
Smernice za preverjanje in ravnanje z žveplovim heksafluoridom (SF6) iz električne opreme in specifikacija za njegovo ponovno uporabo (IEC 60480:2004)

Guidelines for the checking and treatment of sulfur hexafluoride (SF6) taken from electrical equipment and specification for its re-use (IEC 60480:2004)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 60480:2005](https://standards.iteh.ai/catalog/standards/sist/bdae1b-f4d8-4cb5-9159-0770d0295979/sist-en-60480-2005)

<https://standards.iteh.ai/catalog/standards/sist/bdae1b-f4d8-4cb5-9159-0770d0295979/sist-en-60480-2005>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 60480:2005

<https://standards.iteh.ai/catalog/standards/sist/bdaefc1b-f4d8-4cb5-9159-0770d0295979/sist-en-60480-2005>

EUROPEAN STANDARD

EN 60480

NORME EUROPÉENNE

EUROPÄISCHE NORM

December 2004

ICS 29.040.20; 29.130

English version

**Guidelines for the checking and treatment of sulphur hexafluoride (SF₆)
taken from electrical equipment and specification for its re-use
(IEC 60480:2004)**

Lignes directrices relatives au contrôle
et au traitement de l'hexafluorure
de soufre (SF₆) prélevé sur le matériel
électrique et spécification en vue
de sa réutilisation
(CEI 60480:2004)

Richtlinien für die Prüfung und
Aufbereitung von Schwefelhexafluorid
(SF₆) nach Entnahme aus elektrischen
Betriebsmitteln und Spezifikation für
dessen Wiederverwendung
(IEC 60480:2004)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 60480:2005

This European Standard was approved by CENELEC on 2004-11-01. 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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 10/611/FDIS, future edition 2 of IEC 60480, prepared by IEC TC 10, Fluids for electrotechnical applications, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60480 on 2004-11-01.

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) 2005-08-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2007-11-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60480:2004 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

ISO 14040

NOTE Harmonized as EN ISO 14040:1997 (not modified).

<https://standards.iteh.ai/catalog/standards/sist/bdae1b-f4d8-4cb5-9159-0770d0295979/sist-en-60480-2005>

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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-191	1990	International Electrotechnical Vocabulary (IEV) Chapter 191: Dependability and quality of service	-	-
IEC 60050-212	1990	Chapter 212: Insulating solids, liquids and gases	-	-
IEC 60050-441	1984	Chapter 441: Switchgear, controlgear and fuses	-	-
IEC 60050-826	1982	Chapter 826: Electrical installations of buildings	-	-
IEC 60376	1971	Specification and acceptance of new sulphur hexafluoride	-	-
IEC 60376A	1973	First supplement - Section Thirteen: Mineral oil content	-	-
IEC 60376B	1974	Second supplement - Clause 26	-	-
IEC 60694	1996	Common specifications for high-voltage switchgear and controlgear standards	EN 60694 + Corr. May	1996 1999
IEC 61634	1995	High-voltage switchgear and controlgear – Use and handling of sulfur hexafluoride (SF ₆) in high-voltage switchgear and controlgear	-	-

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 60480:2005

<https://standards.iteh.ai/catalog/standards/sist/bdaefc1b-f4d8-4cb5-9159-0770d0295979/sist-en-60480-2005>

NORME
INTERNATIONALE
INTERNATIONAL
STANDARD

CEI
IEC

60480

Deuxième édition
Second edition
2004-10

**Lignes directrices relatives au contrôle et au
traitement de l'hexafluorure de soufre (SF₆)
prélevé sur le matériel électrique et
spécification en vue de sa réutilisation**

iTeh STANDARD PREVIEW

**Guidelines for the checking and treatment
of sulfur hexafluoride (SF₆) taken from
electrical equipment and specification
for its re-use**

<https://standards.iteh.org/standards/sist/bdaefc1b-f4d8-4cb5-9159-0770d0295979/sist-en-60480-2005>

© IEC 2004 Droits de reproduction réservés — Copyright - all rights reserved

Aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'éditeur.

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE

V

*Pour prix, voir catalogue en vigueur
For price, see current catalogue*

CONTENTS

FOREWORD.....	7
INTRODUCTION.....	11
1 Scope.....	13
2 Normative references.....	13
3 Terms and definitions	15
3.1 General terms.....	15
3.2 Material aspects	15
3.3 Environmental aspects.....	17
4 Typical applications of SF ₆	19
5 Impurities and their sources	19
5.1 Introductory remark	19
5.2 Impurities from handling and in service	19
5.3 Impurities in equipment having only an insulating function	19
5.4 Impurities in switching equipment.....	19
5.5 Impurities from internal arcs	21
6 Environmental aspects.....	21
6.1 Introductory remark	21
6.2 Impact on the ecosystem.....	21
6.3 Ozone depletion	21
6.4 Greenhouse effect.....	21
6.5 Decomposition products.....	21
6.6 Conclusion	21
7 Health and safety.....	23
7.1 Introductory remark	23
7.2 Precautions necessary with SF ₆	23
7.3 Necessary precautions with used SF ₆	23
7.4 Health considerations	25
8 Quality specification for re-use of SF ₆ in new or existing switchgear	25
8.1 Decision flowchart for SF ₆ removed from electrical equipment for treatment.....	25
8.2 Maximum acceptable impurity levels for re-use of SF ₆	29
9 Analytical methods for SF ₆ and their significance	29
9.1 General	29
9.2 On-site analysis.....	31
9.3 Laboratory analysis.....	33
10 Handling, storage and transportation.....	35
10.1 Introductory remark	35
10.2 Gas handling equipment	35
10.3 General safety requirements.....	35
10.4 Condition of the SF ₆ in an enclosure	37
10.5 Removing used SF ₆ from an enclosure	39
10.6 Storage and transportation of used SF ₆	39

Annex A (informative) Derivation of maximum tolerable moisture levels for re-use	41
Annex B (informative) Description of the different methods of analysis (on-site and laboratory)	45
Annex C (informative) Reclaiming recommendations and procedures on-site	61
Bibliography	67
Figure 1 – Decision flow chart for the destination of removed SF ₆	27
Figure 2 – Decision flow chart for on-site analysis	31
Figure A.1 – Moisture levels (ppmv) as a function of gas pressure <i>p</i>	41
Figure B.1 – SF ₆ gas sampling set-up: evacuation	45
Figure B.2 – SF ₆ gas sampling set-up: purging	47
Figure B.3 – Typical gas chromatogram of decomposed SF ₆	53
(analysis performed with a Porapak Q column)	53
Figure B.4 – IR spectrum of contaminated SF ₆	59
Table 1 – Origin of SF ₆ impurities	19
Table 2 – Maximum acceptable impurity levels	29
Table 3 – On-site methods	33
Table 4 – Laboratory methods	33
Table B.1 – Thermal conductivity detector relative response factor	55
Table B.2 – Peak absorption of SF ₆ and contaminants	59
Table C.1 – Suggested reclaiming operations	61
Table C.2 – Typical adsorbents for various SF ₆ impurities	63
Table C.3 – Summary of SF ₆ transportation regulations	65

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**GUIDELINES FOR THE CHECKING AND TREATMENT
OF SULFUR HEXAFLUORIDE (SF₆) TAKEN FROM ELECTRICAL
EQUIPMENT AND SPECIFICATION FOR ITS RE-USE**

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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 second edition cancels and replaces the first edition, published in 1974, and constitutes a technical revision.

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

- updating of standard as it relates to environmental issues, storage and analytical methods;
- addition of specification for the re-use of gas;
- inclusion of a regeneration process for sulfur hexafluoride taken from electrical equipment.

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

FDIS	Report on voting
10/611/FDIS	10/612/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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 60480:2005](#)

<https://standards.iteh.ai/catalog/standards/sist/bdaefc1b-f4d8-4cb5-9159-0770d0295979/sist-en-60480-2005>

INTRODUCTION

Sulfur hexafluoride, SF₆, is an essential gas for electrical equipment. Influenced by environmental concerns, the international community, and especially the electrical industry, has made and is still making a substantial contribution towards controlling the environmental impact of the product at all stages of its life, from “the cradle to the grave”, as it is defined in ISO 14040 [5]¹.

In line with these efforts and as a complement to them, particular attention has been paid to reclaiming procedures of the SF₆ as used in electrical equipment. These procedures allow the re-use of the gas when equipment is maintained, repaired or reaches the end of its service life. This includes acceptable limits for impurity levels, according to experience gained by main users (manufacturers and electrical utilities).

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 60480:2005](https://standards.iteh.ai/catalog/standards/sist/bdaefc1b-f4d8-4cb5-9159-0770d0295979/sist-en-60480-2005)

<https://standards.iteh.ai/catalog/standards/sist/bdaefc1b-f4d8-4cb5-9159-0770d0295979/sist-en-60480-2005>

¹ References in square brackets refer to the bibliography.

GUIDELINES FOR THE CHECKING AND TREATMENT OF SULFUR HEXAFLUORIDE (SF₆) TAKEN FROM ELECTRICAL EQUIPMENT AND SPECIFICATION FOR ITS RE-USE

1 Scope

This International Standard concerns the re-use of sulfur hexafluoride (SF₆) after removal from electrical equipment (for maintenance, or at the end of life).

This standard recommends procedures for reclaiming used SF₆ and for restoring its quality to an acceptable level, which would allow the filling of new or existing electrical equipment.

This standard provides guidance to operational and maintenance personnel for the testing and safe handling of used SF₆.

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 60050(191):1990, *International Electrotechnical Vocabulary (IEV) – Chapter 191: Dependability and quality of service*

IEC 60050(212):1990, *International Electrotechnical Vocabulary (IEV) – Chapter 212: Insulating solids, liquids, gases*

IEC 60050(441):1984, *International Electrotechnical Vocabulary (IEV) – Chapter 441: Switchgear, controlgear and fuses*

IEC 60050(826):1982, *International Electrotechnical Vocabulary (IEV) – Chapter 826: Electrical installations of buildings*

IEC 60376:1971, *Specification and acceptance of new sulfur hexafluoride*

IEC 60376A:1973, First supplement, *Specification and acceptance of new sulfur hexafluoride – Section Thirteen: Mineral oil content*

IEC 60376B:1974, Second supplement, *Specification and acceptance of new sulfur hexafluoride – Clause 26*

IEC 60694:1996, *Common specifications for high-voltage switchgear and controlgear standards*

IEC 61634:1995, *High-voltage switchgear and controlgear – Use and handling of sulfur hexafluoride (SF₆) in high-voltage switchgear and controlgear*