

 <b>Eskom</b>	<b>Standard</b>	<b>Technology</b>
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Title: **SPECIFICATION FOR THE  
REPLACEMENT OF THE  
SERUMULA BLUE PHASE MOV**

Unique Identifier: **240-170000366**

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## **1. Introduction**

On Tuesday, 26 May 2020, 13:03 the Serumula 400kV Series Capacitor Bank No. 1, situated in the Free State Grid, was switched out of service after routine inspections identified a visual MOV being faulty on the blue phase.

This specification sets out Eskom's requirements for the design, manufacture, testing, delivery and installation of an entire MOV for use on the blue phase at Serumula series capacitor bank.

## **2. Supporting Clauses**

### **2.1 Scope**

This specification sets out Eskom's requirements for the manufacture, testing, delivery and installation of an MOV for use on the blue phase at Serumula series capacitor bank.

#### **2.1.1 Purpose**

The purpose of this specification is to ensure that the MOV for use on the blue phase at Serumula series capacitor bank are designed, manufactured, tested, supplied, delivered and installed in accordance with Eskom's requirements to satisfy the desired technical performance.

#### **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 and applicable amendments of the documents listed in the following paragraphs.

### **2.2.1 Normative**

- [1] ISO 9001: 2015 Quality Management Systems.
- [2] SANS/IEC 60099-4: 2014 Surge Arresters - Part 4: Metal-oxide surge arresters without gaps for a.c. systems
- [3] SANS 60815: 2009/IEC 60815: 2008 Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles - Part 3: Polymer insulators for a.c. systems
- [4] SANS 121: 2011/ISO 1461:2009: Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods.
- [5] SANS 17025: 2018/IEC/ISO 17025: 2017, General requirements for the competence of testing and calibration laboratories

### **2.2.2 Informative**

- [6] IEEE Std C62.11-1999: IEEE Standard for Metal-Oxide Surge Arresters for AC Power Circuits (> 1 kV)
- [7] IEC 60071-1:2006, Insulation co-ordination – Part 1: Definitions, principles and rules
- [8] Eskom Procedure, 240-95453610, Management of Manufacturers/Supplier Equipment Drawings, Revision 3.
- [9] SANS/IEC 60143-2:1994, Series capacitors for power systems – Part 1: General

[10] SANS/IEC 60143-2:1994, Series capacitors for power systems – Part 2: Protective equipment for series capacitor banks

[11] SANS/IEC 60143-3:1998, Series capacitors for power systems – Part 3: Internal fuses

## 2.3 Definitions

### 2.3.1 General

The Station class surge arresters are classified according to Table 1. The table is adopted from SANS/IEC60099-4:2014 and only shows the information relevant to Station class surge arresters.

**Table 1: Station Arrester Classification [2]**

Station Arrester class				
Designation	SH	SH	SM	SL
Nominal discharge current	20 kA	20 kA	10 kA	10 kA
Switching impulse discharge current	2 kA	2 kA	1 kA	0.5 kA
$Q_{rs}$ ( C )	$\geq 3.6$	$\geq 2.4$	$\geq 1.6$	$\geq 1$
$W_{th}$ (kJ/kV)	$\geq 14$	$\geq 10$	$\geq 7$	$\geq 4$
Line Discharge Class (IEC/SANS 60099-4: 2014)	5	4	3	2

**Note:** The letter “S” refers to Station class. Letters “H”, “M” and “L” in the designation stand for “High”, “Medium” and “Low” duty, respectively.

**Table 2: Site Pollution Severity Class [3]**

Site Pollution Severity Class (SPS)	Specific creepage distance for three-phase ac systems in mm/kV (SCD)	Unified Specific creepage distance for the rms voltage across the insulator in mm/kV (USCD)
Light	16	28
Medium	20	35
Heavy	25	44
Very Heavy	31	55
Extreme	38	66

Only the definitions related to the identification and classification of Station Class Metal Oxide Surge Arresters are provided in definitions. Refer to SANS/IEC60099-4:2014 for other related terms and definitions.

Definition	Description
<b>Maximum continuous operating voltage (MCOV or <math>U_c</math>)</b>	The highest r.m.s. power-frequency voltage that an arrester can withstand continuously.
<b>Mean Breaking Load (MBL)</b>	The average breaking load for porcelain or cast resin-housed arresters determined from tests
<b>Nominal discharge current of an arrester (<math>I_n</math>)</b>	The peak value of lightning impulse current which is used to classify an arrester.

Definition	Description
<b>Rated voltage of an arrester (<math>U_r</math>)</b>	The maximum permissible 10 s power frequency r.m.s voltage that can be applied between its terminals at which it is designed to operate correctly under temporary overvoltage conditions as established in the operating duty tests. <b>NOTE</b> — The rated voltage is used as a reference parameter for the specification of operating characteristics.
<b>Repetitive Charge Transfer Rating (<math>Q_{rs}</math>)</b>	Maximum specified charge transfer capability of an arrester, in the form of a single event or group of surges that may be transferred through an arrester without causing mechanical failure or unacceptable electrical degradation to the Metal Oxide resistors. <b>Note</b> — The charge is calculated as the absolute value of current integrated over time. For the purpose of this standard this is the charge that is accumulated in a single event or group of surges lasting for not more than 2 s and which may be followed by a subsequent event at a time interval not shorter than 60 s.
<b>Specified long-term load (SLL)</b>	Force perpendicular to the longitudinal axis of an arrester, allowed to be continuously applied during service without causing any mechanical damage to the arrester
<b>Specified short-term Load (SSL)</b>	Greatest force perpendicular to the longitudinal axis of an arrester, allowed to be applied during service for short periods and for relatively rare events (for example, short-circuit current loads and extreme wind gusts) without causing any mechanical damage to the arrester
<b>Thermal charge transfer rating(<math>Q_{th}</math>)</b>	Maximum specified charge that may be transferred through an arrester or arrester section within 3 minutes in a thermal recovery test without causing a thermal runaway. Only relevant for Distribution class arresters.
<b>Thermal energy rating (<math>W_{th}</math>)</b>	Maximum specified energy (kJ/kV) as a function of the Rated voltage ( $U_r$ ), that may be injected into an arrester or arrester section within 3 minutes in a thermal recovery test without causing a thermal runaway.

### 2.3.2 Disclosure Classification

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

## 2.4 Abbreviations

Abbreviation	Description
$\mu s$	Microsecond
A	Ampere
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
ISO	International Standardization Organisation
kA	kiloAmpere
kg	kilogram
kJ	kiloJoule
kV	kiloVolt
MOV	Metal Oxide Varistor
OEM	Original Equipment Manufacturer

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Abbreviation	Description
PCD	Pitch Circle Diameter
SANS	South African National Standard
SCD	Specific Creepage Distance
SPS	Site Pollution Severity Class

## 2.5 Roles and Responsibilities

The designated Technical Specialist shall ensure that this document is updated, renewed and current at all times. Any person in Eskom and its subsidiaries shall use this standard.

## 2.6 Process for Monitoring

Not applicable.

## 2.7 Related/Supporting Documents

Not applicable.

# 3. Specification for Blue Phase Serumula Series Capacitor Bank MOV

## 3.1 Requirements

### 3.1.1 Serumula Series Capacitor Bank Details

The 400kV Serumula series capacitor bank no. 1 is connected in series with the 400kV Beta-Delphi Transmission line for the purpose of increasing the power transfer capability. The series capacitor equipped with fuseless type capacitor units and is of H configuration. The series capacitor bank equipment is situated on a raised platform that is insulated from ground level for a 400kV BIL level. The capacitor portion is protected with a gapless MOV system during system disturbances. See Table 3 for Series Capacitor bank details.

The MOV stacks are installed on platform level and consist out of columns connected in series and parallel arrangements. 10 % spare MOV stacks are included in the total MOV module to allow equal and gradual change in MOV stack characteristics due to line faults and energy conduction.

**Table 3: Series Capacitor Bank Details**

Manufacturer	-	ABB
Year	-	2009
Rated System Voltage, UN	kV	400
Rated Voltage, UM	kV	420
Rated Output, QM	MVA <sub>r</sub> – 3 phase	292.9
Nominal Line Current, IN	A (r.m.s.)	2 093
Swing Current, ISW	A (r.m.s.)	3 349
Rated Capacitor reactance, XN	Ω	66.87
Protective Level	kV (peak)	435.4
Over Voltage Protection	-	MOV – Gapless
Rated short time energy rating per phase (excluding spares)	MJ	77



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Rated short time energy rating per phase (including redundancy)	MJ	85.4
Number of MOV columns per phase	-	52
Number of spare MOV columns per phase	-	6
MOV Coordinating current per phase	kA (peak)	10
Capacitor Unit Fusing Technology	-	Fuseless



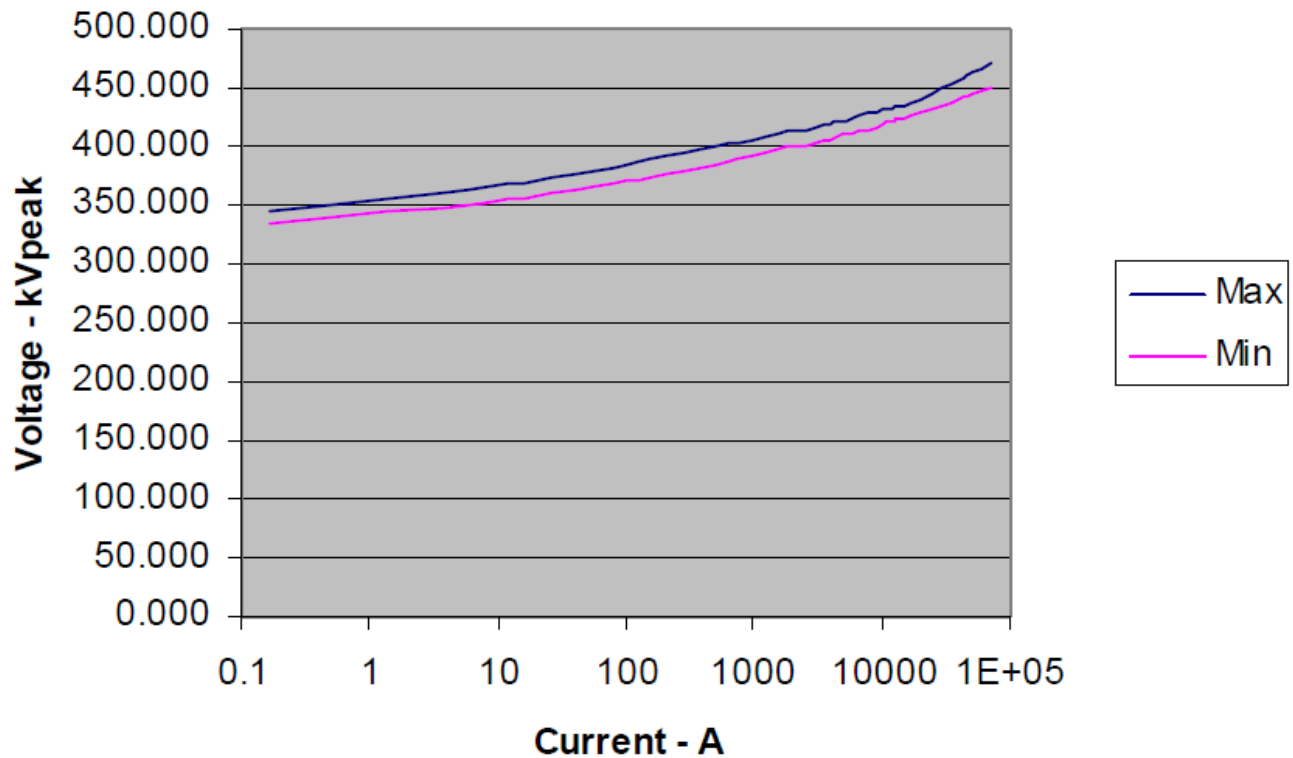
**Figure 1: 400kV, 292 MVar Serumula Series Capacitor No. 1 Blue phase**

### 3.1.2 MOV characteristics for Serumula bank

Figure 2 below sets out the V-I characteristic of the current MOV on the blue phase of the Serumula Series Capacitor Bank. The successful tenderer shall, if required, prove through simulations that the product offered matches / exceeds the capability as described by this V-I characteristic.

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### 3.1.3 Operating Conditions

Table 4: Operating Conditions

a)	Altitude	Up to 1800 m above Sea Level
b)	Average humidity	30% to 90%;
c)	Ambient temperature	Minimum: - 10 °C Maximum: + 40 °C
d)	Daily temperature variation	Maximum: 30 °C
e)	Solar radiation	1.1 kW/m <sup>2</sup>
f)	IEC 60815 Pollution Severity Class	Heavy
g)	Earthing	Effectively earthed
h)	System configuration	Three-phase, three wire
i)	Nominal system voltage (Un)	400 kV
j)	System frequency	50 Hz
	Seismic	0.3 G

### 3.1.4 General Requirements

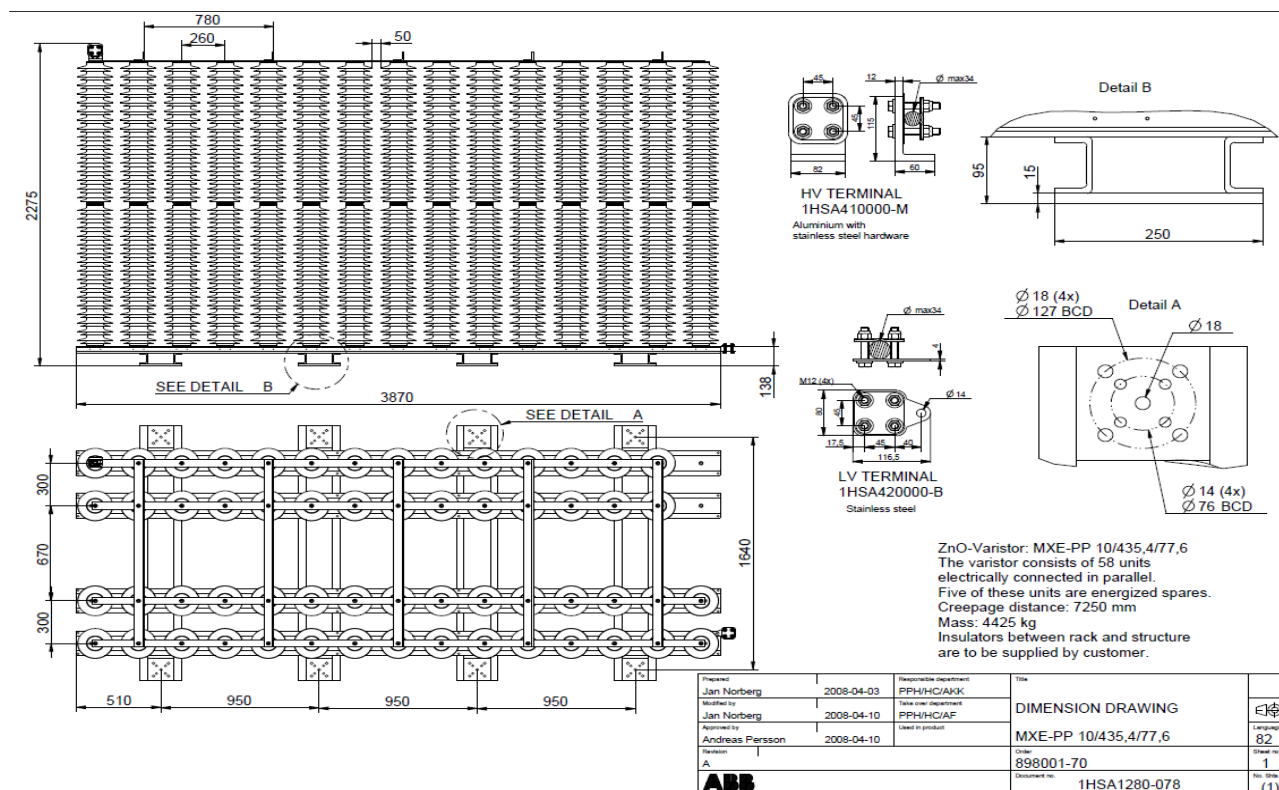
For each Nominal System Voltage level, the major performance requirements are set out in the respective Schedule A. In addition to these requirements, the following should be met:

- MOV will be able to withstand the effects of airborne contamination on the external surfaces of the arrester housing.

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- b) Internal components shall be dry at the time of assembly and arresters shall be permanently sealed. If elastomer gaskets or seals are used, precautions shall be taken to ensure adequate compression and that such gaskets or seals do not deteriorate in service as a result of exposure to the environment or electrical stresses.
- c) All ferrous, non-current carrying components exposed to the atmosphere shall be hot-dip galvanized in accordance with SANS 121.
- d) The MOV shall be mounted in the same area as per Figure 2. The OEM shall ensure that no galvanic (bi-metal) corrosion can occur.
- e) The MOV shall have the same approximate weight as the currently installed MOV (4425 kg).
- f) MOV shall withstand short-circuit currents without violent shattering, and shall have the ability to self-extinguish any fire caused by the arc. The short circuit performance of the MOV shall be as per IEC/SANS 60099-4, declared over a period of 200ms(0.2s)
- g) MOV are to be housed in polymeric insulation, and profiles are to be designed in accordance with the requirements in IEC 60815 with no deviations. Open, flat profiles are preferred.
- h) Only conventional silicone rubber polymer will be accepted for the polymeric housing material. Non-conventional or exotic blends of material are not acceptable.
- i) Samples, shall be available for inspection at the premises of the supplier. Eskom reserves the right to sample test any unit(s) available or so requested.
- j) Unique product code shall be assigned per individual MOV component.
- k) The guarantees of all major performance criteria stated in Schedule B shall be supported by evidence in the form of type test certificates.
- l) MOV shall be designed for an expected lifespan of 30 years.
- m) All information to be supplied in English.

**Figure 2: Clearance limitation****ESKOM COPYRIGHT PROTECTED**

### **3.1.5 Mechanical Requirements**

#### **3.1.5.1 Sealing**

Sealing, except where the external housing is directly moulded on the internal components:

- MOV will be permanently sealed. Dryness of internal components will be ensured by hermetic seals and moisture absorption devices e.g. silica gel.
- An approved routine test of seal integrity must be carried out on every assembled arrester or arrester unit.
- Technical details of the sealing arrangements and the routine seal test must be submitted for approval.
- The sealing requirement is not applicable where the external housing is directly moulded to the internal components of the surge arrester.

#### **3.1.5.2 Mounting**

Mounting shall be done to fit the footprint and the terminations of the existing MOV.

#### **3.1.5.3 Finish**

All ferrous components exposed to the atmosphere, excluding those of stainless steel and aluminium, will be hot-dip galvanized in accordance with SANS 121. This includes earth terminals and holding-down bolts.

#### **3.1.5.4 Dimension limitations**

The MOV shall be mounted in the same area as per Figure 2.

### **3.2 Tests**

#### **3.2.1 General**

- a) All type and routine tests on arresters, or where applicable pro-rata sections, identical to those stipulated in Technical Schedule A and offered in Technical Schedule B of an enquiry document, shall be conducted in accordance with SANS 60099-4: 2014.
- b) Single copies of type test reports (in English) shall be submitted with a tender. If all the required type test reports are not submitted, the tender will be rated incomplete and will be excluded. If required, any special test reports will be submitted as soon as possible and at least three months before dispatch of the arresters.
- c) Type tests reports from in-house testing laboratories must be compliant to ISO/IEC 17025 and have been witnessed by an independent accredited body to assess the validity of such tests.
- d) Eskom reserves the right to demand test reports from an accredited testing laboratory should any problems arise that question the validity of the in-house test reports. An accredited testing laboratory is defined as that which is ISO/IEC 17025 accredited and/or which holds valid certification issued by ILAC (International Laboratory Accreditation Corporation) or one of its members.
- e) Eskom reserves the right to appoint a representative to inspect the arresters at any stage of manufacture and to witness and sanction any tests. If inspection or witnessing of tests is required, Eskom will advise the contractor who will then give at least eight weeks notice of the date on which impending inspection or testing will take place.
- f) Any design change must be verified by tests wherever applicable and shall be subject to Eskom's approval.

**3.2.2 Type Tests**

- a) Test certificates and reports shall be provided to prove that the surge arresters comply fully with the provisions of SANS 60099-4:2014 for polymer-housed arresters as well as for any further requirements as stipulated in this specification as well as Technical Schedule A.
- b) Should such evidence not be available, the relevant type tests shall be performed and the costs thereof paid by the manufacturer or supplier.
- c) Type test reports shall be arranged and numbered in the order set out in Annex B and shall be marked clearly with the identification and description of the relevant test number in Annex B.
- d) Should the product naming convention used in the type test report differ from that of the product offered, clear unambiguous explanation must be given indicating how the product tested is applicable to that offered.
- e) The following type tests shall be conducted as per SANS 60099-4:2014 and submitted for review:

**Table 5: Type test summary**

Test		SANS/IEC60099-4 Reference Section
1	Insulation withstand test on the arrester housing	Lighting Impulse 10.8.2 Switching Impulse 10.8.2 Power Frequency 10.8.2
2	Residual voltage test	Steep Current 10.8.3 Switching Impulse 10.8.3 Power Frequency 10.8.3
3	Test to verify long term stability under continuous operating voltage	10.8.4
4	Repetitive charge transfer withstand	10.8.5
5	Heat dissipation behaviour verification of test sample	10.8.6
6	Operating duty test	10.8.7
7	Power-frequency voltage versus time	10.8.8
8	Short-circuit tests	10.8.10
9	Bending moment test	10.8.11
10	Environmental tests (Applicable to Porcelain housings only)	10.8.12
11	Seal leak rate (Applicable to housings having an enclosed gas volume)	10.8.13
12	Radio interference voltage (RIV) test	10.8.14
13	Test to verify the dielectric withstand of internal components	10.8.15
14	Weather ageing	10.8.17

**3.2.3 Routine Tests**

Routine tests shall be performed on the arresters in accordance with SANS 60099-4:2014 clause 9.

**3.2.3.1 Measure reference voltage (Uref)**

The test shall be conducted in accordance with IEC60099-4, clause 9.1.a.

### **3.2.3.2 Residual voltage test**

The test shall be conducted in accordance with IEC60099-4, clause 9.1.b.

### **3.2.3.3 Internal partial discharge test**

The tests shall be conducted in accordance with IEC60099-4, clause 9.1.c.

### **3.2.3.4 Leakage check**

The tests shall be conducted in accordance with IEC60099-4, clause 9.1.e where required.

## **3.3 Documentation**

### **3.3.1 Supporting Data**

Supporting data in the form of marketing brochures or catalogues stating the electrical characteristics of the arresters on offer shall be included with the tender. Deviations between the published data and the completed Technical Schedule A shall be pointed out and clarified.

### **3.3.2 Characteristics Curves**

The manufacturer of MOV shall furnish Eskom with the following characteristic data:

- a) V-I characteristics (protective level characteristics) at 8/20  $\mu$ s, 30/60  $\mu$ s and 1/2  $\mu$ s (steep current) impulses
- b) Temporary overvoltage withstand capability curve with and without prior duty.
- c) AC voltage-resistive current curves from 20°C to 180°C

**Note:** These curves shall be submitted as drawings that contain the manufacturers name, logo and a unique drawing number as a minimum. Clear unambiguous definitions of rated voltage, reference voltage and protective level must be provided. Curves submitted as part of a test report and/or data sheet are not acceptable. Items a and b are mandatory requirements, items c may be required before contract award or to be made available during factory inspection.

### **3.3.3 Drawings Submitted with Tender**

Single copies of drawings shall be submitted as part of the original tender showing the following details:

- a) Overall dimensions, including mounting details with drilling plan.
- b) Clamping arrangements.
- c) Line and earth terminal type details and physical dimensions.
- d) Minimum electrical clearances.
- e) Details of special items such as the disconnecting device or overpressure relief device.
- f) Total creepage and SCD.

### **3.3.4 Drawings (Contractual)**

Outline drawings, electronic copies in scale PDF and acceptable CAD format, will be submitted and must contain the following information as a minimum:

- a) Overall dimensions, including mounting details
- b) Plan view of layout of the MOV with dimensions
- c) Details of MOV terminals and conductor clamping arrangements
- d) Mass of complete MOV, and individual arrester sections
- e) Minimum electrical clearances

- f) Creepage distances
- g) A drawing indicating the position of the identification rating plate and the detail that will be provided on the rating plate.
- h) MOV electrical and mechanical ratings

Drawings will be submitted not later than one month from contract award date for approval. Once the drawings have been approved by Eskom, the contractor will be notified and supplied with an Eskom drawing number and additional details (if required). The Eskom drawing number as well as additional details (if required) must then be incorporated in the approved drawing and sent back to Eskom for acceptance and archiving.

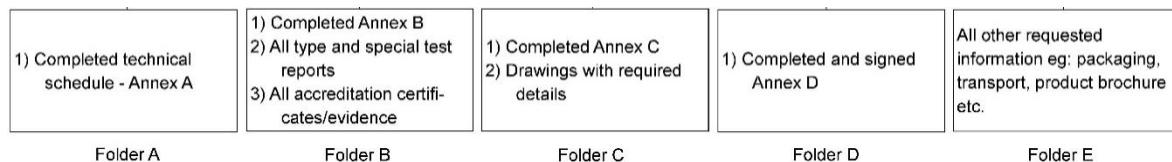
### **3.3.5 Supporting Documentation**

Single copies of the following documentation will be submitted as part of the original tender:

- a) Product catalogue.
- b) Transport, storage and installation procedure.
- c) Compliance to ISO 9001 and IEC/ ISO 17025 certificates.
- d) Customer reference list for item type tendered for.
- e) Factory location, facility name, production start date and routine test failure rate for item tendered for.

### **3.3.6 Electronic File structure**

For electronic/softcopy files submitted as part of the technical component of the tender submission, the folder structure given in Figure 3 is preferred. The folder structure should contain all relevant information relating to this item.



**Figure 3: Folder structure for electronic files**

## **3.4 Marking and Packaging**

### **3.4.1 Marking**

The minimum required information shall appear on a rating plate permanently attached to the arrester. In addition the following shall appear:

- a) Repetitive charge transfer rating,  $Q_{rs}$ .
- b) Contamination withstand level or specific creepage distance in mm/kV.
- c) Name of Manufacturer.

### **3.4.2 Packaging**

All packaging shall be such as to protect the MOV and its components against corrosion and damage during normal handling, uncarting and transportation.

The crate must be able to be lifted using forklifts and/or slings. Lifting positions must be marked. Crates must be designed such that inspections of the contents can be undertaken without damaging the crate.

It is preferred that the packing should allow for surge arresters to be transported and stored on a horizontal position which would prevent toppling over during transportation and storage.

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The packing should protect the profile of the shed from deformity or damage during transport and for both outdoor and indoor storage

- a) Marking of packaging shall be such as to permit easy identification of the components without their removal from the packing.
- b) Each crate shall bear the following information on the outside of the crate:
  - Product description;
  - Product code or part number;
  - Name of manufacturer and contact details;
  - Number of components of each type in the container;
  - Address of the destination;
  - Eskom's purchase order number;
  - Eskom's material SAP number(s).
- c) If the product is supplied by a third party supplier (e.g. importers, agents, etc.) the crate shall additionally bear the following information:
  - Name of the supplier;
  - Contact details of the supplier.
- d) Assembly diagrams and installation/instruction manual must be supplied with each arrester and associated fittings in weather proof housing to ensure correct usage and installation at site.

#### **4. Authorization**

This document has been seen and accepted by:

<b>Name and surname</b>	<b>Designation</b>
Bheki Ntshangase	Senior Manager: PDE – High Voltage Plant
Kevin Kleinhans	PDE – Chief Engineer
Neels van Staden	PDE – Senior Consultant – FACTS Devices
Pranesh Sewkumar	HV Plant Manager: Free State Grid

#### **5. Revisions**

<b>Date</b>	<b>Rev</b>	<b>Compiler</b>	<b>Remarks</b>
March 2021	1	K Kleinhans	New Specification

#### **6. Development Team**

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

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- F Witbooi
- N v Staden
- P Sewkumar
- V Masuku

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- M Sekgobela

## **7. Acknowledgements**

The Free State Grid and PDE – HV Plant colleagues are acknowledged for their input in compiling this document.

**Annex A – Technical Schedule**

**Note:** Details provided in Schedule B must be only for one item per sheet. Print and complete a new sheet for each separate item tendered for.

Schedule A: Eskom's particular requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Description	Unit	Schedule A	Schedule B
<b>1</b>	<b>Surge arrester identification:</b>		<b>xxxxxxxxxx</b>	<b>xxxxxxxxxx</b>
1.1	Supplier		xxxxxxx	
1.2	Manufacturer, physical address and name of factory		xxxxxxx	
1.3	Product code		xxxxxxx	
<b>2</b>	<b>Electrical Characteristics</b>		<b>xxxxxxxxxx</b>	<b>xxxxxxxxxx</b>
2.1	IEC 60815 Pollution class (minimum)		Heavy	
2.2	System earthing		Effective	
2.3	Nominal system voltage ( $U_n$ )	kV	400	
2.4	Maximum system voltage	kV	420	
2.5	Supply frequency	Hz	50	
2.6	Lightning Impulse Withstand Level (LIWL) of system	kV <sub>(peak)</sub>	1550	
2.7	Switching Impulse Withstand Voltage (SIWL) of system	kV <sub>rms</sub>	1050	
2.8	Rated short time energy rating per phase (excluding spares)	MJ	77	
2.9	Rated short time energy rating per phase (including redundancy)	MJ	85.4	
<b>3</b>	<b>Individual Arrester Parameters</b>		<b>xxxxxxxxxx</b>	<b>xxxxxxxxxx</b>
3.1	Arrester classification		Station class	
3.2	IEC line discharge class		Specify	
3.3	Nominal discharge current	kA	Specify	
3.4	Switching Impulse discharge current	kA <sub>(peak)</sub>	Specify	
3.5	Arrester rated voltage ( $U_r$ )	kV	Specify	
3.6	MCOV ( $U_c$ )	kV	140	
3.7	Maximum residual voltage ( $U_{res}$ ) at 10kA peak	kV	435	
3.8	Minimum Repetitive Charge Transfer Rating ( $Q_{rs}$ )	C	Specify	
3.9	Minimum Thermal energy rating ( $W_{th}$ )	kJ/kV <sub>r</sub>	Specify	
<b>4</b>	<b>Arrester housing</b>		<b>xxxxxxxxxx</b>	<b>xxxxxxxxxx</b>

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4.1	Housing material		Silicone Polymer	
4.2	Minimum external creepage distance [Um x 25 mm/kV]	mm		
4.3	Arrester housing profile designed in strict accordance with IEC 60815 with no deviations		Yes	
<b>5</b>	<b>Arrester mounting details</b>		<b>xxxxxxxxxx</b>	<b>xxxxxxxxxx</b>
5.1	Orientation		Vertical	
5.2	Method of mounting		Specify	
5.3	Reference number of drawing showing mounting details		xxxxxx	
<b>6</b>	<b>Arrester top terminals</b>		<b>xxxxxxxxxx</b>	<b>xxxxxxxxxx</b>
6.1	Type		Specify	
6.2	Diameter		Specify	
6.3	Minimum length	mm	Specify	
6.4	Orientation		Vertical	
6.5	Supplied with attachments		Specify	
6.6	Material		xxxxxx	
6.7	Reference number of drawing showing details of line terminal		xxxxxx	
<b>7</b>	<b>Arrester bottom terminals</b>		<b>xxxxxxxxxx</b>	<b>xxxxxxxxxx</b>
7.1	Type		Specify	
7.2	Diameter		Specify	
7.3	Minimum length	mm	Specify	
7.4	Orientation		Vertical	
7.5	Supplied with attachments		Specify	
7.6	Material		xxxxxx	
7.7	Reference number of drawing showing details of line terminal		xxxxxxx	
<b>8</b>	<b>Drawings to be submitted with tender (Single copies of drawings shall be submitted as part of the original tender showing the following detail):</b>		<b>xxxxxxxxxx</b>	<b>xxxxxxxxxx</b>
8.1	Outline dimensions of MOV, fit as for service		Reference Number:	
8.2	Mounting details		Reference Number:	
8.3	Terminal clamping arrangement		Reference Number:	
<b>9</b>	<b>Arrester characteristic data required</b>		<b>xxxxxxxxxx</b>	<b>xxxxxxxxxx</b>
9.1	V-I characteristic curve, AC		Reference Number:	

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9.2	V-I characteristic curve, DC		Reference Number:	
9.3	Temporary overvoltage withstand capability curve in per unit of MCOV, with and without prior duty		Reference Number:	
<b>10</b>	<b>Physical dimensions of arresters</b>		<b>xxxxxxxxxx</b>	<b>xxxxxxxxxx</b>
10.1	Overall height of arrester	mm	Specify	
10.2	Minimum external flashover distance	mm	Specify	
10.3	External diameter of arrester housing	mm	Specify	
<b>11</b>	<b>Miscellaneous</b>		<b>xxxxxxxxxx</b>	<b>xxxxxxxxxx</b>
11.1	Total mass of assembled unit	Kg	Specify	
11.2	Minimum expected life of arrester at 40°C and MCOV	yrs	30	
<b>12</b>	<b>Mechanical characteristics</b>		<b>xxxxxx</b>	<b>xxxxxx</b>
12.1	Minimum Specified Long-term Load (SLL)	Nm		
12.2	Minimum Specified Short-term Load(SSL)	Nm		
12.3	Test report confirming mechanical characteristics		Report reference number	

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**Annex B – Type test report summary sheet**

Test		File name of electronic test report submitted	Applicable page number	Product code used in type test report	Full product code of item offered	Name of test facility and electronic file name of accreditation certificate/evidence	Comments	Outcome Passed/Failed	SANS/IEC60099-4 Reference Section
1	Insulation withstand test on the arrester housing								Lighting Impulse 10.8.2 Switching Impulse 10.8.2 Power Frequency 10.8.2
2	Residual voltage test								Steep Current 10.8.3 Switching Impulse 10.8.2 Power Frequency 10.8.3
3	Test to verify long term stability under continuous operating voltage								10.8.4
4	Repetitive charge transfer withstand								10.8.5
5	Heat dissipation behaviour verification of test sample								10.8.6
6	Operating duty test								10.8.7

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Item Number as per Annex A convention :									SANS/IEC60099-4 Reference Section
Test		File name of electronic test report submitted	Applicable page number	Product code used in type test report	Full product code of item offered	Name of test facility and electronic file name of accreditation certificate/evidence	Comments	Outcome Passed/Failed	
7	Power-frequency voltage versus time								10.8.8
8	Short-circuit tests								10.8.10
9	Bending test								10.8.11
10	Environmental tests (Applicable to Porcelain housings)								10.8.12
11	Seal leak rate (Applicable to units with enclosed gass volume)								10.8.13
12	Radio interference voltage (RIV) test								10.8.14

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13	Weather ageing test/ Pollution related test as per cl. 3.2.2.f								10.8.17
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Notes:

- 1) Should the product naming convention used in type test report differ from that of the product offered, clear unambiguous explanation must be given indicating how the product tested is applicable to that offered in the comments column provided.
- 2) If more than one type test is contained in a single report, page numbers must also be provided.

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**Annex C – Summary sheet of drawings, outlines and characteristic curves**

Detail/Drawing required		Electronic File name of drawing/sheet	Product code used in Drawing/Sheet	Full product code of item offered	Date of Issue	Comments	Submitted (Y/N)
1	Overall dimensions, including, shed profile, mounting details with drilling plan.						
2	Terminal type details and physical dimensions.						
3	Minimum electrical clearances.						
5	V-I characteristics (protective level characteristics) at 8/20 $\mu$ s, 30/60 $\mu$ s and 1/2 $\mu$ s front (steep current) impulses						
6	Temporary overvoltage withstand capability curve, with and without prior duty.						

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- 1) If a drawing or characteristic curve is not submitted or not applicable, clear justification must be provided in the comments column. Omission of key information may result in disqualification.
- 2) Characteristic Curves submitted as part of a test report and/or data sheet are not acceptable. Curves shall be submitted as drawings that contain the manufacturers name, logo and a unique drawing number as a minimum
- 3) Should the product naming convention used in the drawing/sheet differ from that of the product offered, clear unambiguous explanation must be given indicating how the product indicated is applicable to that offered in the comments column provided.
- 4) Clear unambiguous definitions of rated voltage, reference voltage and protective level
- 5) AC voltage-resistive current curves from 20°C to 180°C and Region of thermal stability information may be required before contract award or to be made available during factory inspection

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### Annex D – Deviations and Declaration

Item Number as per Annex A convention :		
Deviation		Comments
1		
2		
3		
4		
5		
6		
7		

**Note:**

- 1) All deviations to any requirement in this specification and associated technical schedule or annex (A-D) must be listed above with clear explanations/ justification with regards to fitness for use for the full expected life of the product.

**Declaration by supplier:**

With the exception of the above deviations, this specification, associated technical schedules, factory evaluation and annexes together with the requirements contained within, will be fully complied with in the manufacture, testing, supply, provision of drawing and documents, packaging, labelling, transport and delivery of the product being offered, amongst others. Further it is declared that all information provided has been checked and is correct.

Signature\_\_\_\_\_ Date: \_\_\_\_\_

Full Name and Designation of Authorised Representative:\_\_\_\_\_

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