

	Standard	Cape Coastal Cluster
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Title: **SPECIFICATION FOR NEW
SULPHUR HEXAFLUORIDE
(SF₆) GAS SUPPLIED IN
STANDARD GAS CYLINDERS**

Document Identifier: **559-344083080**

Alternative Reference n/a
Number:

Area of Applicability: **Cape Coastal Cluster**

Functional Area: **Engineering**

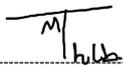
Revision: **1**

Total Pages: **12**

Next Review Date: **June 2030**

Disclosure Classification: **Controlled Disclosure**

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1. Introduction

This document is necessary for Eskom Distribution Division's Cape Coastal Cluster (hereafter referred to as the Cluster) to procure the correct grade of sulphur hexafluoride (SF₆) gas for use in MV, HV and EHV SF₆ gas insulated switchgear. The SF₆ gas is required for use on SF₆ gas filled high voltage equipment, namely, live-tank and dead-tank circuit breakers (AIS/GIS/MTS), GIS isolators, GIS earthing switches, SF₆ bushings, SF₆ gas compartments, SF₆ CT's and SF₆ VT's, Ring Main Units (RMU) and SF₆ filled reclosers.

2. Supporting Clauses

2.1 Scope

This document covers Eskom Distribution's Cape Coastal Cluster requirements for new SF₆ supplied in standard type gas cylinders for use in electrical apparatus employing SF₆ as insulation and/or interruption medium.

2.1.1 Purpose

The purpose of this document is to ensure that the quality of Sulphur Hexafluoride (SF₆) gas supplied to the Cluster for use in HV and MV switchgear meets IEC/SANS requirements for use in the equipment as well as to ensure that the gas is delivered in containers meeting the requirements of national legislation. This document aims to provide a standard for the Cluster to procure SF₆ gas.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Distribution Division's Cape Coastal Cluster.

2.1.3 Effective date

The date from which this document is effective is the same as the authorisation date of this document as per the "Authorized by" signatory in the document cover page.

2.2 Normative/Informative References

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

The latest revision of the following documents are indispensable for the application of this document and should be used together with this document.

[1] ISO 9001 Quality Management Systems

[2] Occupation Health and Safety Act (OHS Act) No 85 of 1993 – Construction and Electrical Machinery Regulations

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- [3] SANS/ IEC 60376, Standard of technical grade sulphur hexafluoride (SF₆) for use in electrical equipment
- [4] SANS 10019, Transportable pressure receptacles for compressed, dissolved and liquefied gases - Basic design, manufacture, use and maintenance.
- [5] SANS/ IEC 60050(441):1984: International Electro-technical Vocabulary – Chapter 441: Switchgear, control-gear and fuses
- [6] SANS/ IEC 62271-1, Common specifications for high voltage switchgear and control gear standards
- [7] SANS/ IEC 62271-100, High voltage switchgear and control-gear: Part 100: High voltage alternating current circuit-breakers.
- [8] SANS/ IEC 62271-102, High voltage switchgear and control-gear: Part 102: Alternating current disconnectors and earthing switches.
- [9] SANS/ IEC 62271-203, High-voltage switchgear, and control-gear – Part 203: Gas-insulated metal enclosed switchgear for rated voltages above 52kV.
- [10] 240-50807380, Specification for GIS and associated auxiliary equipment.
- [11] 240-56063756, Outdoor Circuit-breakers for system with nominal voltages from 6.6kV up to and including 765kV Standard.
- [12] 240-56065202, Switchgear training requirements from Original Equipment Manufacturers Standard.
- [13] 240-56063765, Eskom Health and Safety Management Supplier Requirement Standard
- [14] SANS/ ISO 9809-1, Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa.
- [15] SANS/ ISO 9809-2, Gas cylinders — Refillable seamless steel gas cylinders — Design, construction and testing Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1 100 MPa.
- [16] SANS/ ISO 9809-3, Gas cylinders — Design, construction and testing of refillable seamless steel gas cylinders and tubes Part 3: Normalized steel cylinders and tubes
- [17] SANS 10263-2, The warehousing of dangerous goods Part 2: The storage and handling of gas cylinders
- [18] 559-399862082, Technical Evaluation Criteria for New SF₆ Gas Supplied in Standard Gas Cylinders
- [19] Occupation Health and Safety Act (OHS Act) No 85 of 1993 – Regulations for Hazardous Chemical Agents (RHCA)
- [20] National Environmental Management: Waste Act, 2008
- [21] Hazardous Substances Act, 1973

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2.2.2 Informative

The following documents are further sources of information referenced in this document.

[22]NRS 087, Guidelines for the purchase use and disposal of SF6

[23]240-125809509, Eskom Greenhouse Gas Emissions Reporting Procedure

2.3 Definitions

The following definitions are applicable to this document.

Definition	Explanation
Class 1 cylinder	Seamless metallic pressure receptacle
Class 3 cylinder	Metallic pressure receptacles of welded construction where the seams have been partially radiographed in accordance with an approved standard
Class of pressure receptacle	Category into which a pressure receptacle is placed based on whether the pressure receptacle is seamless, or of welded construction (the weld being fully or partially radiographed)
Cylinder	A pressure vessel used to store SF6 gas is referred to in this standard. {transportable pressure receptacle (that may be seamless, welded or composite) with a water capacity of 0,5 L to 150 L}
New gas	Technical grade SF6 that complies with IEC 60376 standard
Pressure receptacle	Collective term that includes cylinders, bundles, tubes and pressure drums for the storage and transportation of liquefied or compressed gases with a water capacity from 0,5 L to 3 000 L Note 1 All types of pressure receptacle, excluding non-refillable cylinders, are refillable. Note 2 The terms "transportable gas containers", "transportable pressure containers" and "containers" as used in SANS 347 and the relevant national legislation (see foreword), the relevant European Industrial Gases Association (EIGA) documents, and the various manufacturing standards listed in Table 1 and Annex A, are deemed to have the same meaning as a pressure receptacle as defined in this standard.
Special gas	Gas or gas mixture that has specific properties and that is prepared for special applications. Examples Instrument calibration gas mixtures or technical diving mixtures.
Technical grade SF6	SF6 gas having a very low level of impurities in accordance with IEC 60376 standard
Technical evaluator	End-users, technical experts nominated by the end-user and Divisional technical functionaries with the necessary technical expertise. NB: The switchgear technical evaluation shall be performed by the switchgear representatives in the Commodity Cross Functional team.
Threshold for Qualification	This is the threshold that has been determined by Eskom Technical evaluation, which the submission must meet to proceed with the technical evaluation after scoring stage.

2.4 Abbreviations

The following terms and abbreviations are used in this document.

Abbreviation	Explanation
AIS	Air Insulated Switchgear
BSP	British Standard

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Abbreviation	Explanation
CB	Circuit-breaker
CG	Care Group
CT	Current Transformer
EHV	Extra High Voltage
GIS	Gas Insulated Switchgear
HV	High Voltage
IEC	Independent Electoral Commission
kg	Kilo Gram
kV	Kilo Volt
MEW	Major Engineering Works Department
MTS	Mixed Technology Switchgear
MV	Medium Voltage
OEM	Original Equipment Manufacturer
OHS Act	Occupational Health and Safety Act ^[2]
ORHVS	Operating Regulations for High Voltage Systems
OU	Operating Unit
PPM	Primary Plant Maintenance
RHCA	Regulations for Hazardous Chemical Agents ^[19]
SCOT	Steering Committee for Technology
SDS	Safety Data Sheet
SED	Substation Equipment Diagnostics
SF ₆ /SF6	Sulphur Hexafluoride gas
VT	Voltage Transformer

2.5 Roles and Responsibilities

The following roles and responsibilities relating to the implementation and maintenance of this document are applicable.

The Distribution Switchgear Care Group in conjunction with the relevant Chief Engineer in Technology and Engineering or the Operating Units Technical Teams shall ensure the correctness of this document. They shall further ensure that it is adequately maintained and updated to align with applicable national and international technical standards.

Commercial and Materials Management teams shall ensure that the contents of this document are implemented during all commercial processes for procuring SF₆ gas, SF₆ cylinders and SF₆ assets. These shall further ensure that all documentation in relation to SF₆, SF₆ assets and SF₆ cylinders required by the Cluster for technical and/or legal compliance are received from Suppliers.

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All parties handling SF₆, SF₆ cylinders and SF₆ assets shall ensure compliance to the requirements of this document, all reference documents listed in the normative references and all other applicable laws and regulations. This includes the handing over and receipt of required documentation upon delivery, collection and exchange of SF₆, SF₆ cylinders and SF₆ assets.

2.6 Process for Monitoring

This document and its relevance will be periodically evaluated by the relevant SCOT Care Group.

2.7 Related/Supporting Documents

The following technical evaluation criteria document has been developed to support this specification.

- a. 559-399862082, "Technical Evaluation Criteria for New SF₆ Gas Supplied in Standard Gas Cylinders"

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3. Specification for New SF₆ Gas Supplied in Standard Gas Cylinders

3.1 General Requirements

- a. SF₆ is preferably to be supplied in Class 1 steel standard type gas cylinders in which the SF₆ is stored in liquid form under its own vapour pressure when the cylinder is fully charged.

Note: Unless otherwise stated Class 3 cylinders will also be accepted under the prescribed specifications, however Class 1 steel standard type gas cylinders are preferred. This is reflected in the technical evaluation criteria (559-399862082) associated with this specification.

- b. The SF₆ capacity of each cylinder shall be either 50 (± 3) kilograms in a ± 50-litre bottle, 20 (± 2) kilograms in a 20-litre bottle or in 10 (± 1) kilograms in a 10-litre bottle and according to the purchasing requirement Bill of Material.
- c. The Supplier/Bidder shall be able to transport, deliver, off-load and collect SF₆ gas and SF₆ gas cylinders at various Eskom sites, as per the tender enquiry.
- d. The Supplier/Bidder shall be responsible for making arrangements with the relevant authorities for the transportation and handling of both SF₆ gas and SF₆ gas cylinders.
- e. Suppliers/Bidders shall, if required by the tender evaluation teams, make their factory or premises available for the team to assess the methods and processes involved in the filling of new gas into cylinders, the handling and the management of both SF₆ and the cylinders.
- f. Rental of cylinders shall be included as part of contract and/or once off purchases.
- g. On delivery of the gas the Supplier/Bidder shall supply a valid South African Safety Data Sheet for the SF₆ in line with OHS Act^[2] and RHCA^[19] requirements.

3.2 SF₆ Gas Purity

The required quality of new SF₆ to be used in SF₆ insulated equipment is detailed in the latest edition of IEC 60376. Furthermore,

- a. A bottle certificate verifying the quality of the gas is to be supplied by the OEM with each bottle. The supplied certificate is to correlate with the specific cylinder, with the traceable bottle serial number as reference.
- b. The process followed by the Supplier to supply the gas to the end user, must be made known to the client by the Supplier. This should include information on whether the bottle was filled by the supplier from a bulk supply or whether the bottle was prefilled before the supplier obtained it.

In either case, the bottle certificate verifying the quality of the gas from the OEM, is to be supplied by the Supplier with each bottle.

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If at any time, the client verifies that the new gas supplied does not adhere to the required specification as set in IEC60376, the Supplier is to be held responsible and shall carry associated financial liability.

3.3 SF₆ Gas Cylinder Type, Colour and Marking

The cylinder type, colour and markings thereof shall meet the following requirements.

- a. SF₆ shall be supplied in Class 1 steel seamless metallic cylinders in accordance with SANS 10019.

Note: Unless otherwise stated Class 3 cylinders will also be accepted under the prescribed specifications, however Class 1 steel standard type gas cylinders are preferred. This is reflected in the technical evaluation criteria (559-399862082) associated with this specification.

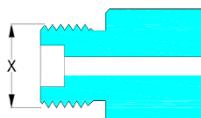
- b. Each bottle shall be supplied with a removeable enclosed top valve cover. There should be NO guard ring fitted onto the bottle.
- c. There is no preference to colour of the cylinder, but the wording "Sulphur Hexafluoride" is to be painted onto the bottle in vertical format with a black letter size of at least 75mm for the 50-litre bottle. (The letter sizes for the 20 and 10 litre bottles must be in relation to that of the 50-litre bottle.)
- d. The name of the OEM is to be written on the bottle either in paint or stamped format but not by paste on sticker format.
- e. Each cylinder must have a legible hydrostatic test date stamped on it. The Supplier/Bidder must provide the Cluster a copy of the valid test Certificate of hydrostatic testing (hydraulic burst test). The Certificate shall be in an acceptable form similar to Annex D of SANS/ ISO 9809 standard ^{[14],[15],[16]}.

Furthermore, gas will only be accepted in cylinders that have at least a minimum of 3 years remaining before their next hydrostatic test due date.

- f. Cylinder stampings shall comply with the requirements of an approved manufacturing standard according to the requirements of SANS 10019.

3.4 SF₆ Gas Cylinder Valves and Fittings

- a. Each cylinder shall be equipped with a non-removable one-way type shutoff valve which ensures the contents may only be extracted by the user.
- b. The valve outlet shall be to British Standard BS341-3, valve no. 6 as per Figure 1, below. It is a 5/8" BSP RH External thread that accepts a fitting having a flat seal and gasket.
- c. No additional adaptor fittings are to be supplied to ensure 5/8" BSP RH External thread final fitting.



BS No 6
5/8" BSP RH External, 14 T.P.I.
Flat end sealing face, thread O.D. 22.8mm

Figure 1: BS 341 British Standard Cylinder Valve Outlets and Connections

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4. SF₆ Gas and SF₆ Gas Cylinders Handling and Record Keeping

In the handling of SF₆ gas and SF₆ gas cylinders the Supplier shall always insist on its personnel handling the SF₆ gas cylinders to comply with SANS 10019. The same shall be applicable to the Cluster personnel interacting with the Supplier and handling the SF₆ gas cylinders and switchgear.

The gas Supplier shall keep a full record of all SF₆ gas supplied to the Cluster as well as returned used weighted cylinders from the Cluster, for a period of at least five years after expiry of the Cluster awarded contract for SF₆ gas purchased on a contract. The same records retention requirement applies for SF₆ gas supplied through a once off purchase. The Supplier shall make this record available to a Cluster appointed delegate on a monthly basis or as and when requested by a Cluster delegate.

Very important: The Cluster shall only accept cylinders that have a legible hydrostatic test date stamped on them and that stamped date indicates that the cylinder has at least a minimum of three (3) years remaining before its next hydrostatic test due date.

5. Reuse, Maintenance, Testing, Recycling and Disposal of SF₆ Gas Cylinders

Reuse, maintenance, testing, recycling and disposal of cylinders shall be in line with prevailing legislation. Responsibility for these shall reside with the owner of the gas cylinders meaning:

1. Where the gas cylinders are rented by Eskom from a Supplier, the Supplier shall be responsible for the reuse, maintenance, testing, recycling and disposal thereof.
2. Where the gas cylinders are owned by Eskom, Eskom shall be responsible for the reuse, maintenance, testing, recycling and disposal thereof.

Notwithstanding the above, the user of a cylinder shall conduct a visual inspection before and after handling or utilisation of a gas cylinder. Where necessary the user shall conduct a leak test where leakage is suspected e.g. at couplings. A soap test shall not be used for SF₆ gas leak detection on SF₆ cylinders due to limitations in its effectiveness, safety and potential contamination. Leak detection methods which may be used on SF₆ gas cylinders include:

- a. an SF₆ leak detector (SF₆ sniffer),
- b. optical gas imaging with infrared cameras,
- c. acoustic leak detection
- d. and other SF₆ specific scientific methods.

The disposal of SF₆ gas cylinders shall remain the responsibility of the owner and shall be conducted in line with prevailing legislation. Options available for disposal include:

- a. Removal of all residual SF₆ prior to disposing of the cylinder as scrap metal or
- b. Disposal of the gas and cylinder through a licenced hazardous waste service provider or hazardous waste disposal company.

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6. Acceptance

This document has been seen and accepted by:

Full Name and Surname	Designation
Sikelela Mkhabela	Senior Manager Maintenance and Operations Eastern Cape
Promise Ntuli	Senior Manager Maintenance and Operations Western Cape
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Rustum Emjedi	Manager Power Plant Maintenance Western Cape
Freddy Mvula	Distribution Switchgear Care Group Chairperson
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7. Revisions

Date	Rev.	Compiler	Remarks
August 2025	1	Tebello Mahlaba (adopted from Frik Schoeman)	First issue specific to the Cluster. New and updated technical requirements for tactical sourcing of new SF6 gas supplied in standard gas cylinders.

8. Development Team

This document was developed from an adopted document authored and developed by Frik Schoeman and a National Transmission Company of South Africa (NTCSA) development team. The adopted document was then tailored to suite the Cluster needs.

The following members of the Eskom Distribution Division Switchgear Care Group were involved in the tailoring and further development of this document:

- | | | |
|---------------------|---|--|
| b. Abdullah Ebrahim | Senior Engineer Power Plant Maintenance | Distribution Switchgear Care Group Member |
| c. Freddy Mvula | Senior Technologist Engineer Maintenance and Operations Centre of Expertise | Distribution Switchgear Care Group Chairperson |
| d. Tebello Mahlaba | Chief Engineer Maintenance and Operations | Distribution Switchgear Care Group Member |

9. Acknowledgements

The Author, Cluster and Distribution Switchgear Care Group acknowledges Frik Schoeman for authoring and compiling the requirements herein adopted for use by the Cluster. Furthermore, all who authored and contributed to the previous versions of this document i.e. made input on this document from its first draft version.

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Appendix A – Guideline on General Scope of Work for Procuring SF6

In the procurement of SF6 for use in high voltage equipment the following is recommended for inclusion as part of the scope and terms and conditions of the purchase or contract.

A.1 SAP DETAILS FOR SCOPE OF WORK

The following list of material or services is recommended for inclusion in the procurement of SF6. This includes the SF₆, the rental of the associated cylinder and other charges. In the below example 50kgs of SF6 was used, however in the procurement process for a different size the appropriate SAP/ERP number and material short description should be used.

Item	SAP/ ERP Number	Material/Service SAP Short Format Description
01	0586736	GAS:SF6;99.9 PCT;CYL 50 KG
02	3000034075	RENT CYL:GAS SF6;50 KG;STEEL;MONTHLY
03	0559209	CLAIM KILOMETERS
04	0566235	DELIVERY SURCHARGE

A.2 SPECIAL ADDITIONAL NEC CLAUSES

The following additional terms and conditions are recommended for inclusion in the contract or purchase agreement and should be tailored to the specific scope of work:

- a. The Supplier shall ensure that cylinder rentals are billed and invoiced timeously at the end of each month. Eskom will not take responsibility for outstanding rental fees which have not been invoiced timeously.
- b. The Supplier shall only collect cylinders during working hours on business days namely Monday to Friday between 08:30 and 15:30.
- c. The Supplier shall ensure that at the end of this contract, all cylinders are collected. Eskom will not be responsible for payment of any rental fees post the end date of this contract.
- d. The Supplier shall ensure that on delivery of the SF6 gas, each 50kg cylinder is accompanied by its gas purity certificate, a hydrostatic testing (hydraulic burst test) certificate and has a legible hydrostatic test date stamped thereon as stipulated in specification 559-344083080. SF6 gas cylinders not meeting these requirements will be rejected by Eskom. Furthermore, Eskom will not incur or be responsible any costs associated with the delivery of SF6 or SF6 gas cylinders which do not conform to any part of specification 559-344083080.

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