Eskom	Standard	Technology

Title: **SPECIFICATION FOR OUTDOOR METAL OXIDE LINE SURGE ARRESTERS**

Unique Identifier:	**240-42193474**
Alternative Reference Number:	**<n/a>**
Area of Applicability:	**Engineering**
Documentation Type:	**Standard**
Revision:	**2**
Total Pages:	**50**
Next Review Date:	**October 2022**
Disclosure Classification:	**Public**

Compiled by

Faith Mokhonoana

Lines Performance Care Group Chairperson

Date: 14/09/2017

Approved by

Kevin Kleinhans

Surge Arrester Care Group Chairperson

Date: 14/9/2017

Authorized by

Riaz Vajeth

Line Engineering Senior Manager

Date: 14/9/2017

Supported by SCOT/SC

Kevin Kleinhans

Surge Arrester Care Group Chairperson

Date: 14/9/2017

PCM Reference: **<xxxxxx>**

SCOT Study Committee Number/Name: **Surge Arrester care group**

Content

1. Introduction

The historical performance analysis of the Eskom transmission network has indicated that lightning is the third highest fault cause contributor. Use of transmission line surge arresters helps in mitigating against lightning related faults on transmission lines and protect station equipment. This specification details Eskom's technical requirements for suppliers to supply line surge arresters for distribution, sub-transmission and transmission networks.

2. Supporting clauses

2.1 Scope

This specification covers ESKOM's requirements for non-linear metal oxide surge arresters without spark gaps for outdoor installation in distribution, sub-transmission and transmission systems.

2.1.1 Purpose

The purpose for this document is to facilitate procurement of outdoor metal oxide line surge arresters for 66kV, 88kV, 132kV, 220kV, 275, 400 and 765kV lines.

2.1.2 Applicability

This specification shall apply throughout Eskom Holdings Limited, its divisions, subsidiaries and entities wherein Eskom has a controlling interest

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 9001:2000 Quality Management Systems

2.2.2 Informative

[2] IEC 60099-4 – 2014, Surge arresters part 4: Metal oxide surge arresters without gaps for A.C. systems

[3] IEC 60815 – 3 2009, Selection and dimensioning of high-voltage insulators intended for use in polluted conditions: Polymer insulators for a.c. systems

[4] SANS 121/ISO 1461: Hot-dipped (galvanised) Zinc Coatings (other than on continuous zinc coated sheet and wires)

2.3 Definitions

2.3.1 General

None

2.3.2 Disclosure classification

Public domain: published in any public forum without constraints (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description

Abbreviation	Description
CE	Chief Executive
EDC	Eskom Documentation Centre
IEC	International Electrotechnical Commission
kA	Kilo Amp
kV	Kilo volt
MD	Managing Director
SABS	South African Bureau of Standards
SANS	South African National Standard
SCOWT	Steering Committee on Wires Technology
TLA	Transmission Line Arrester

2.5 Roles and responsibilities

Eskom/Technology is accountable for the upkeep of the document. Process for monitoring

2.6 Process for Monitoring

Not applicable.

2.7 Related/supporting documents

Not applicable.

3. Design

3.1 Electrical Requirements

The major electrical performance requirements are set out in schedule A. In addition to these requirements the following electrical characteristics should be attained.

a) Arresters will be immune to the effects of airborne contamination on the external surfaces of the arrester housing. The shed profile shall be in compliance with IEC/TS 60815-3.

b) In the event of arrester failure, its housing will not violently explode or shatter. The short circuit performance of the arrester will be as per IEC 60099-4 which permits acceptance of molded design polymeric arresters that have no “pressure-relief” devices.

c) Transmission Line Arresters (TLA)

d) A disconnecting device will be provided to disconnect the earth lead in order to isolate the arrester electrically from the overhead line and to give a positive identification of the failed arrester.

e) Electrical clearances

If called for, the surge arrester flashover distance will not be less than the minimum value stated in Schedule A.

Pro-rata arrester sections will provide a thermal replica of the complete arrester.

Shed profile in compliance with IEC 60815.

The guarantees of all electrical performance stated in Schedule B will be supported by evidence in the form of type test certificates or by tests witnessed by an Eskom representative.

3.2 Mechanical Requirements

a) Sealing except where the external housing is directly molded on the internal components.

The sealing requirement is not applicable where the external housing is directly molded in the internal component.

Internal components will be dry at the time of assembly and arresters 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 will be carried out on every assembled arrester or arrester unit.

Technical details of the sealing arrangements and the routine seal test will be submitted.

b) Mounting

Transmission line arresters (TLA)

All arresters are to be mounted in the suspension mode.

c) Terminals

Both main and earth-lead terminations will be suitable for the standard conductor of dimensions and materials specified in Schedule A.

Terminals will be of sufficient strength to withstand forces arising during installation and service. Such forces will not overstress the components of the arrester, particularly the sealing system.

d) Finish

All ferrous components exposed to atmosphere, excluding those of stainless steel and aluminum, will be hot-dip galvanized in accordance with SANS 121/ISO 1461. This includes the earth terminals and holding down bolts.

4. Tests

4.1 Type Tests

Evidence in the form of test certificates will be presented to show that the arresters comply with the provisions in IEC 60099-4, Section 10 (for polymer-housed arresters). Furthermore, the disconnector shall comply with the type tests prescribed in section 8.9. Should such evidence not be available, the relevant type tests will be performed.

All type tests are to be done by an independent accredited laboratory, or witnessed by an independent accredited body.

4.2 Routine Tests

Routine tests will be performed on the arresters in accordance with IEC 60099-4, clause 9.1

4.3 Test Certificates

Single copies of test certificates covering type tests and, if required, any special tests will be submitted as soon as possible and at least three months before dispatch of the arresters.

4.4 Witnessing of Tests

Eskom reserves the right to appoint a representative to inspect the arresters at any stage of manufacture and to witness and sanction any tests.

5. Miscellaneous

5.1 Design Changes

Any design change will be verified by tests wherever applicable and will be subject to Eskom's approval.

5.2 Arrester Characteristic

The manufacturer of the metal oxide surge arresters will furnish Eskom with the following characteristic data.

a) V-I characteristics are the protective level characteristics at 8/20 µs, 30/60 µs and at 1 µs front (steep current).

b) A.C. voltage-resistive current curves from 20˚C to 180˚C.

c) Clear unambiguous definitions of rated voltage, reference voltage and protective level.

d) Region of thermal stability.

e) Temporary overvoltage withstand capability curve.

5.3 Drawings (contractual)

Outline drawings, of which three copies will be submitted for approval, will contain the following information as a minimum:

a) Overall dimensions, including mounting details.

b) Details of main and earthing terminals and conductor clamping arrangements.

c) Mass of complete arrester, and if applicable, individual arrester sections.

d) Minimum electrical clearances.

e) Surge arrester rating plate details.

5.4 Drawings submitted with tender

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

a) Overall dimensions, including mounting details with drilling plan (where applicable).

b) Line conductor and earth conductor 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) Insulating base type details and physical dimensions (where applicable).

g) Outline with insulator profile

h) V-I characteristics (protective level characteristics) at 8/20 µs, 30/60 µs and 1/2 µs front (steep current) impulses

i) Temporary overvoltage withstand capability curve, with and without prior duty.

5.5 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 ISO 14001 certificates.

6. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Kevin Kleinhans	Surge Arrester Care Group Chairperson
Faith Mokhonoana	Line Performance Care Group Chairperson
Fernando Witbooi	Chief Technologist High Voltage Plant Engineering
Mdu Mthethwa	Senior Technologist Line Design
Riaz Vajeth	Line Engineering Senior Manager and Lines SCOT chairperson

7. Revisions

Date	Rev	Compiler	Remarks
Oct 2017	2	Faith Mokhonoana	Included specification of surge arrestors for voltages 66kV to 220kV
April 2014	1	Faith Mokhonoana	Reached revision date, change of signatories required.
May 2011	0	Luthando Peter	Specification for outdoor transmission line surge arresters required

8. Development team

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

- Kevin Kleinhans – Surge Arrester Care Group Chairman
- Faith Mokhonoana – Line Performance Care Group Leader
- Fernando Witbooi – Chief Technologist High Voltage Plant Engineering
- Mdu Mthethwa - Line Performance Senior Technologist
- Thavenesen Govender – Chief Engineer High Voltage Plant Engineering

9. Acknowledgements

Not applicable.

Annex A – System Voltage: 765kV

Schedule A: Eskom's particular requirements.

Schedule B: Guarantees and technical particulars of equipment offered

Item	Description	Unit	Schedule A	Schedule B
1	**Surge arrester identification.**			
1.1	Manufacturer.		-	
1.2	Type designation of arrester.		-	
2	**Site and service conditions.**			
2.1	Electrical conditions of service.			
2.1.1	Nominal system voltage (U_n).	kV	765	
2.1.2	Maximum system voltage (U_m).	kV	800	
2.1.3	Basic insulation level of equipment to be protected.	$kV_{(peak)}$	2 100	
2.1.4	Frequency of supply.	Hz	50	
2.1.5	System earthing.		Effectively Earthed	
2.2	Site conditions of service.			
2.2.1	Altitude.	m	1800	
2.2.2	Maximum ambient temperature.	°C	40	
2.2.3	Minimum ambient temperature.	°C	-10	
2.2.4	Maximum diurnal variation.	°C	30	
2.2.5	Pollution condition as per IEC 60815	mm/kV	>251.1	
2.2.6	Intensity of solar radiation.	(U_m)	No	
2.2.7	Spray washing.	kW/m^2		
3	**Electrical characteristics.**			

3.1	Arrester classification.			
			5	
3.1.1	IEC long duration class.		20	
3.1.2	Nominal discharge current.	$kA_{(peak)}$		
3.2	Arrester ratings.			
			490	
3.2.1	Maximum Continuous operating voltage.	kV	612	
3.2.2	Rated voltage.	kV	-	
3.2.3	Arrester power frequency reference voltage.	kV		
			20	
3.2.4	Nominal lightning discharge current.	$kA_{(peak)}$	-	
3.2.5	High current (4/10 μs)	$kA_{(peak)}$		

Item	**Description**	**Unit**	**Schedule A**	**Schedule B**
3.3	Arrester temporary voltage TOV (with a prior energy stress of two line discharges of class 5):			
3.3.1	1 s (not greater than).	$kV_{(peak)}$	710	
3.4	Peak residual voltage for 8 / 20 μs current impulse of the following magnitudes:			
3.4.1	5 kA (not greater than).	$kV_{(peak)}$	1 326	
3.4.2	10 kA (not greater than).	$kV_{(peak)}$	1 384	
3.4.3	20 kA (not greater than).	$kV_{(peak)}$	1 457	
3.4.4	40 kA (not greater than).	$kV_{(peak)}$	1 588	
3.5	Operating duty test 1.			

3.5.1	Preferred arrester energy capability expressed as kilojoule per kV rated.	kJ/kV_r	15.4	
3.5.2	Total energy absorption capability.	kJ	-	
3.6	Surge arrester expected life at 40°C and maximum continuous operating voltage, longer or equal than.	years		
3.7	Arrester insulation withstand with internal parts removed (at sea level).			
3.7.1	Lightning impulse (1,2/50µs) withstand level.	$kV_{(rms)}$	2 100	
3.7.2	Switching impulse (250/2500µs) withstand level.	$kV_{(peak)}$	1 550	
3.8	External insulation dimensions.			
3.8.1	Specific Creepage for external insulation (not less than).	mm/kV	25	
3.8.2	External flashover distance (at least).	mm	5 500	
4	**Arrester construction details.**			
4.1	Number of MOV elements in series per stack.		-	
4.2	Number of stacks in parallel.		-	
4.3	Dimensions of MOV elements.			
4.3.1	Outside diameter of MOV element.	mm	-	
4.3.2	Inside diameter (if applicable).	mm	-	
4.3.3	Length (thickness).	mm	-	

4.4	Arrester mounting.			
4.4.1	Overall height of line terminal above arrester base or mounting bracket.	mm	-	
4.4.2	Method of mounting.		-	
4.4.3	Diameter of voltage grading ring	mm	-	
4.4.4	Distance of grading ring from top of arrester.	mm		
4.5	Line terminals.			
4.5.1	Line terminal with stem:			
	- Diameter.	mm	Specify	
	- Minimum length.	mm	Specify	
	- Orientation.		Specify	
4.5.2	Other type of line terminal to be suitable for clamping of the following conductor:			
	- Material.		Specify	
	- Type.		Specify	
	- Cross section dimensions.	mm	Specify	
4.6	Earth terminal to be provided with clamp suitable for the following conductor:			
4.6.1	Material.		Specify	
4.6.2	Type.		Specify	
4.6.3	Cross section dimensions.	mm	Specify	
5	**Mechanical characteristics.**			
5.1	Minimum fracture moment.	Nm	-	
5.2	Maximum permissible horizontal force.	N	-	
6	**Miscellaneous.**		-	

6.1	Colour of housing.			
6.2	Type of housing (silicon polymer).		-	
6.3	Mass of completely assembled single pole arrester.	Kg	-	
6.4	External diameter of arrester housing	mm	-	
6.5	Special arrester identification other than nameplate.		-	
6.6	Number of instruction/application manuals to be supplied.		3	

Annex B – System Voltage: 400kV

Schedule A: Eskom's particular requirements.

Schedule B: Guarantees and technical particulars of equipment offered

Item	Description	Unit	Schedule A	Schedule B
1	**Surge arrester identification.**			
1.1	Manufacturer.		-	
1.2	Type designation of arrester.		-	
2	**Site and service conditions.**			
2.1	Electrical conditions of service.			
2.1.1	Nominal system voltage (U_n).	kV	400	
2.1.2	Maximum system voltage (U_m).	kV	420	
2.1.3	Basic insulation level of equipment to be protected.	$kV_{(peak)}$	1 425	
2.1.4	Frequency of supply.	Hz	50	
2.1.5	System earthing.		Effectively Earthed	
2.2	Site conditions of service.			
2.2.1	Altitude.	m	1800	
2.2.2	Maximum ambient temperature.	°C	40	
2.2.3	Minimum ambient temperature.	°C	-10	
2.2.4	Maximum diurnal variation.	°C	30	
2.2.5	Pollution condition as per IEC 60815	mm/kV	>25	
2.2.6	Intensity of solar radiation.	(U_m)	1.1	
2.2.7	Live spray washing.	kW/m^2	No	
3	**Electrical characteristics.**			

3.1	Arrester classification.			
3.1.1	IEC long duration class.		4	
3.1.2	Nominal discharge current.	$kA_{(peak)}$	20	
3.2	Arrester ratings.			
3.2.1	Continuous operating voltage.	kV	269	
3.2.2	Rated voltage.	kV	336	
3.2.3	Arrester power frequency reference voltage.	kV	-	
3.2.4	Nominal lightning discharge current.	$kA_{(peak)}$	20	
3.2.5	High current (4/10 μs)	$kA_{(peak)}$	100	
3.3	Arrester temporary voltage TOV (with a prior energy stress of two line discharges of class 4):			
3.3.1	1 μs (not greater than).	$kV_{(peak)}$	361	
3.4	Peak residual voltage for 8 / 20 μs current impulse of the following magnitudes:			
3.4.1	5 kA (not greater than).	$kV_{(peak)}$	766	
3.4.2	10 kA (not greater than).	$kV_{(peak)}$	806	
3.4.3	20 kA (not greater than).	$kV_{(peak)}$	870	
3.4.4	40 kA (not greater than).	$kV_{(peak)}$	951	
3.5	Operating duty test 1.			
3.5.1	Preferred arrester energy capability expressed as kilojoule per kV rated.	kJ/kV_r	12	

3.5.2	Total energy absorption capability.	kJ	-	
		years	-	
3.6	Surge arrester expected life at 40°C and maximum continuous operating voltage, longer or equal than.			
3.7	Arrester insulation withstand with internal parts removed (at sea level).	$kV_{(rms)}$		
3.7.1	Lightning impulse (1,2/50µs) withstand level.	$kV_{(peak)}$	1 425	
3.7.2	Switching impulse (250/2500µs) withstand level.		1 050	
3.8	External insulation dimensions.			
3.8.1	Specific Creepage for external insulation (not less than).	mm/kV	25	
3.8.2	External flashover distance (at least).	mm	3 200	
4	**Arrester construction details.**			
4.1	Number of MOV elements in series per stack.	No	-	
4.2	Number of stacks in parallel.	No	-	
4.3	Dimensions of MOV elements.			
4.3.1	Outside diameter of MOV element.	mm	-	
4.3.2	Inside diameter (if applicable).	mm	-	
4.3.3	Length (thickness).	mm	-	
4.4	Arrester mounting.			
4.4.1	Overall height of line terminal above arrester base or mounting bracket.	mm	-	

4.4.2	Method of mounting.		-	
4.4.3	Diameter of voltage grading ring (if applicable).	mm	-	
4.4.4	Distance of grading ring from top of arrester.	mm		
4.5	Line terminals.			
4.5.1	Line terminal with stem:			
	- Diameter.	mm	Specify	
	- Minimum length.	mm	Specify	
	- Orientation.		Specify	
4.5.2	Other type of line terminal to be suitable for clamping of the following conductor(shunt):			
	- Material.		Specify	
	- Type.		Specify	
	- Cross section dimensions.	mm	Specify	
4.6	Earth terminal to be provided with clamp suitable for the following conductor:			
4.6.1	Material.		Specify	
4.6.2	Type.		Specify	
4.6.3	Cross section dimensions.	mm	Specify	
5	**Mechanical characteristics.**			
5.1	Minimum fracture moment.	Nm	-	
5.2	Maximum permissible horizontal force.	N	-	
6	**Miscellaneous.**		-	

6.1	Colour of housing.			
6.2	Type of housing (silicon polymer).		-	
6.3	Mass of completely assembled single pole arrester.	Kg	-	
6.4	External diameter of arrester housing	mm	-	
6.5	Special arrester identification other than nameplate.		-	
6.6	Number of instruction/application manuals to be supplied.		3	

Annex C – System Voltage: 275kV

Schedule A: Eskom's particular requirements.

Schedule B: Guarantees and technical particulars of equipment offered

Item	Description	Unit	Schedule A	Schedule B
1	**Surge arrester identification.**			
1.1	Manufacturer.		-	
1.2	Type designation of arrester.		-	
2	**Site and service conditions.**			
2.1	Electrical conditions of service.			
2.1.1	Nominal system voltage (U_n).	kV	275	
2.1.2	Maximum system voltage (U_m).	kV	300	
2.1.3	Basic insulation level of equipment to be protected.	$kV_{(peak)}$	1 050	
2.1.4	Frequency of supply.	Hz	50	
2.1.5	System earthing.		Effectively Earthed	
2.2	Site conditions of service.			
2.2.1	Altitude.	m	Up to 1 800	
2.2.2	Maximum ambient temperature.	°C	40	
2.2.3	Minimum ambient temperature.	°C	-10	
2.2.4	Maximum diurnal variation.	°C	30	
2.2.5	Pollution condition as per IEC 60815	mm/kV	>25	
2.2.6	Intensity of solar radiation.	(U_m)	1.1	
2.2.7	Live spray washing.	kW/m^2	No	
3	**Electrical characteristics.**			

3.1	Arrester classification.			
3.1.1	IEC long duration class.		4	
3.1.2	Nominal discharge current.	$kA_{(peak)}$	20	
3.2	Arrester ratings.			
3.2.1	Continuous operating voltage.	kV	192	
3.2.2	Rated voltage.	kV	240	
3.2.3	Arrester power frequency reference voltage.	kV	-	
3.2.4	Nominal lightning discharge current.	$kA_{(peak)}$	20	
3.2.5	High current (4/10 μs)	$kA_{(peak)}$	100	
3.3	Arrester temporary voltage TOV (with a prior energy stress of two line discharges of class 4):			
3.3.1	1 μs (not greater than).	$kV_{(peak)}$	276	
3.4	Peak residual voltage for 8 / 20 μs current impulse of the following magnitudes:			
3.4.1	5 kA (not greater than).	$kV_{(peak)}$	547	
3.4.2	10 kA (not greater than).	$kV_{(peak)}$	576	
3.4.3	20 kA (not greater than).	$kV_{(peak)}$	622	
3.4.4	30 kA (not greater than).	$kV_{(peak)}$	680	
3.5	Operating duty test 1.			
3.5.1	Preferred arrester energy capability expressed as kilojoule per kV rated.	kJ/kV_r	12	
3.5.2	Total energy absorption capability.	kJ	-	

3.6	Surge arrester expected life at 40°C and maximum continuous operating voltage, longer or equal than.	years		
3.7	Arrester insulation withstand with internal parts removed (at sea level).			
3.7.1	Lightning impulse (1,2/50µs) withstand level.	$kV_{(rms)}$	1 050	
3.7.2	Switching impulse (250/2500µs) withstand level.	$kV_{(peak)}$	850	
3.8	External insulation dimensions.			
3.8.1	Specific Creepage for external insulation (not less than).	mm/kV	25	
3.8.2	External flashover distance (at least).	mm	2 100	
4	**Arrester construction details.**			
4.1	Number of MOV elements in series per stack.		-	
4.2	Number of stacks in parallel.		-	
4.3	Dimensions of MOV elements.			
4.3.1	Outside diameter of MOV element	mm	-	
4.3.2	Inside diameter (if applicable).	mm	-	
4.3.3	Length (thickness).	mm	-	
4.4	Arrester mounting.			
4.4.1	Overall height of line terminal above arrester base or mounting bracket.	mm		
4.4.2	Method of mounting.			

			-	
4.4.3	Diameter of voltage grading ring (if applicable).	mm	-	
4.4.4	Distance of grading ring from top of arrester.	mm		
4.5	Line terminals.			
4.5.1	Line terminal with stem:			
	- Diameter.	mm	Specify	
	- Minimum length.	mm	Specify	
	- Orientation.		Specify	
4.5.2	Other type of line terminal to be suitable for clamping of the following conductor (shunt):			
	- Material.		Specify	
	- Type.		Specify	
	- Cross section dimensions.	mm	Specify	
4.6	Earth terminal to be provided with clamp suitable for the following conductor:		-	
4.6.1	Material.		Specify	
4.6.2	Type.		Specify	
4.6.3	Cross section dimensions.	mm	Specify	
5	**Mechanical characteristics.**			
5.1	Minimum fracture moment.	Nm	-	
5.2	Maximum permissible horizontal force.	N	-	
6	**Miscellaneous.**		-	

6.1	Colour of housing.		-	
6.2	Type of housing (silicon polymer).		-	
6.3	Mass of completely assembled single pole arrester.	Kg	-	
6.4	External diameter of arrester housing	mm	-	
6.5	Special arrester identification other than nameplate.		-	
6.6	Number of instruction/application manuals to be supplied.		3	

Annex D – System Voltage: 220kV

Schedule A: Eskom's particular requirements.

Schedule B: Guarantees and technical particulars of equipment offered

Item	Description	Unit	Schedule A	Schedule B
1	**Surge arrester identification**			
1.1	Manufacturer			
1.2	Type designation of arrester			
2	**Operating conditions**			
2.1	Electrical conditions of service			
2.1.1	Nominal system voltage (U_n)	kV	220	
2.1.2	Maximum system voltage (U_{rn})	kV	242	
2.1.3	Basic insulation level of equipment to be protected	kV (peak)	850	
2.1.4	Frequency of supply	Hz	50	
2.1.5	System earthing		Effectively Earthed	
2.2	Site conditions of service			
2.2.1	Altitude	m	1800	
2.2.2	Maximum ambient temperature	^oC	40	
2.2.3	Minimum ambient temperature	^oC	-10	
2.2.4	Maximum diurnal variation	^oC	30	
2.2.5	Pollution class as per IEC 60815	mm/kV	>25	
2.2.6	Intensity of solar radiation	(U_{rn})	1.1	
2.2.7	Live Spray washing	kW/m^2	No	
3	**Electrical characteristics**			
3.1	Arrester classification			
3.1.1	IEC long duration class		3	
3.1.2	Nominal discharge current	$kA_{(peak)}$	10	
3.2	Arrester ratings			
3.2.1	Continuous operating voltage	kV	154	
3.2.2	Rated voltage	kV		
3.2.3	Arrester power frequency reference voltage at 1 mA resistive current	kV		
3.2.4	Nominal lighting discharge current	$kA_{(peak)}$	10	
3.2.5	High current (4/10 µs)	$kA_{(peak)}$	100	
3.3	Arrester steep-current impulse residual voltage with nominal discharge current front-times of:			
3.3.1	1 µs (not greater than)	$kV_{(peak)}$		

3.4	Peak residual voltage for 8 x 20 µs current impulse of the following magnitudes:			
3.4.1	10 kA (not greater than)	$kV_{(peak)}$		
3.4.2	20 kA (not greater than)	$kV_{(peak)}$		
3.4.3	30 kA (not greater than)	$kV_{(peak)}$		
3.5	Operating duty test 1			
3.5.1	Arrester energy capability expressed as kilojoules per kV rated	kJ/kV_r		
3.5.2	Total energy absorption capability	kJ		
3.6	Temporary overvoltage capability expressed as p.u. of Um assuming maximum temperature and maximum energy absorbed just prior to application of overvoltage			
3.6.1	1.20 p.u. of Um/√3	ms		
3.6.2	1.40 p.u. of Um/√3	ms		
3.6.3	1.60 p.u. of Um/√3	ms		
3.7	Surge arrester expected life at 40°C and maximum continuous operating voltage, longer or equal than	years	30	
3.8	Arrester insulation withstand with internal parts removed (at sea level)			
3.8.1	Lightning impulse (1.2/50 µs) withstand level	$kV_{(rms)}$		
3.8.2	Switching impulse (250/2500 µs) withstand level	$kV_{(peak)}$		
3.9	External insulation dimensions			
3.9.1	Total creepage distance over external insulation (not less than)	mm	7502	
3.9.2	Minimum SCD	mm/kV	>25	
3.9.3	External flashover distance (Preferred)	mm	1850	
3.10	Radio influence voltage (RIV) at 1 MHz measured in accordance with NEMA publication 107, when energized at the following power voltages			
3.10.1	Maximum system voltage	µV	100	
3.10.2	Arrester continuous operating voltage	µV	100	
3.10.3	Arrester rated voltage	µV	250	
4	**Arrester construction details**			
4.1	Number of MOV elements in series per stack	No		
4.2	Number of stacks in parallel	No		
4.3	Dimensions of MOV elements			
4.3.1	Outside diameter of MOV element	mm		
4.3.2	Inside diameter (if applicable)	mm		

4.3.3	Length (thickness)	mm		
4.4	Pressure relief device installed according to IEC 99-4			
4.4.1	High current	$kA_{(rms)}$		
4.4.2	Low current	$kA_{(rms)}$		
4.5	Filler medium of arrester (nitrogen, dry air etc.)			
4.6	Arrester mounting			
4.6.1	Overall height of line terminal above arrester base or mounting bracket	mm		
4.6.2	Method of mounting			
4.6.3	Diameter of voltage grading ring (if applicable)	mm		
4.6.4	Distance of grading ring from top of arrester	mm		
4.6.5	Base insulator material type			
4.7	Line terminals			
4.7.1	Line terminal with stem:			
	Diameter	mm		
	Minimum length	mm		
	Orientation			
4.7.2	Other type of line terminal to be suitable for clamping of the following conductor:			
	Material			
	Type			
	Cross section dimensions	mm		
4.8	Earth terminal to be provided with clamp suitable for the following conductor:			
4.8.1	Material			
4.8.2	Type			
4.8.3	Cross section dimensions	mm		
5	**Mechanical characteristics**			
5.1	Minimum fracture moment	Nm		
5.2	Maximum permissible horizontal force	N		
6	**Miscellaneous**			
6.1	Colour of housing			
6.2	Type of housing (porcelain or silicone polymer)		Silicone Polymer	
6.3	Mass of completely assembled single pole arrester	Kg		
6.4	External diameter of arrester housing	mm		
6.5	Special arrester identification other than nameplate			

6.6	Number of instruction/application manuals to be supplied		2	
6.7	Arrester housing profile designed in strict accordance with IEC 60815 with no deviations			
6.7.1	c			
6.7.2	s/p			
6.7.3	Ld/d			
6.7.4	P1 - P2			
6.7.5	CF			
6.7.6	Profile Type i.e. open, flat, alternating, under-rib, etc. List those applicable.			

Annex E – System Voltage: 132kV

Schedule A: Eskom's particular requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Description	Unit	Schedule A	Schedule B
1	**Surge arrester identification:**			
1.1	Manufacturer			
1.2	Type designation of arrester			
2	**Operating conditions:**			
2.1	Altitude	m	1800	
2.2	Average humidity	%	30 to 90	
2.3	Minimum ambient temperature	°C	-10	
2.4	Maximum ambient temperature	°C	40	
2.5	Maximum diurnal variation	°C	30	
2.6	Intensity of solar radiation	kW/m²	1.1	
2.7	IEC 60815 Pollution class:		E	
2.8	Lightning activity	Flashes/km²/annum	>12	
2.9	System earthing		Effective	
2.10	System configuration		3 phase, 3 wire	
2.11	Nominal system voltage (Un)	kV	132	
2.12	Maximum system voltage	kV	145	
2.13	Supply frequency	Hz	50	
2.14	BIL of equipment to be protected	kV(peak)	550	
3	**Electrical characteristics of arrester:**			
3.1	Arrester classification			
3.2	IEC line discharge class		2	
3.3	Arrester classification	kA	10	
3.4	Nominal lightning discharge current (8/20µs)	kA	10	
3.5	Minimum energy absorption capability for a single high current impulse, 100kA 4/10µs in per unit of MCOV	kJ/kV	3.4	
3.6	Arrester rated voltage (Ur)	kV		
3.7	MCOV (Uc)	kV	84	

3.8	Maximum residual voltage (Ures) at 10kA (8/20µs)	kV	300	
4	**Arrester housing:**			
4.1	Housing material:		Silicone Polymer	
4.2	Minimum external creepage distance:	mm/kV	>25	
4.2.1	Item 14A and 14B [Um x 31 mm/kV]	mm	4495	
4.3	Arrester housing profile designed in strict accordance with IEC 60815 with no deviations			
5	**Arrester mounting details**			
5.1	Orientation			
5.2	Method of mounting			
6	Arrester line terminal			
6.1	Type			
6.2	Diameter			
6.3	Minimum length	mm		
6.4	Orientation			
6.5	Material			
7	Arrester earth terminal			
	Earth terminal to be provided with clamping arrangement suitable for clamping of the following conductor:			
7.1	Conductor material			
7.2	Conductor type			
7.3	Conductor dimensions	mm		
7.4	Material used for clamping arrangement			
8	Drawings to be submitted with tender(Single copies of drawings shall be submitted as part of the original tender showing the following detail)			
8.1	Outline dimensions of arrester, fit as for service			
8.2	Mounting details			
8.3	Line and earth terminal, conductor clamping arrangement			
8.4	Details of grading rings			
9	Arrester characteristic data required			
9.1	V-I characteristic curve, AC			
9.2	V-I characteristic curve, DC			

9.3	Temporary overvoltage withstand capability curve in per unit of MCOV, with and without prior duty			
9.4	Arrester temporary overvoltage capability, with prior duty as defined in Appendix D, IEC 60099-4:			
9.4.1	Overvoltage applied for 1 s	pu of MCOV		
9.4.2	Overvoltage applied for 5 s	pu of MCOV		
9.4.3	Overvoltage applied for 10 s	pu of MCOV		
10	Physical dimensions of arresters			
10.1	Overall height of arrester	mm		
10.2	Preferred external flashover distance	mm	1100	
10.3	External diameter of arrester housing	mm		
10.4	Diameter of voltage grading rings	mm		
10.5	Distance of grading ring from top of arrester	mm		
11	MOV elements:			
11.1	Diameter of elements	mm		
11.2	Thickness of elements	mm		
11.3	Number of elements per arrester			
11.4	Number of stacks in parallel		0	
12	Miscellaneous:			
12.1	Live spray washing (Yes/No)		No	
12.2	Total mass of assembled unit	Kg		
12.3	Minimum expected life of arrester at 40oC and MCOV	years	30	
12.4	Sample available for inspection		Yes	
12.5	Declared specified long-term load	kN		
12.6	Insulation withstand test (Reference number of test report)			
12.7	Lightning impulse (1.2/50µs) withstand level [(1.3/0.82) x Ures]	kV	476	
12.8	60 s wet power frequency withstand	r.m.s kV	230	
12.9	Residual voltage test (Reference number of test report			
12.10	Maximum residual voltage for a 10kA steep current impulse (1/20µs)	kV	336	
12.11	Maximum residual voltage for a lightning current impulse (8/20µs) of magnitude:			
12.11.1	5 kA	kV		

12.11.2	10 kA	kV	300	
12.11.3	20 kA	kV		
12.12	Maximum residual voltage for a 500 A switching current impulse	kV		
12.13	Long duration current impulse withstand test (Reference number of test report)			
12.13.1	Charging voltage	pu of Ur	3.2	
	or			
12.13.2	Charging current	A		
12.13.3	Virtual duration of peak	µs	2000	
12.13.4	Number of discharge operations		18	
12.13.5	Number of grouped operations		6	
12.13.6	Operations per group		3	
12.13.7	Maximum interval between operations	s	60	
12.13.8	Interval between operations		Cool to ambient	
12.13.9	Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5	
12.14	Operating duty test (Reference number of test report)			
	Conditioning part 1:			
12.14.1	10 kA current impulse (8/20µs), energized at 1.2 x MCOV	kV	101	
12.14.2	Number of discharge operations		20	
12.14.3	Number of grouped operations		4	
12.14.4	Operations per group		5	
12.14.5	Interval between operations	s	60	
12.14.6	Intervals between groups	min	30	
	Conditioning part 2:			
12.14.7	High current impulse (4/10µs)	kA	100	
12.14.8	Number of applications		2	
12.15	Conditions for switching surge test:			
12.15.1	Charging voltage	pu of Ur	3.2	
	or			
12.15.2	Charging current	A		
12.15.3	Virtual duration of peak	µs	2000	
12.15.4	Number of discharge operations		2	
12.15.5	Interval between operations	s	60	

12.15.6	Starting temperature for first impulse	oC	60		
12.15.7	Energy dissipated during second impulse	kJ			
12.16	Conditions for power frequency test at elevated levels as in IEC 60099-4, 7.5.2:				
12.16.1	Interval between last long duration current impulse and power frequency test	ms	100		
12.16.2	Elevated rated voltage (Ur*) applied for 10 s	kV			
12.16.3	Elevated continuous operating voltage (Uc*) applied for 30 min	kV			
12.16.4	Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5		
12.17	Power frequency voltage versus time characteristic (Reference number of test report)				
12.18	Short-circuit test (Reference number of test report)				
12.18.1	High current	kA r.m.s	40		
12.18.2	Low current	kA r.m.s	0.6 ± 0.2		
12.19	KIPTS Natural ageing and pollution performance test (Reference number of test report)		14A	Yes	
			14B	No	
12.20	Internal partial discharge test (Reference number of test report)				
12.21	Power frequency voltage applied [1.05 x MCOV]	kV	89		
12.22	Maximum partial discharge	pC	10		
12.23	Moisture ingress test (Reference number of test report)				
12.24	Bending moment test (Reference number of test report)				

Annex F – System Voltage: 88kV

Schedule A: Eskom's particular requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Description	Unit	Schedule A	Schedule B
1	**Surge arrester identification:**			
1.1	Manufacturer			
1.2	Type designation of arrester			
2	**Operating conditions:**			
2.1	Altitude	m	1800	
2.2	Average humidity	%	30 to 90	
2.3	Minimum ambient temperature	°C	-10	
2.4	Maximum ambient temperature	°C	40	
2.5	Maximum diurnal variation	°C	30	
2.6	Intensity of solar radiation	kW/m²	1.1	
2.7	IEC 60815 Pollution class:		E	
2.9	Lightning activity	Flashes/km²/annum	>12	
2.10	System earthing		Effective	
2.11	System configuration		3 phase, 3 wire	
2.12	Nominal system voltage (Un)	kV	88	
2.13	Maximum system voltage	kV	97	
2.14	Supply frequency	Hz	50	
2.15	BIL of equipment to be protected	kV(peak)	380	
3	**Electrical characteristics of arrester:**			
3.1	Arrester classification			
3.2	IEC line discharge class		2	
3.3	Arrester classification	kA	10	
3.4	Nominal lightning discharge current (8/20µs)	kA	10	
3.5	Minimum energy absorption capability for a single high current impulse, 100kA 4/10µs in per unit of	kJ/kV	3.4	

	MCOV			
3.6	Arrester rated voltage (Ur)	kV		
3.7	MCOV (Uc)	kV	56	
3.8	Maximum residual voltage (Ures) at 10kA (8/20µs)	kV	210	
4	**Arrester housing:**			
4.1	Housing material		Silicone Polymer	
4.2	Minimum external creepage distance:	mm/kV	>25	
4.2.1	Item 12A and 12B [Um x 31 mm/kV]	mm	3007	
4.3	Arrester housing profile designed in strict accordance with IEC 60815 with no deviations			
5	**Arrester mounting details:**			
5.1	Orientation			
5.2	Method of mounting			
6	**Arrester line terminal:**			
6.1	Type			
6.2	Diameter			
6.3	Minimum length	mm		
6.4	Orientation			
6.5	Material			
7	**Arrester earth terminal:**			
	Earth terminal to be provided with clamping arrangement suitable for clamping of the following conductor:			
7.1	Conductor material			
7.2	Conductor type			
7.3	Conductor dimensions	mm		
7.4	Material used for clamping arrangement			
7.5	If dissimilar metals are used for clamping arrangement, state types			
8	**Drawings to be submitted with tender (Single copies of drawings shall be submitted as part of the original tender showing the following detail)**			
8.1	Outline dimensions of arrester, fit as for service			
8.2	Mounting details			

8.3	Line and earth terminal, conductor clamping arrangement			
8.4	Details of grading rings			
9	**Arrester characteristic data required:**			
9.1	V-I characteristic curve, AC			
9.2	V-I characteristic curve, DC			
9.3	Temporary overvoltage withstand capability curve in per unit of MCOV, with and without prior duty			
9.4	Arrester temporary overvoltage capability, with prior duty as defined in Appendix D, IEC 60099-4:			
9.4.1	Overvoltage applied for 1 s	pu of MCOV		
9.4.2	Overvoltage applied for 5 s	pu of MCOV		
9.4.3	Overvoltage applied for 10 s	pu of MCOV		
10	**Physical dimensions of arresters:**			
10.1	Overall height of arrester	mm		
10.2	Minimum external flashover distance	mm	900	
10.3	External diameter of arrester housing	mm		
10.4	Diameter of voltage grading rings	mm		
10.5	Distance of grading ring from top of arrester	mm		
11	**MOV elements:**			
11.1	Diameter elements	mm		
11.2	Thickness elements	mm		
11.3	Number of elements per arrester			
11.4	Number of stacks in parallel		0	
12	**Miscellaneous:**			
12.1	Live spray washing		No	
12.2	Total mass of assembled unit	Kg		
12.3	Minimum expected life of arrester at 40oC and MCOV	years	30	
12.4	Sample available for inspection		Yes	
12.5	Declared specified long-term load	kN		
12.6	Insulation withstand test (Reference number of test			

	report)			
12.7	Lightning impulse (1.2/50µs) withstand level [(1.3/0.82) x Ures]	kV	333	
12.8	60 s wet power frequency withstand	r.m.s kV	150	
12.9	Residual voltage test (Reference number of test report)			
12.10	Maximum residual voltage for a 10kA steep current impulse (1/20µs)	kV	227	
12.11	Maximum residual voltage for a lightning current impulse (8/20µs) of magnitude:			
12.11.1	5 kA	kV		
12.11.2	10 kA	kV	210	
12.11.3	20 kA	kV		
12.12	Maximum residual voltage for a 500 A switching current impulse	kV		
12.13	Long duration current impulse withstand test (Reference number of test report)			
12.13.1	Charging voltage	pu of Ur	3.2	
	or			
12.13.2	Charging current	A		
12.13.3	Virtual duration of peak	µs	2000	
12.13.4	Number of discharge operations		18	
12.13.5	Number of grouped operations		6	
12.13.6	Operations per group		3	
12.13.7	Maximum interval between operations	s	60	
12.13.8	Interval between operations		Cool to ambient	
12.13.9	Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5	
12.14	Operating duty test (Reference number of test report)			
	Conditioning part 1:			
12.14.1	10 kA current impulse (8/20µs), energized at 1.2 x MCOV	kV	67	
12.14.2	Number of discharge operations		20	
12.14.3	Number of grouped operations		4	
12.14.4	Operations per group		5	
12.14.5	Interval between operations	s	60	
12.14.6	Intervals between groups	min	30	
	Conditioning part 2:			

12.14.7	High current impulse (4/10µs)	kA	100		
12.14.8	Number of applications		2		
12.14.9	Conditions for switching surge test				
12.14.9.1	Charging voltage	pu of Ur	3.2		
	or				
12.14.9.2	Charging current	A			
12.14.9.3	Virtual duration of peak	µs	2000		
12.14.9.4	Number of discharge operations		2		
12.14.9.5	Interval between operations	s	60		
12.14.9.6	Starting temperature for first impulse	oC	60		
12.14.9.7	Energy dissipated during second impulse	kJ			
12.15	Conditions for power frequency test at elevated levels as in IEC 60099-4, 7.5.2:				
12.15.1	Interval between last long duration current impulse and power frequency test	ms	100		
12.15.2	Elevated rated voltage (Ur*) applied for 10 s	kV			
12.15.3	Elevated continuous operating voltage (Uc*) applied for 30 min	kV			
12.15.4	Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5		
12.16	Power frequency voltage versus time characteristic (Reference number of test report)				
12.17	Short-circuit test (Reference number of test report)				
12.17.1	High current	kA r.m.s	40		
12.17.2	Low current	kA r.m.s	0.6 ± 0.2		
12.18	KIPTS Natural ageing and pollution performance test (Reference number of test report)		12A	Yes	
			12B	No	
12.18	Internal partial discharge test (Reference number of test report)				
12.19	Power frequency voltage applied [1.05 x MCOV]	kV	59		
12.20	Maximum partial discharge	pC	10		
12.21	Moisture ingress test (Reference number of test report)				
12.22	Bending moment test (Reference number of test report)				

Annex G – System Voltage: 66kV

Schedule A: Eskom's particular requirements.

Schedule B: Guarantees and technical particulars of equipment offered

Item	Description	Unit	Schedule A	Schedule B
1	**Surge arrester identification:**			
1.1	Manufacturer			
1.2	Type designation of arrester			
2	**Operating conditions**			
2.1	Altitude	m	1800	
2.2	Average humidity	%	30 to 90	
2.3	Minimum ambient temperature	°C	-10	
2.4	Maximum ambient temperature	°C	40	
2.5	Maximum diurnal variation	°C	30	
2.6	Intensity of solar radiation	kW/m²	1.1	
2.7	IEC 60815 Pollution class:		E	
2.8	Lightning activity	Flashes/ km²/annum	>12	
2.9	System earthing		Effective	
2.10	System configuration		3 phase, 3 wire	
2.11	Nominal system voltage (Un)	kV	66	
2.12	Maximum system voltage	kV	73	
2.13	Supply frequency	Hz	50	
2.14	BIL of equipment to be protected	kV(peak)	350	
3	**Electrical characteristics of arrester**			
3.1	Arrester classification		Station class	
3.2	IEC line discharge class		2	
3.3	Arrester classification	kA	10	
3.4	Nominal lightning discharge current (8/20µs)	kA	10	
3.5	Minimum energy absorption capability for a single high current impulse, 100kA 4/10µs in per unit of MCOV	kJ/kV	3.4	

3.6	Arrester rated voltage (Ur)	kV		
3.7	MCOV (Uc)	kV	48	
3.8	Maximum residual voltage (Ures) at 10kA (8/20µs)	kV	165	
4	**Arrester housing**			
4.1	Housing material:		Silicone Polymer	
4.2	Minimum external creepage distance:	mm/kV	>25	
4.2.1	Item 10A and 10B [Um x 31 mm/kV]	mm	2263	
4.3	Arrester housing profile designed in strict accordance with IEC 60815 with no deviations			
4.3.1	c			
4.3.2	s/p			
4.3.3	Ld/d			
4.3.4	P1 - P2			
4.3.5	CF			
4.3.6	Profile Type i.e. open, flat, alternating, under-rib, etc. List those applicable.			
5	**Arrester mounting details**			
5.1	Orientation			
5.2	Method of mounting			
5.3	Diameter of mounting holes in base	mm		
5.4	PCD	mm		
5.5	Supplied with: 3 bolts, 3 nuts, 3 tapered washers and 6 flat washers			
5.6	Reference number of drawing showing mounting details			
6	**Arrester line terminal**			
6.1	Type		Stem	
6.2	Diameter		26	
6.3	Minimum length	mm	100	
6.4	Orientation		Vertical	
6.5	Material			
6.6	Reference number of drawing showing details of line terminal			

7	**Arrester earth terminal**			
	Earth terminal to be provided with clamping arrangement suitable for clamping of the following conductor:			
7.1	Conductor material		Copper	
7.2	Conductor type		Strap	
7.3	Conductor dimensions	mm	50 x 3	
7.4	Material used for clamping arrangement			
7.5	If dissimilar metals are used for clamping arrangement, state types			
7.6	Reference number of drawing showing details of earth terminal			
8	**Drawings to be submitted with tender (Single copies of drawings shall be submitted as part of the original tender showing the following detail)**			
8.1	Outline dimensions of arrester, fit as for service			
8.2	Mounting details			
8.3	Line and earth terminal, conductor clamping arrangement			
8.4	Details of grading rings			
9	**Arrester characteristic data required:**			
9.1	V-I characteristic curve, AC			
9.2	V-I characteristic curve, DC			
9.3	Temporary overvoltage withstand capability curve in per unit of MCOV, with and without prior duty			
9.4	Arrester temporary overvoltage capability, with prior duty as defined in Appendix D, IEC 60099-4:			
9.4.1	Overvoltage applied for 1 s	pu of MCOV		
9.4.2	Overvoltage applied for 5 s	pu of MCOV		
9.4.3	Overvoltage applied for 10 s	pu of MCOV		
10	**Physical dimensions of arresters:**			
10.1	Overall height of arrester	mm		
10.2	Minimum external flashover distance	mm	450	
10.3	External diameter of arrester housing	mm		
10.4	Diameter of voltage grading rings	mm		

10.5	Distance of grading ring from top of arrester	mm		
11	**MOV elements:**			
11.1	Diameter elements	mm		
11.12	Thickness elements	mm		
11.13	Number of elements per arrester			
11.14	Number of stacks in parallel		0	
12	**Miscellaneous:**			
12.1	Live spray washing (Yes/No)		No	
12.2	Total mass of assembled unit	Kg		
12.3	Minimum expected life of arrester at 40oC and MCOV	years	30	
12.4	Sample available for inspection		Yes	
12.5	Declared specified long-term load	kN		
12.6	Insulation withstand test (Reference number of test report)			
12.7	Lightning impulse (1.2/50µs) withstand level [(1.3/0.82) x Ures]	kV	262	
12.8	60 s wet power frequency withstand	r.m.s kV	90	
12.9	Residual voltage test (Reference number of test report)			
12.10	Maximum residual voltage for a 10kA steep current impulse (1/20µs)	kV	183	
12.11	Maximum residual voltage for a lightning current impulse (8/20µs) of magnitude:			
12.11.1	5 kA	kV		
12.11.2	10 kA	kV	165	
12.11.3	20 kA	kV		
12.12	Maximum residual voltage for a 500 A switching current impulse	kV		
12.13	Long duration current impulse withstand test (Reference number of test report)			
12.13.1	Charging voltage	pu of Ur	3.2	
	or			
12.13.2	Charging current	A		
12.13.3	Virtual duration of peak	µs	2000	
12.13.3	Number of discharge operations		18	
12.13.4	Number of grouped operations		6	
12.13.5	Operations per group		3	
12.13.6	Maximum interval between operations	s	60	
12.13.7	Interval between operations		Cool to ambient	

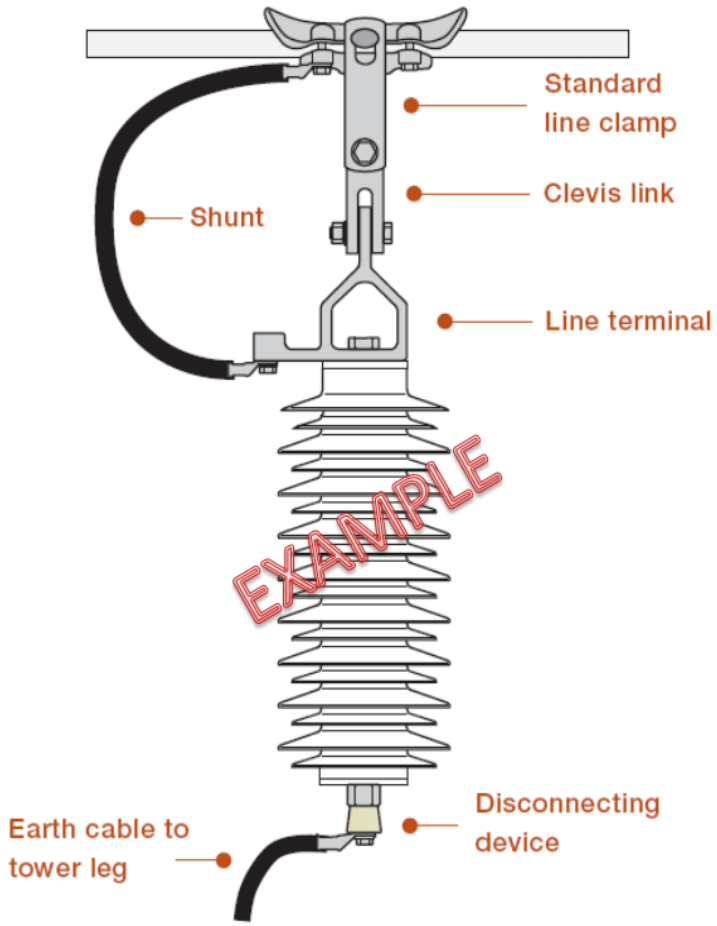
12.13.8	Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5		
12.14	Operating duty test (Reference number of test report)				
	Conditioning part 1:				
12.14.1	10 kA current impulse (8/20µs), energized at 1.2 x MCOV	kV	58		
12.14.2	Number of discharge operations		20		
12.14.3	Number of grouped operations		4		
12.14.4	Operations per group		5		
12.14.5	Interval between operations	s	60		
12.14.6	Intervals between groups	min	30		
	Conditioning part 2:				
12.14.7	High current impulse (4/10µs)	kA	100		
12.14.8	Number of applications		2		
12.15	Conditions for switching surge test:				
12.15.1	Charging voltage	pu of Ur	3.2		
	or				
12.15.2	Charging current	A			
12.15.3	Virtual duration of peak	µs	2000		
12.15.3	Number of discharge operations		2		
12.15.4	Interval between operations	s	60		
12.15.5	Starting temperature for first impulse	oC	60		
12.15.6	Energy dissipated during second impulse	kJ			
12.16	Conditions for power frequency test at elevated levels as in IEC 60099-4, 7.5.2:				
12.16.1	Interval between last long duration current impulse and power frequency test	ms	100		
12.16.2	Elevated rated voltage (Ur*) applied for 10 s	kV			
12.16.3	Elevated continuous operating voltage (Uc*) applied for 30 min	kV			
12.16.4	Maximum permitted change in residual voltage after long duration current impulse withstand test	%	5		
12.17	Power frequency voltage versus time characteristic (Reference number of test report)				
12.18	Short-circuit test (Reference number of test report)				
12.18.1	High current	kA r.m.s	40		
12.18.1	Low current	kA r.m.s	0.6 ± 0.2		
12.19	KIPTS Natural ageing and pollution performance test (Reference number of test report)		10A	Yes	
			10B	No	

12.20	Internal partial discharge test (Reference number of test report)			
12.21	Power frequency voltage applied [1.05 x MCOV]	kV	50.5	
12.22	Maximum partial discharge	pC	10	
12.23	Moisture ingress test (Reference number of test report)			
12.24	Bending moment test (Reference number of test report)			

Annex H – Example of Arrangement

Example of Arrangement

- Standard Line Clamp
- Clevis Link
- Shunt (connection conductor)
- Line terminal
- Disconnecting Device
- Earth Cable to tower leg



Annex I – Line Surge Arrester Monitors

	LINE SURGE ARRESTER MONITORS	**Unit**	**Schedule A**	**Schedule B**
1	General			
1.1	Climatic Conditions (Sealed water-tight design)			
1.2	Short Circuit Capability (according to IEC 60099-4)	kA	65	
1.3	Power Supply (built in solar cells and field probe)			
1.2				
1.2.1	Surge Registration	A	10	
1.2.2	Minimum Counting Threshold (8/20µs)			
1.2.3	Amplitude Classification(8/20µs)			
		A	10 - 99	
		A	100 - 999	
		A	1 000 - 4 999	
		A	5 000 - 9 999	
		A	10 000	
1.2.4	Time Stamp	Yes		
1.2.5	Time resolution	s	<0.5	
1.2.6	Memory capacity	Registrations	1000	
1.3	Leakage Current Measurement	mA_{peak}	0.2 – 12	

1.3.1	Measuring range of total leakage current	µA	10 – 2000	
1.3.2	Measuring range of resistive leakage current (peak level)	Hz	48 – 62	
1.3.3	Measuring Frequency Range		-	
1.4.	Additional			
1.4.1	Remote Sensor			
	Remote reading provides increased personnel safety compared with conventional counters.		-	
	The measured data can then be transferred to a computer for statistical analysis.		-	
1.4.2	Negligible residual voltage		-	
1.4.2.1	Does not reduce protection margins.		-	
1.4.2.3	Minimized risk for injury in case of accidental contact during surges.		-	
1.4.3	Long life			
1.4.3.1	Moulded components, non-sensitive to humidity or temperature variations.		-	
	Universal application		-	
1.4.4	All makes and types of gapless surge arresters.			
1.4.4.1	All weather and temperature conditions.			

Annex J – Summary sheet of drawings, outlines and characteristic curves (To be completed per item)

Item Number:							
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 mounting details with drilling plan.						
2	Line conductor and earth conductor clamping arrangements.						
3	Line and earth terminal type details and physical dimensions.						
4	Minimum electrical clearances.						
5	Details of special items such as the disconnecting device or overpressure relief device.						
6	Insulating base type details and physical dimensions (where applicable).						

7	Outline with insulator profile						
8	V-I characteristics (protective level characteristics) at 8/20 µs, 30/60 µs and 1/2 µs front (steep current) impulses						
9	Temporary overvoltage withstand capability curve, with and without prior duty.						

Notes:

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

Annex K – Deviation to SPECIFICATION schedule (To be completed per item)

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

Notes:

1) For each item, all deviations to any requirement in this specification and associated technical schedule or annex (A-C) 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:_____