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SIST EN 60480:2005

Specifikacija za ponovno uporabo žveplovega heksafluorida(SF6) in njegovih mešanic v električni opremi

Specification for re-use of SF6 and its mixtures in electrical equipment

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EUROPEAN STANDARD

EN IEC 60480

NORME EUROPÉENNE

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Supersedes EN 60480:2004

English Version

Specifications for the re-use of sulphur hexafluoride (SF₆) and its mixtures in electrical equipment (IEC 60480:2019)

Spécifications pour la réutilisation de l'hexafluorure de soufre (SF₆) et des mélanges contenant du SF₆ dans le matériel électrique
(IEC 60480:2019)

Spezifikationen für die Wiederverwendung von Schwefelhexafluorid (SF₆) und seinen Mischungen in elektrischen Betriebsmitteln
(IEC 60480:2019)

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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

EN IEC 60480:2019 (E)**European foreword**

The text of document 10/1075/FDIS, future edition 3 of IEC 60480, prepared by IEC/TC 10 "Fluids for electrotechnical applications" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 60480:2019.

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) 2020-02-09
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-05-09

This document supersedes EN 60480:2004.

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The text of the International Standard IEC 60480:2019 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 60079-29-2	NOTE	Harmonized as EN 60079-29-2
IEC 62271-203	NOTE	Harmonized as EN 62271-203
IEC 60376	NOTE	Harmonized as EN IEC 60376
IEC 60068-2-17	NOTE	Harmonized as EN 60068-2-17

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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-192	-	International electrotechnical vocabulary - Part 192: Dependability	-	-
IEC 60050-212	-	International Electrotechnical Vocabulary - Part 212: Electrical insulating solids, liquids and gases	-	-
IEC 60050-441	-	International Electrotechnical Vocabulary. Switchgear, controlgear and fuses	-	-
IEC 60050-826	-	International Electrotechnical Vocabulary Part 826: Electrical installations	-	-
IEC 62271-4	2013	High-voltage switchgear and controlgear - Part 4: Handling procedures for sulphur hexafluoride (SF ₆) and its mixtures	EN 62271-4	2013

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IEC 60480

Edition 3.0 2019-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Specifications for the re-use of sulphur hexafluoride (SF₆) and its mixtures
in electrical equipment** (standards.iteh.ai)

**Spécifications pour la réutilisation de l'hexafluorure de soufre (SF₆)
et des mélanges contenant du SF₆ dans le matériel électrique**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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ELECTROTECHNIQUE
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SPECIFICATIONS FOR THE RE-USE OF SULPHUR HEXAFLUORIDE (SF₆)
AND ITS MIXTURES IN 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 60480 has been prepared by IEC technical committee 10: Fluids for electrotechnical applications.

This third edition cancels and replaces the second edition, published in 2004. This edition constitutes a technical revision.

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

- specifications for the re-use of SF₆ have been confirmed;
- specifications for the re-use of SF₆ mixtures, namely SF₆/N₂ and SF₆/CF₄ mixtures are included;
- as a result of a new repartition of annexes in IEC 60376, IEC 60480 and IEC 62271-4, this new edition now contains the following five annexes:
 - Annex A: Description of methods of analysis (on-site and laboratory);
 - Annex B: By-products of SF₆ and its mixtures;

- Annex C: Procedure for evaluating the potential effects on health from by-products of SF₆ and its mixtures;
- Annex D: Reclaiming recommendations.
- Annex E: Cryogenic reclaiming of SF₆;

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

FDIS	Report on voting
10/1075/FDIS	10/1080/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 website 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.

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SPECIFICATIONS FOR THE RE-USE OF SULPHUR HEXAFLUORIDE (SF₆) AND ITS MIXTURES IN ELECTRICAL EQUIPMENT

1 Scope

This document provides criteria for the re-use of sulphur hexafluoride (SF₆) and its mixtures after recovery and reclaiming from electrical equipment (e.g. for maintenance, at the end-of-life).

Sulphur hexafluoride (SF₆), nitrogen (N₂) and carbon tetrafluoride (CF₄), are gases commonly used for electrical equipment. Taking into account environmental concerns, particular attention is paid to re-use criteria for SF₆ and its mixtures with N₂ and CF₄ for its use in electrical equipment. Procedures for recovering and reclaiming used SF₆ and its mixtures are outside the scope of this document and are described in IEC 62271-4.

This document provides several annexes on the description of the different methods of analysis, on by-products, on the procedure for evaluating the potential health effects from by-products, on cryogenic reclaiming of SF₆, and on reclaiming recommendations.

Storage, transportation and disposal of SF₆ and its mixtures are outside the scope of this document and are covered by IEC 62271-4. Procedures to determine SF₆ leakages are described in IEC 60068-2-17 [4]¹.

For the purposes of this document, the complementary gases used in SF₆ mixtures will be limited to N₂ or CF₄.

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

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

IEC 60050-441, *International Electrotechnical Vocabulary – Part 441: Switchgear, controlgear and fuses* (available at <http://www.electropedia.org>)

IEC 60050-826, *International Electrotechnical Vocabulary – Part 826: Electrical installations* (available at <http://www.electropedia.org>)

IEC 62271-4:2013, *High-voltage switchgear and controlgear – Part 4: Handling procedures for sulphur hexafluoride (SF₆) and its mixtures*

¹ Numbers in square brackets refer to the bibliography.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-192, IEC 60050-212, IEC 60050-441 and IEC 60050-826, and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

electrical equipment

item used for such purposes as generation, conversion, transmission, distribution or utilization of electrical energy, such as electric machines, transformers, switchgear and controlgear, measuring instruments, protective devices, wiring systems, current-using equipment, insulated bushings, surge arresters

[SOURCE: IEC 60050-826:2004, 826-16-01, modified – "insulated bushings, surge arresters" has been added.]

3.2

container

vessel (cylinder) suitable for the containment of pressurized gases either in gaseous or liquid phase, according to local and/or international safety and transportation regulations

3.3

used sulphur hexafluoride

SF₆ which has been introduced into electrical equipment

3.4

reclaiming

process of contaminants removal from an insulating liquid or gas

3.5

recovery

process of transferring gas from electrical equipment to an alternate container

3.6

SF₆ mixture

gas mixture formed by SF₆ and a complementary gas, typically N₂ or CF₄

3.7

contaminant

foreign substance or material in an insulating liquid or gas which usually has a deleterious effect on one or more properties

[SOURCE: IEC 60050-212:2010, 212-17-27, modified – "or solid" has been deleted.]

3.8

by-products

contaminants which are formed by the degradation of SF₆ and its mixtures by electrical arcs or sparks

3.9

ambient air

normal atmosphere surrounding the equipment

[SOURCE: IEC 60079-29-2:2015, 3.1.1]

4 Contaminants and their sources

4.1 General

SF₆ recovered from electrical equipment in operation contains several kinds of contaminants. Contaminants in recovered SF₆ come both from gas handling and from use.

Table 1 summarizes the main contaminants and their sources. Additional information is available in Annex B.

Table 1 – SF₆ contaminants

SF ₆ situation and use	Origin	Possible contaminant
Handling and in service	Leaks and incomplete evacuation	For pure SF ₆ : Air, oil, H ₂ O
	Desorption	For SF ₆ mixtures: Air, oil, H ₂ O, N ₂ , CF ₄
Insulating function	Partial discharges (e.g. corona) and low energy flashovers and sparkovers	Gaseous by-products: HF, SO ₂ , SOF ₂ , SOF ₄ , SO ₂ F ₂
		For SF ₆ mixtures: HF, SO ₂ , SOF ₂ , SOF ₄ , SO ₂ F ₂ , NO _x , NF _x
Switching equipment	Switching arc erosion	Gaseous by-products: HF, SO ₂ , SOF ₂ , SOF ₄ , SO ₂ F ₂ , SF ₄ , CF ₄ , WF ₆ Solid by-products: Metal dusts, particles, AlF ₃ , FeF ₃ , WO ₃ , CuF ₂ For SF ₆ mixtures: HF, SO ₂ , SOF ₂ , SOF ₄ , SO ₂ F ₂ , NO _x , NF _x
	Mechanical erosion	Metal dusts, particles
Internal arc	Melting and decomposition of materials	Gaseous by-products: HF, SO ₂ , SOF ₂ , SOF ₄ , SO ₂ F ₂ , SF ₄ , CF ₄ , WF ₆
		Solid by-products: Metal dusts, particles, AlF ₃ , FeF ₃ , WO ₃ , CuF ₂ For SF ₆ mixtures: HF, SO ₂ , SOF ₂ , SOF ₄ , SO ₂ F ₂ , NO _x , NF _x

4.2 Contaminants from handling and use

Filling and recovering gas leads to the additional contamination with ambient air and water (humidity).

Moisture desorbs from internal surfaces of the equipment and from polymeric parts. Oil from handling equipment (pumps and compressors) may also be inadvertently introduced.

When using gas mixtures, the possibility of cross contamination shall be considered (contaminating one gas mixture by another).

4.3 SF₆ by-products in equipment that only have an insulating function

The essential process is the decomposition of SF₆ by partial discharges (e.g. corona) and low energy flashovers and sparkovers. The immediate products are fragments of SF₆, such as SF₅, SF₄ and F, combining with O₂ and H₂O to form compounds, mainly HF, SO₂, SOF₂, SOF₄ and SO₂F₂. Due to low energy of the partial discharges, flashovers or sparkovers, the accumulated quantities of these compounds are usually negligible.