



Eskom

Standard

Transmission

Title: **SPECIFICATION FOR NEW SF6
GAS SUPPLIED IN STANDARD
GAS CYLINDERS FOR NTCSA**

Unique Identifier: **240-185000041**

Alternative Reference Number: **<n/a>**

Area of Applicability: **Engineering**

Documentation Type: **Standard**

Revision: **1**

Total Pages: **11**

Next Review Date: **April 2029**

Disclosure Classification: **Controlled
Disclosure**

Compiled by

**Frik Schoeman
Senior Consultant
SED HV Plant GIS**

Date: 04/06/2024

Approved by

**Frik Schoeman
GIS/MTS CG Convener**

Date: 04/06/2024

Authorized by

**Bheki Ntshangase
Senior Manager HV Plant**

Date: 08/08/2024

Supported by SCOT/SC

**Bheki Ntshangase
SCOT/SC Chairperson**

Date: 08/08/2024

Content

	Page
1. Introduction	3
2. Supporting clauses	3
2.1 Scope	3
2.1.1 Purpose	3
2.1.2 Applicability	3
2.2 Normative/informative references	3
2.2.1 Normative	3
2.2.2 Informative	4
2.3 Definitions	4
2.3.1 General	4
2.3.2 Disclosure classification	5
2.4 Abbreviations	5
2.5 Roles and responsibilities	5
2.6 Process for monitoring	5
2.7 Related/supporting documents	5
3. Specification for new SF ₆ gas supplied in standard gas cylinders	5
3.1 General Requirement	5
3.2 Gas Purity	6
3.3 Cylinder – Type, colour and marking	6
3.4 Valves and fittings	6
4. SF ₆ gas handling	7
5. Authorization	7
6. Revisions	7
7. Development team	7
8. Acknowledgements	8
Annex A	9

Figures

Figure 1: BS 341 British Standard Cylinder Valve Outlets and Connections	6
--	---

1. Introduction

This document is necessary for Eskom Transmission 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 all Eskom's 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.

The Supplier shall read this document to ensure compliance to Eskom Transmission's requirement, also respond with the Technical returnable as indicated under Annex A. The Annex A consists of the technical evaluation criteria which Eskom Transmission uses to evaluate the tender submission.

2. Supporting clauses

2.1 Scope

This document covers Eskom Transmissions 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 Eskom Transmission 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 Eskom Transmission to procure SF₆ gas.

2.1.2 Applicability

This document shall apply throughout Eskom Transmission

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

- [1] ISO 9001, Quality Management Systems.
- [2] Occupation Health and Safety Act (OHS Act) No 85 of 1993 – Construction and Electrical Machinery Regulations
- [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.

ESKOM COPYRIGHT PROTECTED

- [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 9809-1, 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.

2.2.2 Informative

- [16] NRS 087, Guidelines for the purchase use and disposal of SF₆
- [17] 240-125809509, Eskom Greenhouse Gas Emissions Reporting Procedure

2.3 Definitions

2.3.1 General

Definition	Description
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 SF ₆ 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 SF ₆ that complies with IEC 60376 <i>standard</i>
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.
Technical grade SF₆	SF ₆ gas having a very low level of impurities in accordance with IEC 60376 <i>standard</i>
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.
------------------------------------	--

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description	Abbreviation	Description
EHV	Extra High Voltage	HV	High Voltage
OEM	Original Equipment Manufacturer	MV	Medium Voltage
SED	Substation Equipment Diagnostics	CT	Current Transformer
BSP	British Standard	VT	Voltage Transformer
SF ₆	Sulphur hexafluoride gas	IEC	Independent Electoral Commission
GIS	Gas Insulated Switchgear	ORHVS	Operating Regulations for High Voltage Systems
kV	kilo Volt	AIS	Air Insulated Switchgear
MTS	Mixed Technology Switchgear	MPa	Mega-pascal

2.5 Roles and responsibilities

SED HV Plant switchgear specialist shall ensure the correctness of this document. Also, maintains this document up to date with the technical standards.

Group Commercial and Materials Management shall ensure that the content of this document is implemented by the Supplier, and all the documentation required for Eskom Transmission use on its asset that gets installed are received from the Supplier.

2.6 Process for monitoring

Not Applicable.

2.7 Related/supporting documents.

Not Applicable.

3. Specification for new SF₆ gas supplied in standard gas cylinders.

3.1 General Requirement

SF₆ is to be supplied in preferably Class 1 standard type gas cylinders (Class 3 will also be accepted under the prescribed specifications) in which the SF₆ is stored in liquid form under its own vapour pressure when the cylinder is fully charged.

The SF₆ capacity of each cylinder shall be either 50 (± 3) kilograms in a ± 50-litre bottle, 20 (± 1) 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.

ESKOM COPYRIGHT PROTECTED

Gas bottles to be supplied to any Eskom Transmission Major hub / Depot on request (5 or more cylinders per delivery) or must be put available for collection at a centralised mutual agreed supplier depot for the area. eg Johannesburg, Cape Town, Richards Bay, Upington, Bloemfontein, etc.

3.2 Gas Purity

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

The process must be made known to the client, which process was followed by the supplier to supply the gas to the end user. (Was the bottles filled by the supplier from a bulk supply or was this bottle prefilled before the supplier obtained it)

In both cases, a bottle certificate verifying the quality of the gas is to be supplied by the OEM with each bottle. Certificate is to correlate with the specific cylinder with the traceable bottle serial number as reference. If at any time, the client verifies that the new gas supplied does not adhere to the required specification as set by IEC, the supplier is to be held responsible.

3.3 Cylinder – Type, colour and marking

SF₆ shall be supplied in Class 1 seamless metallic cylinders.

Each bottle shall be supplied with a removeable enclosed top valve cover.

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.)

The name of the OEM is to be added to the bottle in painted or stamped format but not by paste on sticker format.

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

3.4 Valves and fittings

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.

The valve outlet shall be to British Standard BS341-3, valve no. 6 as per Figure 2 below. It is a 5/8” BSP RH External thread that accepts a fitting having a flat seal and gasket.

No additional adaptor fittings is to be supplied to ensure 5/8” BSP RH External thread final fitting.

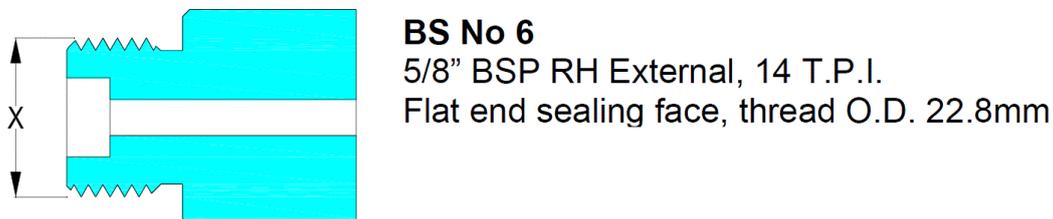


Figure 1: BS 341 British Standard Cylinder Valve Outlets and Connections

4. SF₆ gas handling

The Supplier shall always insist on its personnel handling the SF₆ gas cylinders to comply with SANS 10019, Transportable pressure receptacles for compressed, dissolved and liquefied gases - Basic design, manufacture, use and maintenance. The same shall be applicable to Eskom Transmission personnel interacting with the supplier and handling the SF₆ gas cylinder and switchgear.

The gas Supplier shall keep a full record of all SF₆ gas supplied to Eskom Transmission as well as returned used cylinders from Eskom Transmission, for a period of at least five years after expiry of the Eskom Transmission awarded contract for SF₆ gas purchased on a contract. Also, for at least five years from the date of supply of SF₆ gas supplied through a once off purchase. The Supplier shall make this record available to an Eskom Transmission appointed delegate.

Very important: Eskom Transmission shall accept cylinders that have a legible hydrostatic test date stamped on them and that gas shall be accepted in cylinders that have at the minimum 3 years remaining before next hydrostatic test due date.

5. Authorization

This document has been sent to the following:

Name and surname	Designation
Calvin Bongwe	Middle Manager HV Plant Northern Grid
Ellen Shezi	Middle Manager HV Plant Eastern Grid
Pranesh Sewkumar	Middle Manager HV Plant Southern Grid
Pulane Sereme	Middle Manager HV Plant Central Grid
Rodger Peense	Middle Manager HV Plant Western Grid
Siphesihle Mkhize	Middle Manager HV Plant North-East Grid
Zanele Sethusa	Middle Manager HV Plant Apollo
Matome Matlhadisa	Corporate Specialist HV Plant

6. Revisions

Date	Rev	Compiler	Remarks
March 2024	1	F Schoeman	First Transmission issue

7. Development team

The following people were involved in the development of this document:

- Quinten Nepgen – HV Plant, Northeast Grid
- Raymond Dolly – HV Plant, East Grid
- Pieter Vermeulen - HV Plant, Southern Grid
- Winston Mabusela – HV Plant, Central Grid
- Pierrie Viljoen - HV Plant, Central Grid
- Cambridge Motsitsi - HV Plant, Northeast Grid

ESKOM COPYRIGHT PROTECTED

- Njabulo Nkabinde - HV Plant, East Grid
- Sifiso Khumalo - HV Plant, East Grid

8. Acknowledgements

The Author acknowledges all who made input on this document from its first draft version.

Annex A

All questions is to be answered in writing as stipulated in the evaluation table below:

Failing to provide written proof for all nine statements, will lead to the disqualification of the tender.

The process must be made known to the client, which process was followed by the supplier to supply the gas to the end user.			
Was the bottles filled by the supplier from a bulk supply obtained from the OEM		Was this bottle pre-filled before the supplier obtained it from the OEM	

Description	Proof to be submitted with the tender	Weight %	Score%
<p>SF₆ is to be supplied preferably in Class 1 standard type gas cylinders in which the SF₆ is stored in liquid form under its own vapor pressure when the cylinder is fully charged. Class 3 cylinders will be accepted but not at 11% compliance.</p> <p>11% - Proof of Letter of confirmation that product is supplied in class 1 cylinders. 6% - Proof of Letter of confirmation that product is supplied in class 3 cylinders. 0% - No proof of confirmation of the intent to supply in class 1 cylinders</p>	<p>Letter from OEM to confirm the supply of class 1 or 3 cylinders</p>	<p>11%</p>	
<p>The required purity of new SF₆ to be supplied for SF₆ insulated equipment is detailed in the latest edition of IEC 60376</p> <p>11% - Product Data Sheet confirms compliance to IEC60376 0% - No product sheet supplied or Data sheet does not confirm compliance to IEC60376</p>	<p>Proof of compliance to IEC60376 with product data sheet</p>	<p>11%</p>	
<p>The proof of the SF₆ purity shall be supplied in the form of a traceable bottle specific certificate from Original Supplier. No batch certificate will be accepted.</p> <p>11% - Letter of commitment to supply SF₆ according to IEC60376 0% - No proof of commitment to supply SF₆ according to IEC60376</p>	<p>Letter of commitment to ensure that each bottle is supplied with a traceable reference label verifying bottle and related contents quality</p>	<p>11%</p>	
<p>The SF₆ capacity of each cylinder shall be either 50 (+/- 3) kilograms (in a 50 liter bottle), 20 (+/- 2) Kilograms (in a 20 liter bottle) or 10 (+/- 1) kilograms (in a 10 liter bottle) according to the purchasing requirement Bill of Material.</p> <p>11% - Compliance to content weight / size ration stated above. 0% - Not complying to weight / size ration stated above</p>	<p>Confirmation of bottle content wheights (on quote supplied)</p>	<p>11%</p>	
<p>A removable valve cap shall be supplied with each cylinder and NO Guard ring will be supplied with the bottle.</p> <p>11% - Removable valve cap supplied as stated above. 0% - No Removable valve cap supplied as stated above..</p>	<p>Letter of confirmation that bottle/s will conform to requirement</p>	<p>11%</p>	
<p>The marking of SF₆ gas cylinders (Class 1 category) shall be according to its contents. (Marked as SF₆ / Sulpher Hexa Floride in black painted letters vertically down the length of the bottle of at least 75mm in the case of the 50kg bottle)(20 and 10 kg bottles lettering proportially sized)</p> <p>11% - Letter of confirmation that cylinders will be marked as stated above. 0% No proof that confirms the intent to mark bottles.</p>	<p>Letter of confirmation that bottle/s will conform to requirement</p>	<p>11%</p>	
<p>Cylinder stampings shall comply with the requirements of an approved manufacturing standard according to the requirements of SANS 10019 standard.</p> <p>11% - Cylinder Sesification confirms compliance to SANS 10019 0% - No proof of cylinder compliance to SANS 10019</p>	<p>Letter of confirmation that bottle/s will conform to requirement</p>	<p>11%</p>	

<p>The shutoff valve outlet shall be in accordance with SANS 10019 (Table 9 line item 25; Table 10 namely non-flammable gas) [4] which is to [7] British Standard BS341-3, valve no. 6. It is a 5/8" BSP RH External thread that accepts a fitting having a flat seal and gasket.</p> <p>12% - Compliance to vanlve requirements stated above.</p> <p>0% - Different valve spesification and no fitting supplied with each cylinder</p>	<p>Confirmation of valve type fitted to bottles.</p>	<p>12%</p>	
<p>The SF₆ gas cylinders require hydrostatic testing (hydraulic burst test) every 10 years. The supplier shall provide Eskom the 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 [8],[9].</p> <p>Very important: Eskom shall accept cylinders that have a legible hydrostatic test date stamped on them and that gas shall be accepted in cylinders that have at the minimum 3 years remaining before next hydrostatic test due date.</p> <p>11% - Letter of confirmation that cylinders to be provided will have a valid hydrotesting certificate valid for more than 3 years.</p> <p>0% - No letter of confirmation that cylinders will have valid hydrostatic test certificate valid for longer than 3 years.</p>	<p>Letter of confirmation that bottle/s will conform to requirement</p>	<p>11%</p>	
<p>Total</p>		<p>100%</p>	
<p>Threshold</p>		<p>90%</p>	