SLOVENSKI STANDARD
SIST EN IEC 60480:2019

01-september-2019

Nadomešča:
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

Ta slovenski standard je istoveten z: **EN IEC 60480:2019**

ICS:

29.040.20	Izolacijski plini	Insulating gases

SIST EN IEC 60480:2019 **en**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN IEC 60480

May 2019

ICS 29.130.01; 29.040.20

Supersedes EN 60480:2004

English Version

Specifications for the re-use of sulphur hexafluoride (SF_6) and its mixtures in electrical equipment (IEC 60480:2019)

Spécifications pour la réutilisation de l'hexafluorure de soufre (SF_6) et des mélanges contenant du SF_6 dans le matériel électrique
(IEC 60480:2019)

Spezifikationen für die Wiederverwendung von Schwefelhexafluorid (SF_6) und seinen Mischungen in elektrischen Betriebsmitteln
(IEC 60480:2019)

This European Standard was approved by CENELEC on 2019-05-09. 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, 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 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.

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 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.

Publication	Year	Title	EN/HD	Year
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

IEC 60480

Edition 3.0 2019-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Specifications for the re-use of sulphur hexafluoride (SF_6) and its mixtures in electrical equipment

Spécifications pour la réutilisation de l'hexafluorure de soufre (SF_6) et des mélanges contenant du SF_6 dans le matériel électrique

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.040.20; 29.130.01 ISBN 978-2-8322-6697-7

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

SPECIFICATIONS FOR THE RE-USE OF SULPHUR HEXAFLUORIDE (SF_6) 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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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 SF_6 have been confirmed;
- specifications for the re-use of SF_6 mixtures, namely SF_6/N_2 and SF_6/CF_4 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 SF_6 and its mixtures;

– Annex C: Procedure for evaluating the potential effects on health from by-products of SF_6 and its mixtures;
– Annex D: Reclaiming recommendations.
– Annex E: Cryogenic reclaiming of SF_6;

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.

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.

SPECIFICATIONS FOR THE RE-USE OF SULPHUR HEXAFLUORIDE (SF_6) AND ITS MIXTURES IN ELECTRICAL EQUIPMENT

1 Scope

This document provides criteria for the re-use of sulphur hexafluoride (SF_6) and its mixtures after recovery and reclaiming from electrical equipment (e.g. for maintenance, at the end-of-life).

Sulphur hexafluoride (SF_6), nitrogen (N_2) and carbon tetrafluoride (CF_4), are gases commonly used for electrical equipment. Taking into account environmental concerns, particular attention is paid to re-use criteria for SF_6 and its mixtures with N_2 and CF_4 for its use in electrical equipment. Procedures for recovering and reclaiming used SF_6 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 SF_6, and on reclaiming recommendations.

Storage, transportation and disposal of SF_6 and its mixtures are outside the scope of this document and are covered by IEC 62271-4. Procedures to determine SF_6 leakages are described in IEC 60068-2-17 [4][1].

For the purposes of this document, the complementary gases used in SF_6 mixtures will be limited to N_2 or CF_4.

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 (SF_6) 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
SF_6 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
SF_6 mixture
gas mixture formed by SF_6 and a complementary gas, typically N_2 or CF_4

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 SF_6 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

SF_6 recovered from electrical equipment in operation contains several kinds of contaminants. Contaminants in recovered SF_6 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 – SF_6 contaminants

SF_6 situation and use	Origin	Possible contaminant
Handling and in service	Leaks and incomplete evacuation Desorption	For pure SF_6: Air, oil, H_2O For SF_6 mixtures: Air, oil, H_2O, 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_2F_2 For SF_6 mixtures: HF, SO_2, SOF_2, SOF_4, SO_2F_2, NO_x, NF_X
Switching equipment	Switching arc erosion	Gaseous by-products: HF, SO_2, SOF_2, SOF_4, SO_2F_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_2F_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_2F_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_2F_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 SF_6 by-products in equipment that only have an insulating function

The essential process is the decomposition of SF_6 by partial discharges (e.g. corona) and low energy flashovers and sparkovers. The immediate products are fragments of SF_6, such as SF_5, SF_4 and F, combining with O_2 and H_2O to form compounds, mainly HF, SO_2, SOF_2, SOF_4 and SO_2F_2. Due to low energy of the partial discharges, flashovers or sparkovers, the accumulated quantities of these compounds are usually negligible.