

TECHNICAL REPORT

RAPPORT TECHNIQUE

**High-voltage switchgear and controlgear –
Part 303: Use and handling of sulphur hexafluoride (SF₆)**

**Appareillage à haute tension –
Partie 303: Utilisation et manipulation de l’hexafluorure de soufre (SF₆)**



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IEC 62271-303, which is a technical report, has been prepared by subcommittee 17A: High-voltage switchgear and controlgear, of IEC technical committee 17: Switchgear and controlgear.

This first edition of IEC/TR 62271-303 cancels and replaces the first edition of IEC 61634 published in 1995. This edition constitutes a technical revision.

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

IEC 62271-303 is a major revision of the old IEC 61634. The former sections of IEC 61634 are removed and replaced by the chapters of the CIGRE brochure n. 276.

IEC 61634 was issued in 1995 when the focus was on safety. In 2008, safety is a very well known and established concept and the focus is nowadays on the environmental compatibility. SF₆ must be kept in a closed cycle and any intentional release must be forbidden. The implementation of the SF₆ reuse concept suggested in the CIGRE brochure was updated with the most recent information. Today SF₆ can be recovered and reclaimed for either being reused on-site or given back to the gas supplier and reused as raw material for the production of "technical grade SF₆". Detailed procedures for appropriate SF₆ handling are given together with the description of the state-of-the-art equipments and measuring devices.

More in detail, clause by clause:

- The former Section 1 was removed and replaced with Clause 1 "Scope", Clause 2 "Normative references" and Clause 3 "Terms and Definitions".
- Clause 4 "Storage and transportation of SF₆", Clause 5 "Safety and first aid", Clause 6 "Training and certification", and Clause 11 "Description of SF₆ handling equipment" were taken from the CIGRE brochure and their content was revised.
- Clause 7 "SF₆ handling during installation and commissioning", Clause 8 "SF₆ handling during normal service life", Clause 9 "SF₆ recovery and reclaiming during maintenance", and Clause 10 "Dismantling of SF₆ electric power equipment at the end-of-life" were taken from the CIGRE brochure, their content was revised and replaces the former sections 2, 3, 4, 5, and 6.
- The former Annexes A, B, C, and D were revised while the Annexes E and F were dropped. The Bibliography replaces the former Annex G.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
17A/813/DTR	17A/817/RVC

Full information on the voting for the approval of this technical report 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.

A list of all parts of IEC 62271 series, under the general title *High-voltage switchgear and controlgear* can be found on the IEC website.

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

SF₆ technology is used in switchgear and controlgear, for more than 30 years. Its application is mainly in electric power equipment for rated voltages exceeding 1 kV up to the highest rated voltages for which switchgear and controlgear are manufactured. It is estimated that several millions of the different types of SF₆-filled units are currently in service.

Three methods for gas containment are technically available, according to IEC 62271-1:

- controlled pressure system;

NOTE 1 Controlled pressure systems are no longer used for new equipment, because of the unacceptable leakage rate (see IEC 62271-203).

- closed pressure system: modern high-voltage electric power equipments. The standardized values for leakage rates are 0,5 % and 1 % per year and per gas-filled compartment;
- sealed pressure system: modern medium-voltage electric power equipments (commercially designated as “sealed for life products” or “hermetically sealed systems”). The tightness of sealed pressure systems is specified by their expected operating life. The expected operating life with regard to leakage performance is specified by the manufacturer. Preferred values are 20, 30 and 40 years.

NOTE 2 To fulfil the expected operating life requirement the leakage rate of the SF₆ sealed pressure systems is considered to be less than 0,1 % per year.

The long experience with the use of SF₆ in switchgear and controlgear evidences that a certain number of elementary precautions and procedures should be adopted in order to achieve operational, safety at work and environmental benefits such as:

- safe operation of the equipment;
- optimisation of resources and tools required;
- minimisation of out-of-service time for equipment;
- standard training of personnel handling SF₆;
- reduction of the amount of gas released during handling operations down to the functional physical limit;
- avoidance of any deliberate release, for example flushing to the atmosphere;
- reduction of SF₆ losses and emissions during commissioning, service, operation and end-of-life treatment to a minimum.

Recently, the latest practical recommendations on the use of SF₆ technology applied to switchgear and controlgear have been published by WG B3.02 of CIGRE Study Committee B3 [1]¹. This information is used to revise IEC 61634 into the present technical report.

¹ Figures in square brackets refer to the **Bibliography**.

HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR –

Part 303: Use and handling of sulphur hexafluoride (SF₆)

1 Scope

The scope of this technical report is to address the procedures for safe and environmental compatible handling of SF₆ during installation, commissioning, normal and abnormal operations, disposal at the end-of-life of high-voltage switchgear and controlgear. Storage and transportation of SF₆ are also covered.

These procedures should be regarded as minimum requirements to ensure the safety of personnel working with SF₆ and to minimize the SF₆ emission to the environment.

This technical report generally applies also to gas mixtures containing SF₆.

NOTE 1 For the use of this technical report, the term “high voltage” (reference IEC 601-01-27) is the rated voltage above 1 000 V. However, the term “medium voltage” (reference IEC 601-01-28) is commonly used for distribution systems with voltages above 1 kV and generally applied up to and including 52 kV.

NOTE 2 Throughout this technical report, the term “electric power equipment” stands for “high-voltage and medium voltage switchgear and/or controlgear”.

2 Normative references

The following referenced documents are indispensable for the application of this technical report. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

IEC 60376, *Specification of technical grade sulphur hexafluoride (SF₆) for use in electrical equipment*

IEC 60480, *Guidelines for the checking and treatment of sulphur hexafluoride (SF₆) taken from electrical equipment and specifications for its reuse*

IEC 62271-1, *High-voltage switchgear and controlgear – Part 1: Common specifications*

IEC 62271-100, *High-voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE There are many different types of electric power equipment which use SF₆ as a dielectric and/or arc-quenching medium.

3.1

abnormal release of sulphur hexafluoride (SF₆)

release from equipment in service due to a failure in the pressure system