Eskom	Standard	Technology

Title: **USER SPECIFICATION FOR ONLINE CONDITION MONITORING DEVICE FOR AIR INSULATED CIRCUIT-BREAKERS AND ISOLATORS/EARTHING SWITCHES**

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Content

Executive Summary

This standard sets out Eskom's specific and standardised requirements for online condition monitoring device for air-insulated circuit-breakers and disconnectors for use in three-phase 50 Hz alternating current systems with nominal voltages from 72.5 kV and above. The requirements for online condition monitoring device for air-insulated circuit-breakers and disconnectors are based on Cigre 2000, WG 13.09 Technical Bronchure 167 (User guide for the application of monitoring & diagnostic techniques for switching equipment for rated voltages of 72.5kV and above).

1. Introduction

This standard sets out Eskom's specific and standardised requirements for online condition monitoring device for air-insulated circuit-breakers and disconnectors for use in three-phase 50 Hz alternating current systems with nominal voltages from 72.5 kV and above.

2. Supporting clauses

2.1 Scope

2.1.1 Purpose

This standard provides the specific and standardised requirements for air-insulated circuit-breakers and disconnectors for use in three-phase 50 Hz alternating current systems with nominal voltages from 72.5 kV and above in accordance with WG 13.09 Technical Bronchure 167 (User guide for the application of monitoring & diagnostic techniques for switching equipment for rated voltages of 72.5kV and above).

A set of technical schedules A and B accompanies this standard.

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] SANS 60529, Degrees of protection provided by enclosures (IP code)

[3] SANS 62271-1, High-voltage switchgear and controlgear – Part 1: Common specifications.

[4] 240-56063756 Outdoor Circuit Breakers for System with Nominal Voltages from 6.6kV Up To and including 765kV Standard

[5] 240-56063815 High Voltage Outdoor Disconnectors and Earthing Switches Standard

[6] SANS 62271-100, High-voltage switchgear and controlgear – Part 100: High-voltage alternating-current circuit-breakers.

[7] SANS 62271-3/ IEC 62271-3 High-voltage switchgear and controlgear — Part 3: Digital interfaces based on IEC 61850

[8] 240-42066934 IEC 61850 Protocol implementation document for the purposes of substation automation

[9] 240-64685228 Generic specification for protective Intelligent Electronic Devices (IEDs)

[10] ESP 32-846: Operating Regulations for High Voltage Systems (ORHVS).

[11] 240-56062515 (DISSCAAK9), Distribution Standard Part 15: Specification for labels on control panels, relay panels and other indoor and outdoor equipment.

[12] DSP 34-1658, Distribution Standard Part 4: Corrosion protection specification for new indoor and outdoor Distribution equipment manufactured from steel.

[13] 240-56065202, Distribution Standard Part 7: Switchgear training requirements from original equipment manufacturers.

[14] 240-56030489, Distribution Standard Part 7: Standard requirements for the wiring of outdoor switchgear used in systems of nominal voltage up to and including 132 kV.

[15] QM-58, Supplier contract quality requirements specification.

[16] 240-56063765, Eskom health and safety management – supplier requirements

[17] DST_240-53902499, Standard for the transport, handling, storage and preservation of HV and MV switchgear.

[18] Appendix A – Supplier and Eskom's responsibilities

[19] Appendix B – Technical Schedules

[20] Appendix C – Technical Schedules for the digital secondary plant interface

[21] Appendix D – Maintenance Analysis

2.2.2 Informative

[22] Cigre 2000, WG 13.09 Technical Bronchure 167 (User guide for the application of monitoring & diagnostic techniques for switching equipment for rated voltages of 72.5kV and above).

2.3 Definitions

2.3.1 General

Definition	Description
Condition Based Monitoring (CBM)	Condition Based Monitoring is a maintenance strategy that allows to monitor the actual condition of an asset, extracting information to understand the machines' actual wear, degradation and if a relevant change has occurred [definition from – https://www.rina.org/
	is a type of predictive maintenance that involves using sensors to measure the status of an asset over time while it is in operation. The data collected can be used to establish trends, predict failure, and calculate remaining life of an asset.[1] With CBM, maintenance is only performed when the data shows that performance is decreasing or a failure is likely. Rather than at specified intervals like with predictive maintenance [definition from - https://inspectioneering.com/]
	Condition Based Monitoring (CBM) within a Substation or Power plant environment is the process of using either online or offline tools to capture one or several parameters on an asset and use data analytics to diagnose and trend its health condition over time, predict imminent failure and calculate remaining operational life. [definition from - https://www.qualitrolcorp.com/grid-applications/transmission-distribution/]
Intelligent Electronic Device (IED)	A device incorporating one or more processors with the capability to execute application functions, store data locally in a memory and exchange data with other IEDs (sources or sinks) over a digital link [IEC 61850-5].
Interoperability	the ability of computer systems or software to exchange and make use of information. *"interoperability between devices made by different manufacturers"* [definition from – Oxford Languages]

Definition	Description
	Interoperability is a characteristic of a product or system, whose interfaces are completely understood, to work with other products or systems, at present or in the future, in either implementation or access, without any restrictions. [definition from – Wikipedia]
Process Interface Unit (PIU)	Also referred to as a 'digital merging unit' or 'binary input/output device'; an Intelligent Electronic Device (IED) that collects binary data from process devices, typically electrical primary plant equipment, by way of status contacts, and processes and publishes this data to other IEDs in a digital format (e.g. IEC 61580-based communication). The device similarly converts digital commands from other IEDs into electrical control signals to the primary equipment.

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
ACSI	Abstract Communication Service Interface [IEC 61850-7-2]
CB	Circuit-breaker
DS	Disconnector
ES	Earthing switches
GOOSE	Generic Object Oriented Substation Event [IEC 61850-8-1]
OEM	Original equipment manufacturer

2.5 Roles and responsibilities

Transmission Asset Management SE&D shall ensure that the approved standard is in place for use by Eskom.

2.6 Process for monitoring

Not applicable.

2.7 Related/supporting documents

Technical A & B schedules.

3. User specification for online condition monitoring device for air-insulated circuit-breakers

3.1 Background:

The circuit breaker maintenance in electric power substations has been traditionally based in time (fixed intervals). That criterion, besides having significant costs for the utilities, usually isn't the answer to an immediate need of maintenance being used since the beginning until recent times, when the substations possessed permanent maintenance teams. Possible online CB condition monitoring device can be used on a wider network to reduce costs and to avoid catastrophic failures.

Eskom is intending to get the technological solution with interoperability features, that is dependable and reliable for the operating environment and data capturing, management, analytics and communication. It shall be compliant to the communication protocols and interfaces in accordance with IEC 61850. Its life expectancy shall be within the expected life of computing components used in the power transfer utilities.

3.2 Scope

The Supplier shall offer technology to perform the advanced analysis of electrical wear calculation, arcing time, travel curve analysis, contact stroke, SF6 Gas monitoring of density and leakage detection on circuit-breakers. Also the technology required for smart condition monitoring of disconnectors.

This is the User Specification (with requirements for inspection/calibration tests required during in service) – it also makes reference to the existing technical equipment specifications.

3.3 Objectives

- To find a reliable online condition monitoring device that can assist to verify and alarm if the CB is operating within or out the design parameters or has exceeded the maximum fault current rating (cumulative current).
    - SF6 circuit breaker – determine the condition/status of the interrupter (e.g. arcing contacts and nozzle wear).
- To find out the possible online CB condition-monitoring device that can be used on a wider network
- To find a reliable online condition monitoring device that can assist to verify and alarm if the disconnector is operating within or out the design parameters (namely, electrically, mechanically and operationally).

3.4 Preferred nominal voltages

Air Insulated Switchgear 132kV, 275kV, 400kV, 765kV

3.5 CB measured and monitored parameters are

- Closing and opening coils currents
- Line phases currents
- Motor operating currents - thermal overload
- Voltages supply (AC and DC)
- Phases voltages
- Operating mechanism latches and rollers
- Main contacts travel
- Wear of the main (both male and female) and transfer contacts
- Insulation medium pressure
- Internal temperatures
- Supervision contacts state
- The monitoring device that is able to measure I^2t and cumulative current (incl pre-faults values)
- Point of wave switching – measure point of closing of current on wave form (degree etc.)

3.6 CB additional requirement

- The device must be compliant to IEC 61850 communication protocol.
- The device must be integrated to Secondary Plant protection and control schemes.
- The device must be linkable to SCADA or central monitoring unit.
- The device must be possible to retrofit to older circuit breakers.

4. User specification for online condition monitoring device for air-insulated disconnectors

4.1 Background

Transmission network has a growing population of conventional disconnectors, pantograph disconnectors some with built-in integral earthing switches and the separately mounted standalone earthing switches. Normally the switchgear enters service; maintenance regime is condition & time based and non-intrusive and becomes intrusive where required depending on aging and performance conditions. Transmission Grids have challenges with actuators that were retrofitted later on during the disconnectors life-expectancy, especially 220kV disconnectors. Secondly, there are failures related to problems with the main current carrying path, transfer bearings and operating drive mechanisms gearing system damages. Most of these failures are due to hot connections and misalignment problems. .Thirdly, some designs operating drive mechanisms have recorded water ingress that lead to the failure of the auxiliary switches.

Transmission is aiming to get the suitable smart condition monitoring device that can be used to control and monitoring the condition of disconnectors in service. A technological solution that could be employed to mitigate the number of disconnector failures.

4.2 Preferred nominal voltages

Air Insulated Switchgear 132kV, 275kV, 400kV, 765kV

4.3 DS measured and monitored parameters are

- Opening and closing operations
- Aligning / Positioning system
- Disconnector position failure
- Measure motor voltage, current and torque, travel time
- Temperature and humidity

4.4 DS additional requirement

- The device must be compliant to IEC 61850 communication protocol.
- The device must be integrated to Secondary Plant protection and control schemes.
- The device must be linkable to SCADA or central monitoring unit.
- The device must be possible to retrofit to the older disconnectors.

5. Authorization

This document has been seen by:

Name and surname	Designation
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Tony Taute	Tx North West Grid – HV Plant Management; Tx STT Convener

6. Revisions

Date	Rev	Compiler	Remarks
Oct 2021	Draft 0.1	J Cebekhulu	Final version

7. Development team

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

- Matome Matlhadisa — Transmission HV Plant Management
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8. Acknowledgements

The Compiler acknowledges the contributions to this revision from Technology, Distribution and Transmission.

Annex A – Circuit-breaker online condition monitoring for 132kV and above (110V DC or 220V DC)

Item	Spec/ clause		Description		Schedule A	Schedule B
1			**Device design details**			
1,1		•	Condition Monitoring device/ intelligent electronic device complies to IEC 61850-5 © IEC:2003(E) (p.31) protocol compliant	Y/N	Yes	
1.2		•	Condition Monitoring device/ intelligent electronic device complies with Eskom standard wiring interface as per circuit-breaker standard - ST 240-56063756	Y/N	Yes	
1.3		•	Condition Monitoring device/ intelligent electronic device complies IEC 62271-100 standard	Y/N	Yes	
1.4		•	Condition Monitoring device/ intelligent electronic device complies to the Eskom circuit-breaker standards - 240-56063756	Y/N	Yes	
1.5		•	Measure closing and opening coils currents	Y/N	Yes	
1.6		•	Measure line phases currents	Y/N	Yes	
1.7		•	Measure motor operating currents - thermal overload	Y/N	Yes	
1.8		•	Voltages supply (AC and DC)	Y/N	Yes	
1.9		•	Measure phases voltages	Y/N	Yes	
1.10		•	Monitor operating mechanism latches and rollers	Y/N	Yes	
1.11		•	Measure main contacts travel	Y/N	Yes	
1.12		•	Measure wear of the main (both male and female) and transfer contacts	Y/N	Yes	
1.13		•	Measure insulation medium pressure	Y/N	Yes	
1.14		•	Measure internal temperatures	Y/N	Yes	
1.15		•	Supervision of contacts state	Y/N	Yes	
1.16		•	The monitoring device that is able to measure I^2t and cumulative current (incl pre-faults values)	Y/N	Yes	
1.17		•	Condition Monitoring device/ intelligent electronic device manufactured to which standard(s)		xxxxxxxxx	
1.18		•	Manufacturer of Condition Monitoring device/ intelligent electronic device		xxxxxxxxx	
1.19		•	Design type of Condition Monitoring device/ intelligent electronic device		xxxxxxxxx	
1.20		•	Country of manufacturing		xxxxxxxxx	
1.21		•	Device operating software type		xxxxxxxxx	

1.22		•	Device operating software version		xxxxxxxxx x	
1.23		•	Device operating software:			
1.24		•	Different supplier circuit breaker application	Y/N		
1.25		•	Can be installed in all breaker application	Y/N		
1.26		•	Use circuit breaker data to setup switching program	Y/N		
1.27		•	Minimum expected life-span of the operating software	Years	xxxxxxxxx x	
1.28		•	Minimum expected life-span of circuit-breaker Condition Monitoring device/ intelligent electronic device	Years	xxxxxxxxx x	
1.29		•	Device operating Algorithm:			
2			**Circuit-breaker ratings**			
2,1		•	Circuit-breaker manufacturer(s)		xxxxxxxxx x	
2,2		•	Designed for circuit-breaker type(s)		xxxxxxxxx x	
2,3		•	Circuit-breaker rated voltage	kV	xxxxxxxxx x	
2,4		•	Circuit-breaker rated current	A	xxxxxxxxx x	
2,5		•	Circuit-breaker rated short-time withstand current	kA	xxxxxxxxx x	
2,6		•	Circuit-breaker pole operation	1P/ 3P	1-pole operated (1P)	
		•	Circuit-breaker pole operation	1P/ 3P	3-pole operated (3P)	
2,7		•	Circuit-breaker rated operation sequence		O-0,3s-C-O-3m-CO	
3			**Application and network**			
3,1		•	System nominal voltages applicable	kV	132/ 275/ 400/765	
3.2		•	System neutral	Y/N	non-effectively earthed	
3.3		•	System neutral	Y/N	Effectively earthed	

3.4		•	Shunt capacitor banks	Y/N	Closing single pole	
3.5		•	Filter capacitor banks	Y/N	Closing single pole	
3.6		•	Shunt reactor banks	Y/N	Opening single pole	
3.7		•	Transformer switching		xxxxxxxxx x	
3.8		•	Transformer duty - TLF	Y/N	Yes	
3.9		•	Remnant flux		xxxxxxxxx x	
3.10		•	Line application, also with Series compensation [Optional]		xxxxxxxxx x	
3.11		•	Switching duty		Closing/ Open	
3.12		•	Circuit-breaker DC control voltage	VDC	110 / 220	
		•	Circuit-breaker Adaptive control	Y/N		
4			**Mounting requirements**			
4.1		•	Device mountable on rack size		19-inch	
4.2		•	Device module design		Modular	
4.3		•	All plug-in circuit boards and modules to fitted with		Guide pins	
4.4		•	Device enclosure fitted with		Card guides	
4.5		•	Circuit cards and guides easily replaceable without removal of device from rack or other cards or modules from rack	Y/N	Yes	
4.6		•	Local support - repairs	Y/N	Yes	
4.7		•	Modular units of the rack self-supporting and do not require external supports or bracing other than the 19-inch standard	Y/N	Yes	
4.8		•	In-service or bypass switch has the device in Service or on Bypass	Y/N	Yes	
5			**Wiring design details**			
5.1		•	Condition Monitoring device/ intelligent electronic device shall comply to Eskom circuit-breaker wiring standard (132kV and below - 240-56030489)		240-56030489	
5.2		•	Condition Monitoring device/ intelligent electronic device shall comply to Eskom standard interface drawing		D-DT-5407	

5.3		•	CB wiring schematic diagram provided		xxxxxxxxx x	
5.4		•	Condition Monitoring device/ intelligent electronic device shown on the CB wiring schematic diagram provided	Y/N	Yes	
5.5		•	Wiring diagram drawing number		xxxxxxxxx x	
5.6		•	Wiring special accessories required		xxxxxxxxx x	
5.7		•	Wiring special accessories supplied	Y/N	Yes	
5.8		•	Optional (items or accessories) not part of the controlled switching device		xxxxxxxxx x	
		□				
6			**Type-tests, Factory Routine tests & Field application tests**			
6,1		•	EMC tests submitted with tender documentation	Y/N	Yes	
6.2		•	HV type tests performed submitted with tender documentation	Y/N	Yes	
6.3		•	Factory routine test report submitted with tender documentation	Y/N	Yes	
6.4		•	Application test submitted with tender documentation (e.g. Capacitor Bank Switching, Reactor switching, Line switching, etc.)	Y/N	Yes	
7			**Site delivery and storage requirements**			
7.1		•	Delivered on a separate clearly marked packaging	Y/N	Yes	
7.2		•	Storage instructions provided (separate from packaging)	Y/N	Yes	
7.3		•	Duration of the outdoor storage allowed (if applicable)		xxxxxxxxx x	
7.4		•	Conditions for outdoor storage (if applicable)		xxxxxxxxx x	
7.5		•	Instruction and operating manuals provided	Y/N	Yes	
7.6		•	Instruction and operating manuals on electronic format	Y/N	Yes	

SIGNATURES

Supplier	Name (Print)	Sign	Date
Factory	Name (Print)	Sign	Date
Eskom	Name (Print)	Sign	Date

9. APPENDIX B: Disconnector/Earthing switch online condition monitoring for 132kV and above (110V DC or 220V DC)

Disconnector/Earthing Switch online condition monitoring for 132kV (or above) 110V DC or 220V DC						
Item	**Spec/ clause**		**Description**		**Schedule A**	**Schedule B**
1			**Device design details**			
1,1		•	Controlled switching device electronic controller complies to IEC 61850-5 © IEC:2003(E) (p.31) protocol compliant	Y/N	Yes	
1.2		•	Controlled switching device electronic controller complies with Eskom standard philosophy - ST 240- 75566441	Y/N	Yes	
1.3		•	Controlled switching device electronic controller complies IEC 62271-100 standard	Y/N	Yes	
1.4		•	Controlled switching device electronic controller complies to the Eskom circuit-breaker standards - 240-56063756	Y/N	Yes	
1.5		•	Measure opening and closing operations	Y/N	Yes	
1.6		•	Measure alignment / Positioning system	Y/N	Yes	
1.7		•	Indicate disconnector position failure	Y/N	Yes	
1.8		•	Measure motor voltage, current and torque, travel time	Y/N	Yes	
1.9		•	Measure temperature and humidity	Y/N	Yes	
1.10		•	Controlled switching device electronic controller manufactured to which standard(s)		xxxxxxxxxx	
1.11		•	Manufacturer of controlled switching device		xxxxxxxxxx	
1.12		•	Design type of controlled switching device		xxxxxxxxxx	
1.13		•	Country of manufacturing		xxxxxxxxxx	
1.14		•	Device operating software type		xxxxxxxxxx	
1.15		•	Device operating software version		xxxxxxxxxx	
1.16		•	Device operating software:			
1.17		•	Different supplier circuit breaker application	Y/N		

1.18		•	Can be installed in all breaker application	Y/N		
1.19		•	Use circuit breaker data to setup switching program	Y/N		
1.20		•	Minimim expected life-span of the operating software	Years	xxxxxxxxxx	
1.21		•	Minimim expected life-span of circuit-breaker Controlled switching device	Years	xxxxxxxxxx	
1.22		•	Device operating Algoritm:	Y/N		
2			**Disconnector ratings**			
2,1		•	Disconnector manufacturer(s)		xxxxxxxxxx	
2,2		•	Designed for disconnector type(s)		xxxxxxxxxx	
2,3		•	Disconnector rated voltage	kV	xxxxxxxxxx	
2,4		•	Disconnector rated current	A	xxxxxxxxxx	
2,5		•	Disconnector rated short-time withstand current	kA	xxxxxxxxxx	
2,6		•	Disconnector pole operation	1P/ 3P	1-pole operated (1P)	
2,7		•	Disconnector rated operation sequence		O(1 pole)-0,3s-C(1 pole)-O(all poles)-3m-CO(all poles)	
3			**Application and network**			
3,1		•	System nominal voltages applicable	kV	132/ 275/ 400/765	
3.2		•	System neutral	Y/N	non-effectively earthed	
3.3		•	System neutral	Y/N	Effectively earthed	
3.4		•	Shunt capacitor banks	Y/N	Closing single pole	
3.5		•	Filter capacitor banks	Y/N	Closing single pole	

3.6		•	Shunt reactor banks	Y/N	Opening single pole	
3.7		•	Transformer switching		xxxxxxxxxx	
3.8		•	Transformer duty - TLF	Y/N	Yes	
3.9		•	Remnant flux		xxxxxxxxxx	
3.10		•	Line application, also with Series compensation [Optional]		xxxxxxxxxx	
3.11		•	Switching duty		Closing/ Open	
3.12		•	Circuit-breaker DC control voltage	VDC	110 / 220	
		•	Circuit-breaker Adaptive control	Y/N		
4			**Mounting requirements**			
4.1		•	Device mountable on rack size		19-inch	
4.2		•	Device module design		Modular	
4.3		•	All plug-in circuit boards and modules to fitted with		Guide pins	
4.4		•	Device enslosure fitted with		Card guides	
4.5		•	Circuit cards and guides easily replaceable without removal of device from rack or other cards or modules from rack	Y/N	Yes	
4.6		•	Local support - repairs	Y/N	Yes	
4.7		•	Modular units of the rack self-supporting and do not require external supports or bracing other than the 19-inch standard	Y/N	Yes	
4.8		•	In-service or bypass switch has the device in Service or on Bypass	Y/N	Yes	
5			**Wiring design details**			
5.1		•	Controlled switching device shall comply to Eskom circuit-breaker wiring standard (132kV and below - 240-56030489)		240-56030489	

5.2		•	Controlled switching device shall comply to Eskom standard interface drawing		D-DT-5407	
5.3		•	CB wiring schematic diagram provided		xxxxxxxxxx	
5.4		•	Controlled switching device shown on the CB wiring schematic diagram provided	Y/N	Yes	
5.5		•	Wiring diagram drawing number		xxxxxxxxxx	
5.6		•	Wiring special accessories required		xxxxxxxxxx	
5.7		•	Wiring special accessories supplied	Y/N	Yes	
5.8		•	Optional (items or accessories) not part of the controlled switching device		xxxxxxxxxx	
		□				
6			**Type-tests, Factory Routine tests & Field application tests**			
6,1		•	EMC tests submitted with tender documentation	Y/N	Yes	
6.2		•	HV type tests performed submitted with tender documentation	Y/N	Yes	
6.3		•	Factory routine test report submitted with tender documentation	Y/N	Yes	
6.4		•	Application test submitted with tender documentation (e.g. Capacitor Bank Switching, Reactor switching, Line switching, etc.)	Y/N	Yes	
7			**Site delivery and storage requirements**			
7.1		•	Delivered on a separate clearly marked packaging	Y/N	Yes	
7.2		•	Storage instructions provided (separate from packaging)	Y/N	Yes	
7.3		•	Duration of the outdoor storage allowed (if applicable)		xxxxxxxxxx	
7.4		•	Conditions for outdoor storage (if applicable)		xxxxxxxxxx	
7.5		•	Instruction and operating manuals provided	Y/N	Yes	
7.6		•	Instruction and operating manuals on electronic format	Y/N	Yes	

SIGNATURES

Supplier	Name (Print)	Sign	Date

Factory	Name (Print)	Sign	Date
Eskom	Name (Print)	Sign	Date

10. APPENDIX C: Controlled switching device (Controller) - Point on Wave (POW) relay for 132 kV (and above) circuit-breaker type 1P (3-mechanisms) 110V DC or 220V DC

Controlled switching device (Controller) - Point on Wave (POW) relay for 132 kV (and above) circuit-breaker type 1P (3-mechanisms) 110V DC or 220V DC						
Item	**Spec/ clause**		**Description**		**Schedule A**	**Schedule B**
1			**Device design details**			
1,1		•	Controlled switching device electronic controller complies to IEC 61850-5 © IEC:2003(E) (p.31) protocol compliant	Y/N	Yes	
1.2		•	Controlled switching device electronic controller complies with Eskom standard philosophy - ST 240- 75566441	Y/N	Yes	
1.3		•	Controlled switching device electronic controller complies IEC 62271-100 standard	Y/N	Yes	
1.4		•	Controlled switching device electronic controller complies to the Eskom circuit-breaker standards - 240-56063756	Y/N	Yes	
1.5		•	Controlled switching device electronic controller manufactured to which standard(s)		xxxxxxxxxx	
1.6		•	Manufacturer of controlled switching device		xxxxxxxxxx	
1.7		•	Design type of controlled switching device		xxxxxxxxxx	
1.8		•	Country of manufacturing		xxxxxxxxxx	
1.9		•	Device operating software type		xxxxxxxxxx	
1.10		•	Device operating software version		xxxxxxxxxx	
1.11		□	Device operating software:			
		□	Different supplier circuit breaker application	Y/N		
		□	Application on Shunt Capacitor Bank & Shunt Reactors	Y/N		
		□	Duty: Opening, closing or opening&closing	Y/N		
		□	Adaptive mode	Y/N		
		□	Use circuit breaker data to setup switching program	Y/N		
1.12		•	Minimim expected life-span of the operating software	Years	xxxxxxxxxx	
1.13		•	Minimim expected life-span of circuit-breaker Controlled switching device	Years	xxxxxxxxxx	

1.14		•	Device operating Algoritm:			
		□	Busbar VT and circuitbreaker auxiliary contacts	Y/N		
		□	Busbar VT and device current transformers	Y/N		
2			**Circuit-breaker ratings**			
2,1		•	Circuit-breaker manufacturer(s)		xxxxxxxxxx	
2,2		•	Designed for circuit-breaker type(s)		xxxxxxxxxx	
2,3		•	Circuit-breaker rated voltage	kV	xxxxxxxxxx	
2,4		•	Circuit-breaker rated current	A	xxxxxxxxxx	
2,5		•	Circuit-breaker rated short-time withstand current	kA	xxxxxxxxxx	
2,6		•	Circuit-breaker pole operation	1P/ 3P	1-pole operated (1P)	
2,7		•	Circuit-breaker rated operation sequence		O(1 pole)-0,3s-C(1 pole)-O(all poles)-3m-CO(all poles)	
3			**Application and network**			
3,1		•	System nominal voltages applicable	kV	220/ 275/ 400/765	
3.2		•	System neutral	Y/N	non-effectively earthed	
3.3		•	System neutral	Y/N	Effectively earthed	
3.4		•	Shunt capacitor banks	Y/N	Closing single pole	
3.5		•	Filter capacitor banks	Y/N	Closing single pole	
3.6		•	Shunt reactor banks	Y/N	Opening single pole	

3.7		•	Transformer switching		xxxxxxxxxx	
3.8		•	Transformer duty - TLF	Y/N	Yes	
3.9		•	Remnant flux		xxxxxxxxxx	
3.10		•	Line application, also with Series compensation [Optional]		xxxxxxxxxx	
3.11		•	Switching duty		Closing/ Open	
3.12		•	Circuit-breaker DC control voltage	VDC	110 / 220	
		•	Circuit-breaker Adaptive control	Y/N		
4			**Mounting requirements**			
4.1		•	Device mountable on rack size		19-inch	
4.2		•	Device module design		Modular	
4.3		•	All plug-in circuit boards and modules to fitted with		Guide pins	
4.4		•	Device enslosure fitted with		Card guides	
4.5		•	Circuit cards and guides easily replaceable without removal of device from rack or other cards or modules from rack	Y/N	Yes	
4.6		•	Local support - repairs	Y/N	Yes	
4.7		•	Modular units of the rack self-supporting and do not require external supports or bracing other than the 19-inch standard	Y/N	Yes	
4.8		•	In-service or bypass switch has the device in Service or on Bypass	Y/N	Yes	
5			**Wiring design details**			
5.1		•	Controlled switching device shall comply to Eskom circuit-breaker wiring standard (132kV and below - 240-56030489)		240-56030489	
5.2		•	Controlled switching device shall comply to Eskom standard interface drawing		D-DT-5407	

5.3		•	CB wiring schematic diagram provided		xxxxxxxxxx	
5.4		•	Controlled switching device shown on the CB wiring schematic diagram provided	Y/N	Yes	
5.5		•	Wiring diagram drawing number		xxxxxxxxxx	
5.6		•	Wiring special accessories required		xxxxxxxxxx	
5.7		•	Wiring special accessories supplied	Y/N	Yes	
5.8		•	Optional (items or accessories) not part of the controlled switching device		xxxxxxxxxx	
		□				
6			**Type-tests, Factory Routine tests & Field application tests**			
6,1		•	EMC tests submitted with tender documentation	Y/N	Yes	
6.2		•	HV type tests performed submitted with tender documentation	Y/N	Yes	
6.3		•	Factory routine test report submitted with tender documentation	Y/N	Yes	
6.4		•	Application test submitted with tender documentation (e.g. Capacitor Bank Switching, Reactor switching, Line switching, etc.)	Y/N	Yes	
7			**Site delivery and storage requirements**			
7.1		•	Delivered on a separate clearly marked packaging	Y/N	Yes	
7.2		•	Storage instructions provided (separate from packaging)	Y/N	Yes	
7.3		•	Duration of the outdoor storage allowed (if applicable)		xxxxxxxxxx	
7.4		•	Conditions for outdoor storage (if applicable)		xxxxxxxxxx	
7.5		•	Instruction and operating manuals provided	Y/N	Yes	
7.6		•	Instruction and operating manuals on electronic format	Y/N	Yes	

SIGNATURES

Supplier	Name (Print)	Sign	Date
Factory	Name (Print)	Sign	Date

Eskom	Name (Print)	Sign	Date