to IEC 60599 the corresponding contents of IEC TR 61464 [1][1] relating to DGA in bushings and include the new information on DGA in bushings available in CIGRE Technical Brochure 771 (2019) [2];
b) revision of Clause A.3 on wind turbine transformers, in order to include in IEC 60599 the new information on DGA in wind turbine transformers available in CIGRE Technical Brochure 771 (2019) [2].

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

Draft	Report on voting
10/1164/FDIS	10/1174/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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INTRODUCTION

Dissolved and free gas analysis (DGA) is one of the most widely used diagnostic tools for detecting and evaluating faults in electrical equipment filled with insulating liquid. However, interpretation of DGA results is often complex and should always be done with care, involving experienced insulation maintenance personnel.

This document gives information for facilitating this interpretation. The first edition, published in 1978, has served the industry well, but had its limitations, such as the absence of a diagnosis in some cases, the absence of concentration levels and the fact that it was based mainly on experience gained from power transformers. The second edition (2015) attempted to address some of these shortcomings. Interpretation schemes were based on observations made after inspection of a large number of faulty oil-filled equipment in service and concentrations levels deduced from analyses collected worldwide.

MINERAL OIL-FILLED ELECTRICAL EQUIPMENT IN SERVICE – GUIDANCE ON THE INTERPRETATION OF DISSOLVED AND FREE GASES ANALYSIS

1 Scope

This document describes how the concentrations of dissolved gases or free gases ~~may~~ can be interpreted to diagnose the condition of oil-filled electrical equipment in service and suggest future action.

This document is applicable to electrical equipment filled with mineral insulating oil and insulated with cellulosic paper or pressboard-based solid insulation. Information about specific types of equipment such as transformers (power, instrument, industrial, railways, distribution), reactors, bushings, switchgear and oil-filled cables is given only as an indication in the application notes ~~(see Annex A)~~.

This document ~~may~~ can be applied, but only with caution, to other liquid-solid insulating systems.

In any case, the indications obtained ~~should be viewed~~ are given only as guidance ~~and any~~ with resulting action ~~should be~~ undertaken only with proper engineering judgment.

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 60050-191:1990, *International Electrotechnical Vocabulary – Chapter 191: Dependability and quality of service* (available at http://www.electropedia.org)~~

~~IEC 60050-192:2015, *International Electrotechnical Vocabulary – Part 192: Dependability* (available at http://www.electropedia.org)~~

~~IEC 60050-212:2010, *International Electrotechnical Vocabulary – Part 212: Electrical insulating solids, liquids and gases* (available at http://www.electropedia.org)~~

~~IEC 60050-604:1987, *International Electrotechnical Vocabulary – Chapter 604: Generation, transmission and distribution of electricity – Operation* (available at http://www.electropedia.org)~~

IEC 60475, *Method of sampling insulating liquids*

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

IEC 61198, *Mineral insulating oils – Methods for the determination of 2-furfural and related compounds*

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Mineral oil-filled electrical equipment in service – Guidance on the interpretation of dissolved and free gases analysis

Matériels électriques remplis d'huile minérale en service – Recommandations relatives à l'interprétation de l'analyse des gaz dissous et des gaz libres



IEC 60599:2022-05(en-fr)

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MATÉRIELS ÉLECTRIQUES REMPLIS D'HUILE MINÉRALE EN SERVICE – RECOMMANDATIONS RELATIVES À L'INTERPRÉTATION DE L'ANALYSE DES GAZ DISSOUS ET DES GAZ LIBRES

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L'IEC 60599 a été établie par le comité d'études 10 de l'IEC: Fluides pour applications électrotechniques. Il s'agit d'une Norme internationale.

Cette quatrième édition annule et remplace la troisième édition parue en 2015. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) révision de l'Article A.5 sur les traversées, à la demande du sous-comité 36A de l'IEC, afin de transférer à l'IEC 60599 le contenu qui correspond à l'IEC TR 61464 [1][1] relatif à l'AGD dans les traversées. Elle vise également à transférer les nouvelles informations relatives à l'AGD dans les traversées, disponibles dans la Brochure technique CIGRE 771 (2019) [1];

b) révision de l'Article A.3 sur les transformateurs pour éoliennes afin de transférer à l'IEC 60599 les nouvelles informations relatives à l'AGD dans les transformateurs pour éoliennes, disponibles dans la Brochure technique CIGRE 771 (2019) [1].

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
10/1164/FDIS	10/1174/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/publications.

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- reconduit,
- supprimé,
- remplacé par une édition révisée, ou
- amendé.

[1] Les chiffres entre crochets se réfèrent à la Bibliographie.

INTRODUCTION

L’analyse des gaz libres et des gaz dissous dans l'huile (AGD) est l'un des outils de diagnostic les plus couramment utilisés pour la détection et l'évaluation de défauts dans les matériels électriques remplis de liquide isolant. Cependant, l'interprétation des résultats d'AGD est souvent complexe et il convient qu'elle soit toujours faite avec prudence, en faisant appel à du personnel expérimenté en maintenance des isolants.

Le présent document fournit des informations qui visent à faciliter cette interprétation. La première édition, parue en 1978, a bien servi l'industrie électrique, mais avait ses limites, comme l'absence de diagnostic dans certains cas, l'absence de niveaux de concentration et le fait de reposer principalement sur l'expérience acquise avec les transformateurs de puissance. La deuxième édition (2015) a tenté de remédier à certaines de ces insuffisances. Les schémas d'interprétation étaient fondés sur des observations qui résultent d'examens effectués sur un grand nombre d'appareils remplis d'huile, après un défaut en service, et sur les niveaux de concentration qui résultent d'analyses recueillies dans le monde entier.

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1 Domaine d'application

Le présent document décrit la façon dont les concentrations de gaz dissous ou de gaz libres peuvent être interprétées pour diagnostiquer l'état des matériels électriques remplis d'huile en service et pour proposer une intervention ultérieure.

Le présent document s'applique aux matériels électriques remplis d'huile minérale isolante et isolés par des isolants solides constitués de papier ou de carton cellulosiques. Des informations relatives aux types spécifiques de matériels tels que les transformateurs (de puissance, de mesure, industriels, ferroviaires, de distribution), les réactances, les traversées, les appareillages de connexion et les câbles à huile fluide sont données, à titre informatif seulement, dans les notes d'application.

Le présent document peut être appliqué, mais uniquement avec prudence, à d'autres systèmes d'isolation liquide-solide.

Dans tous les cas, les indications obtenues sont données uniquement à titre de recommandations et toute action qui en résulte n'est à entreprendre qu'après une appréciation technique convenable.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60475, *Méthode d'échantillonnage des liquides isolants*

IEC 60567:2011, *Matériels électriques immergés – Échantillonnage de gaz et analyse des gaz libres et dissous – Lignes directrices*

IEC 61198, *Huiles minérales isolantes – Méthodes pour la détermination du 2-furfural et ses dérivés*