

 <b>Eskom</b>	<b>Standard</b>	<b>Technology</b>
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Title: **SPECIFICATION FOR NEW SF6 GAS SUPPLIED IN STANDARD GAS CYLINDERS WITH THE TECHNICAL EVALUATION CRITERIA**

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## **1. Introduction**

This document is necessary for Eskom to procure the correct grade of sulphur hexafluoride (SF<sub>6</sub>) gas for use in MV, HV and EHV SF<sub>6</sub> gas insulated switchgear and the rental of cylinders that contains it. The SF<sub>6</sub> gas is required for use on all Eskom's SF<sub>6</sub> gas filled high voltage equipment, namely, live-tank and dead-tank circuit-breakers (AIS/GIS/MTS), GIS isolators, GIS earthing switches, SF<sub>6</sub> bushings, SF<sub>6</sub> gas compartments, SF<sub>6</sub> CT's and SF<sub>6</sub> VT's.

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

## **2. Supporting clauses**

### **2.1 Scope**

This document covers Eskom Transmissions and Distribution requirements for new SF<sub>6</sub> supplied in standard type gas cylinders for use in electrical apparatus employing SF<sub>6</sub> as insulation and/or interruption medium

#### **2.1.1 Purpose**

The purpose of this document is to ensure that the quality of SF<sub>6</sub> gas supplied to Eskom 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 to procure SF<sub>6</sub> gas and its cylinders.

#### **2.1.2 Applicability**

This document shall apply throughout Eskom Holdings Limited Divisions.

### **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] IEC 60376, Specification of technical grade sulphur hexafluoride (SF<sub>6</sub>) and complementary gases to be used in its mixtures 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 62271-4, Part 4: Handling procedures for sulphur hexafluoride (SF<sub>6</sub>) and its mixtures
- [6] NRS 087, Guidelines For The Management Of SF<sub>6</sub> (Sulfur Hexafluoride) For Use In Electrical Equipment
- [7] BS 341-1:1991, *Transportable gas container valves. Specification for industrial valves for working pressures up to and including 300 bar*

**(superseded by following current versions:**

BS 341-3:2002, Transportable gas container valves. Valve outlet connections.

BS 341-4:2004, Transportable gas container valves. Pressure relief devices)

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- [8] 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
- [9] 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

- [10] 240-125809509, Eskom Greenhouse Gas Emissions Reporting Procedure
- [11] SANS 10263-2, The warehousing of dangerous goods – Part 2: The storage and handling of gas cylinders

## 2.3 Definitions

### 2.3.1 General

Definition	Description
<b>Class 1 cylinder</b>	Seamless metallic pressure receptacle [4]
<b>Class of pressure receptacle</b>	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) [4]
<b>Cylinder</b>	A pressure vessel used to store SF <sub>6</sub> gas is referred to in this standard. { [4] transportable pressure receptacle (that may be seamless, welded or composite) with a watercapacity of 0,5 L to 150 L }
<b>New gas</b>	Technical grade SF <sub>6</sub> that complies with IEC 60376 <i>standard</i> [3]
<b>Pressure receptacle</b>	[4] 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 <b>Note 1</b> All types of pressure receptacle, excluding non-refillable cylinders, are refillable. <b>Note 2</b> 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.
<b>Special gas</b>	Gas or gas mixture that has specific properties and that is prepared for special applications <b>Examples</b> Instrument calibration gas mixtures or technical diving mixtures.
<b>Technical grade SF<sub>6</sub></b>	SF <sub>6</sub> gas having a very low level of impurities in accordance with IEC 60376 <i>standard</i> [5]
<b>Technical evaluator</b>	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.
<b>Threshold for Qualification</b>	This is the threshold that has been determined by Eskom Technical evaluation, which the submission must meet in order 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
AIS	Air Insulated Switchgear
CB	Circuit-breaker
CT	Current Transformer
EHV	Extra High Voltage
Eskom	Eskom Holdings SOC (Ltd)
GIS	Gas Insulated Switchgear
HV	High Voltage
kg	kilo-grams
M.E.W	Major Engineering Works
MV	Medium Voltage
MTS	Mixed Technologies Switchgear
OU	Operating Unit
PPM	Primary Plant Maintenance
SF <sub>6</sub>	Sulphur hexafluoride
VT	Voltage Transformer

## 2.5 Roles and responsibilities

**Engineering** – HV Switchgear specialist shall ensure the correctness of this document. Also, maintains this document up to date with the technical standards.

**Technical evaluator** – Implement the contents of this document applicable to equipment covered by its scope. Technical evaluation report shall be compiled for Eskom purposes that indicates and refers to the clauses of this document.

**Grids (HV Plant) and OU's (PPM, M.E.W & Plant)** – shall handle the SF6 gas cylinders in accordance to this standard.

**Materials Management** – shall ensure that the content of this document is implemented by the Supplier, and all the documentation required for Eskom use on its asset base that is installed, are received from the Supplier of SF6 gas cylinders.

**Commercial and Project Management** – Make use of the up to date version of this document during commercial processes. Shall ensure that the content of this document is implemented by the Supplier, and all the documentation required for Eskom use on its asset base that is installed, are received from the Supplier of SF6 gas cylinders.

**Suppliers** – shall comply with the requirements stated in this document with its Annexes, and respond to Eskom accordingly. Ensure compliance to this standard during the Eskom contracting phase.

## 2.6 Process for monitoring

Not Applicable.

## 2.7 Related/supporting documents

Not Applicable.

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### **3. Specification for new SF<sub>6</sub> gas supplied in standard gas cylinders**

#### **3.1 General Requirement**

- a) SF<sub>6</sub> is to be supplied in Class 1 standard type gas cylinders in which the SF<sub>6</sub> is stored in liquid form under its own vapour pressure when the cylinder is fully charged.
- b) The SF<sub>6</sub> capacity of each cylinder shall be either 50 (+/- 3) kilograms, 20 kg (+/- 2) or 10 (+/- 1) kilograms according to the purchasing requirement Bill of Material.
- c) The supplier shall comply to this Eskom specification, thus as part of the Technical Returnables, shall prepare and submit a written Clause-by-clause undertaking to meet Eskom requirements.

#### **3.1.2 General requirement for the supply of SF<sub>6</sub> gas in cylinders**

- a) The Supplier shall be able to deliver SF<sub>6</sub> gas at Eskom sites. Eskom requires SF<sub>6</sub> gas to be available for emergencies after hours.
- b) The Supplier shall provide response to contractual handling of the SF<sub>6</sub> gas cylinders between the users (site location, Grids/OU) and itself.
- c) Monthly and Annual reporting the SF<sub>6</sub> gas quantity (in kg) which is delivered to Eskom compared to empty weighed cylinders returned to Supplier.
- d) The Eskom technical evaluation team visit to the Supplier's factory (premises) to assess the method and processes involved with the filling of new gas to the cylinders and how all cylinders are managed.

#### **3.2 Gas Purity**

- a) The required purity of new SF<sub>6</sub> to be used in SF<sub>6</sub> insulated equipment is detailed in the latest edition of IEC 60376 standard [3].
- b) The proof of the SF<sub>6</sub> purity shall be supplied in the form of a batch Certificate as well as a batch reference label attached to each and every gas cylinder.

#### **3.3 Cylinder – Type, colour and marking**

- a) SF<sub>6</sub> gas shall be supplied in Class 1 steel cylinders, seamless metallic type in accordance with [4] SANS 10019 standard.
- b) The seamless metallic type gas cylinders shall be in accordance with SANS 10019. In line with this SANS 10019, other countries acceptable manufacturing standards for cylinders as listed under Annex A (List of acceptable manufacturing standards for gas pressure receptacles), shall only be considered if meeting the special conditions stated under its Annex B (Special conditions applicable to the acceptability of standards given in Annex A).
- c) A ring type guard shall be supplied with each cylinder.
- d) The standard colour code marking of the gas cylinder shall be Protea colour (Protea 1020-Y80R) in accordance to gas type "Special gas" in SANS 10019 standard [4], of which the colour is referred by Eskom as pink colour.



Figure 1: Protea 1020-Y80R colour painting of the cylinder

- e) As per Figure 1, the marking of SF6 gas cylinders (Class 1 category) shall be according to its contents.
- f) Cylinder stampings shall comply with the requirements of an approved manufacturing standard according to the requirements of SANS 10019 standard [4].

### 3.4 Valves and fittings

- a) Each cylinder shall be equipped with a one way type shutoff valve which ensures the contents may only be extracted by the user.
- b) 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 as per Figure 2 below. It is a 5/8" BSP RH External thread that accepts a fitting having a flat seal and gasket.

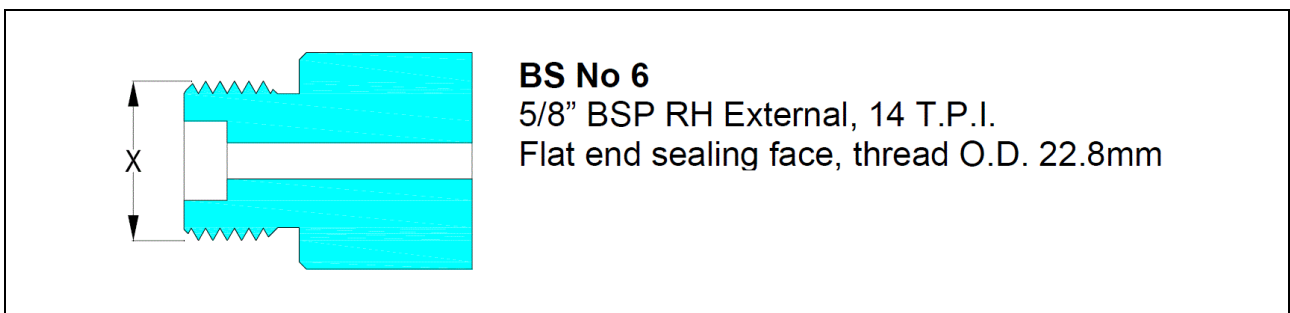


Figure 2: BS 341 British Standard Cylinder Valve Outlets and Connections



## 4. SF<sub>6</sub> gas and cylinder handling

### 4.1 SF<sub>6</sub> gas cylinders design, manufacturing and testing

- a) Strict adherence to South African National Standard SANS 10019 standard [4] shall be exercised.
- b) The SF<sub>6</sub> 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].

**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.

- c) The Supplier shall submit with tender documentation the OEM copy of the prototype test cylinder. This prototype shall have undergone type tests including the hydraulic bursting test. The acceptable Certificate format is that similar to Annex C of SANS/ ISO 9809 standard [8],[9].

### 4.2 SF<sub>6</sub> gas cylinders handling

- a) The Supplier shall at all times insist on its personnel handling the SF<sub>6</sub> gas cylinders to comply with the SF<sub>6</sub> gas handling standard [5], [6]. The same shall be applicable to Eskom personnel interacting with the supplier and handling the SF<sub>6</sub> gas cylinder and switchgear.
- b) The gas Supplier shall keep a full record of all SF<sub>6</sub> gas supplied to Eskom, and shall retain this record for a period of at least five years after expiry of the Eskom awarded contract for SF<sub>6</sub> gas purchased on a contract. Also, for at least five years from the date of supply of SF<sub>6</sub> gas supplied through a once-off purchase. The Supplier shall make this record available to an Eskom appointed delegate.

## 5. Authorization

This document has been sent to:

Name and surname	Designation
Bheki Ntshangase	Senior Manager, Tx Substation Equipment and Diagnostics
Alex Ndlela	Senior Manager, Dx Engineering
Frik Schoeman	HV/EHV GIS/MTS Care Group Convener
Jabulani Cebekhulu	Air Insulated Switchgear Care Group Convener
Tony Taute	Tx Switchgear Task Team Convener & Tx NWG HV Plant Manager
Freddy Mvula	Dx Switchgear Maintenance Task Team Convener
Isaac Sibeko	Dx Operations Support

## 6. Revisions

Date	Rev	Compiler	Remarks
May 2021	2	S Nkosi/ G Drake	Numbering all the sub-clauses; Updated departments of Eskom personnel; Reviewed sub-clauses – 1; 2.2.1; 2.3.1; 3.1; 3.2; 3.3; 3.4; 4; 5; 6; 7; Reviewed Annex A added previous separate sheet of requirements. Introduced scoring of criteria and the minimum threshold for qualifying submission (80 %)

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Date	Rev	Compiler	Remarks
Dec 2019	1	G Drake/ S Nkosi	First official issue on the new 240-numbering. Revised old SF6 gas cylinder document issued for comments now allocated the new 240-numbering.

## **7. Development team**

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

- Garth Drake – Tx Engineering, RT&D
- Sphiwe Nkosi – Tx Engineering, Substation Equipment & Analytics
- Frik Schoeman – Tx Engineering, Substation Equipment & Analytics
- Raymond Dolly – HV Plant, Tx East Grid

## **8. Acknowledgements**

The compiler acknowledges all who made input on this document from its first draft version, and up to now on it new numbering with special acknowledgement to the late Richard Hopkins. Also Andre Marais who contributed to Rev 1.

**– Annex A – Technical evaluation criteria for new SF6 gas supplied in cylinders**

This evaluation criteria shall be used to perform technical evaluation of the technical submissions from the Suppliers that tender for the supply of new SF6 gas supplied in cylinders. This evaluation exercise is performed by the Eskom technical evaluators.

This part of the evaluation starts when the technical submissions are opened for the first time. It begins at evaluation of the Mandatory criteria Stage 1 (Table A1), then proceeds to the Scoring – Stage 2 (Table A2).

The Eskom technical evaluator will go through the details of the returnable submissions that are required and will ensure that Stage 1 qualification criteria are met. Stage 1 returnables are the following:-

**8.1.1 Mandatory criteria required for Stage 1**

The following technical returnables required for each technical submission shall be provided by the Supplier with technical documentation:-

- a) Clause-by-clause responses that answers to the clauses of this specification and its Annex A.
- b) The Supplier shall also supply all the documents required under Table A2 (column titled – “**Required Returnable Documentation**”)

**Note:** If the above returnables are not available on each technical submission of that particular item tendered for, that technical submission is disqualified.

Only the tender submission that has complied with the Stage 1 requirement, shall be taken through to Stage 2 of Desktop evaluation. The full scoring that the technical submission can score under Stage 2 is 100%. The technical threshold for qualification is 80 %.

The successful tender submission that scores 80 % and above, shall be considered for further technical evaluation process. Any technical submission that scored below 80 % is disqualified for any further evaluation.

**The successful tender submission which meets the threshold of 80 %**

The Eskom technical evaluators shall perform the following to the tender submission that has successfully met the technical threshold for qualification of 80 %:-

- a) The list of technical deviations shall be compiled by the technical evaluator.

**Note:** It must be noted that when the Supplier has listed the technical deviations on an offered item, it does not mean that such are already acceptable to Eskom.

**Table 1: Technical evaluation mandatory requirements – Stage 1**

STAGE 1- BASIC COMPLIANCE: TENDER DELIVERABLES AND MANDATORY TECHNICAL REQUIREMENTS FOR EVALUATION						
Item	240-151122225 Clause Ref No.	Description of technical requirement	Required Returnable Documentation	Weight	Yes / No	Eskom assessment
1		<b>Mandatory Technical Returnables</b>				
a)	3.1	Spec Clause-by-clause responses that answers to the clause of this specification and Annex A.	Clause-by-clause document	Yes submitted (continue to Stage 2) / Not submitted (discontinue evaluation)		

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Item	240-151122225 Clause Ref No.	Description of technical requirement	Required Returnable Documentation	Weight	Yes / No	Eskom assessment
b)		The Supplier shall also supply all the documents required under Table A2	Other returnables for scoring listed below 2) Certificate of compliance; 3) Technical data sheet of the cylinder; 4) Certificate of gas purity; 5) Documented proof of colour code marking used to comply with protea as SANS 10019; 6) Photo of cylinder stamping evidencing compliance with the requirements of SANS 10019; 7) Certificate of compliance with BS341-3; 8) Valid Test Certificate of hydrostatic testing	Yes submitted (continue to Stage 2) / Not submitted (discontinue evaluation)		
		<b>NB : FAILURE TO SUBMIT THE TENDER RETURNABLES IN STAGE 1 ABOVE SHALL RENDER THE TENDERER NON-RESPONSIVE AND WILL BE DISQUALIFIED FOR FURTHER EVALUATION</b>				

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Unique Identifier: **240-151122225**Revision: **2**Page: **12 of 14****Table 2: Technical evaluation scoring – Stage 2**

<b>STAGE 2 – SCORING AGAINST CRITERIA FOR EVALUATION</b> (Total = 100 %, minimum threshold for qualification = 80 %)						
<b>Item</b>		<b>Description of technical requirement</b>	<b>Required Returnable Documentation</b>	<b>Weight</b>	<b>Score</b>	<b>Eskom assessment</b>
<b>1)</b>		<b>Compliance to Eskom specification</b>				
	3.1	Spec Clause-by-clause responses that answers to the clause of this specification.	Clause-by-clause document	+20% = (Comply to Eskom spec)		
				+18 % = (minor deviations possible to address before contracting);		
				+0 % = (deviations not possible to address before contracting, does not comply to Eskom spec)		
<b>2</b>	<b>3.1</b>	SF6 is to be supplied in Class 1 standard type gas cylinders in which the SF6 is stored in liquid form under its own vapour pressure when the cylinder is fully charged. <b>Note:</b> A ring type guard shall be supplied with each cylinder.	Certificate of compliance to Class 1 type	+20% = Comply (Class 1)		
				+18 % = (Equivalent offered using another country standard acceptable by SANS 10019);		
				+0 % = (does not comply)		
<b>3</b>	<b>3.1</b>	SF6 gas is to be supplied in cylinder sizes 9kg, 20kg and 50kg	Technical data sheet of the cylinder	+20 % = (Comply (as per Eskom sizes)		

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Item		Description of technical requirement	Required Returnable Documentation	Weight	Score	Eskom assessment
				+18 % = Equivalent, but not exact Eskom standard;		
				0 % = (does not comply)		
4	3.2	The required purity of new SF6 gas to be used in SF6 gas insulated equipment is detailed in the latest edition of IEC 60376 standard [3]. <b>Note:</b> Proof of the SF6 gas purity shall be supplied in the form of a batch certificate as well as a batch reference label attached to each and every gas cylinder.	Certificate of gas purity	+5 % = (Comply to IEC 60376);		
				0 % = (doesn't comply to IEC 60376)		
5	3.3	The standard colour code marking of the gas cylinder shall be protea colour (Protea 1020-Y80R) in accordance to gas type "Special gas" in SANS/ IEC 10019 standard [4], of which the colour is referred by Eskom as pink colour.	Documented proof of colour code marking used to comply with protea as SANS 10019	+5 % = Comply (Protea)		
				+3 % = (other Pink colour, not Protea);		
				0 % = (doesn't comply, it uses different colour)		
6	3.3	Cylinder stampings shall comply with the requirements of an approved manufacturing standard according to the requirements of SANS 10019 standard [4].	Photo of cylinder stamping evidencing compliance with the requirements of SANS 10019	+5 % = (comply) (stamped but meeting other standard that SANS 10019 states)		

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Item		Description of technical requirement	Required Returnable Documentation	Weight	Score	Eskom assessment
				0 % = (is not stamped at all)		
<b>7</b>	<b>3.4</b>	Each cylinder shall be equipped with a one-way type shutoff valve.	Certificate of compliance with BS341-3	+20 % = (Comply to BS 341-3);		
				0 % = (doesn't comply to BS 341-3)		
<b>8</b>	<b>4</b>	The SF6 gas cylinders require hydrostatic testing (hydraulic bursting test) every 10 years. Does your company insist on hydrostatic (hydraulic bursting test) testing of its SF6 gas cylinders? (minimum 10 yearly interval) (Also as per <b>Important Note</b> )	Valid Test Certificate of hydrostatic testing	+5 % = (Comply – valid hydrostatic test)		
				0 % = (doesn't comply- no hydro-testing 10-yearly)		
		<b>Minimum Threshold for qualification</b>		<b>80 %</b>		
		<b>Subtotal (Scored)</b>				
		<b>Grand total (Scored)</b>		<b>100 %</b>		

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