	Standard	Generation Engineering
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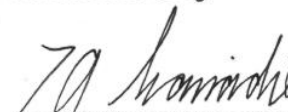


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1. INTRODUCTION

This document contains a list of products (e.g. protective IED's, relays, other electronic devices, etc.) for installation on Eskom Power Stations electrical plant.

2. SUPPORTING CLAUSES

2.1 SCOPE

2.1.1 Purpose

This document endorses Eskom Generation, Asset Management (i.e. Generation Engineering) and PTM field teams in their choice of products (protection, excitation and measurement related) when developing new schemes and/or when performing modifications to existing schemes.

Discrete relays for design and modifications (protection, excitation and measurement related) within the Eskom Generation environment are also listed.

2.1.2 Applicability

This document applies to all Eskom Generation sites.

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

These documents are indispensable for the application of this document and must be used in conjunction with this document.

- [1] 32-9: Definition of Eskom documents.
- [2] 32-644: Eskom documentation management standard.
- [3] 240-64685228: Generic specification for protective intelligent electronic devices (IED's) standard.

2.2.2 Informative

List documents that are further sources of information referenced in your document, e.g. laws, standards, codes and procedures.

- [4] 240-51999977: Specification for digital transducer-based measurement system for electrical quantities.
- [5] 32-310 (240-56032475): Specification for analogue transducer-based measurement system for electrical quantities.
- [6] 240-55410927: Cyber Security Standard for Operational Technology.
- [7] 240-55863502: Definition of Operational Technology (OT) and OT/IT Collaboration Accountabilities.
- [8] 32-373: Information Security – IT/OT Remote Access Standard.

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2.3 DEFINITIONS

Definition	Description
N/A	N/A

2.3.1 Disclosure Classification

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

2.4 ABBREVIATIONS

Abbreviation	Description
AC	Alternating Current
CoE	Centre of Excellence
DC	Direct Current
DPI	Dip Proofing Inverter
LV	Low Voltage
MV	Medium Voltage
N/A	Not Applicable
IED	Intelligent Electronic Devices

3. REQUIREMENTS

3.1 INTRODUCTION

The IED's/relays/equipment will be divided into their functional type and application. Multi-function IED's/relays will be indicated as such.

Tests performed on IED's/relays/equipment are listed under test guidelines. Application testing or specific function testing will only be performed on request.

IED's/relays/equipment that has failed the tests will also be included for completeness. Certain IED's/relays/equipment that has failed the tests may be used **temporarily** with approved modifications to cure symptomatic problems. These will be indicated together with the modifications. These relays **should not** be utilised in the design of new schemes.

The following items, not being relays in the strict sense of the word, have been included in this document as they form an integral part of certain protection systems, or subsystems:

- Timers
- Paralleling devices
- Generator disturbance recorders
- Dip Proofing Inverters
- Transducers

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3.2 IMPORTANT NOTES

- At the time of approval testing, the latest software tool version and current firmware version are used.
- The devices supplied might be of a higher version firmware. Attention is drawn to the relevant ESKOM standard. NOTE: The hardware shall be the same.
- Definitions of details in tables below:

○ Approved devices.

○ Devices not approved.

○ Approved devices obsolete.

○ Approved devices on hold.

3.3 ANSI DESCRIPTION OF FUNCTIONS

Table 1: ANSI Description of Functions

ANSI No.	DESCRIPTION
14	Locked Rotor protection
21	Distance protection, phase
24	Overfluxing
25	Synchronising, Synchronism check
26	Resistive Temperature detection
27	Under Voltage
27/51	Voltage controlled overcurrent
27TN	Third Harmonic under voltage
27X	Auxiliary Under Voltage
32	Directional Power
37	Undercurrent or Under power
38	Bearing Over temperature
39	Bearing Vibration
40	Loss of Excitation (Impedance)
40Q	Loss of Excitation (Reactive Power)
46	Negative Sequence Current
46R	Phase reversal
47	Phase Sequence voltage
49M	Thermal Overload

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49R	Rotor Overload
49S	Stator Overload
50P	Instantaneous overcurrent (Phase)
50/27	Inadvertent Energising
50BF	Breaker Failure (Instantaneous)
50N/G	Instantaneous overcurrent (Neutral/Ground)
51	Time Overcurrent
51BF	Breaker Failure (IDMT)
51N	Neutral Time overcurrent
51NBF	Breaker Failure (Neutral)
51V	Voltage Restraint Phase Overcurrent
53	Out of Step
56	Field Application
59	Overvoltage
59D	Third Harmonic Voltage Differential
59N	Generator Ground Fault
59X	Auxiliary Over Voltage
60	Voltage Balance
60FL	Fuse Loss
64G	Rotor Ground
64R	Rotor Ground (Injection Principle)
64S	Stator Ground (Injection Principle)
66	Cumulative Start-up
67	Ground Directional
67N	Sensitive ground fault
68	Blocking
74TC	Trip coil Supervision
76	Over excitation
78	Pole Slip
79	AC Reclosing
81	Frequency
81A	Under Frequency Accumulation

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81R	R.O.C.O.F
86	Lockout (Master Trip)
87G	Generator Differential
87T	Transformer Differential
87B	Bus Differential
87S	Stator Differential
87L	Line Current Differential
87PC	Line Phase Comparison
87Gnd	Ground Differential
AFD	Arc Flash Detection

3.4 TYPE TESTING GUIDELINE

3.4.1 General

3.4.1.1 Type testing shall consist of performing testing on at least one sample of the IED/equipment family design.

3.4.1.2 The Tenderer is not required to repeat type tests already passed by its equipment, provided type test certificates are produced, including fully detailed, certified test reports from an independent laboratory and has been scrutinised by an Eskom employee with the related skill.

3.4.1.3 The submitted certification should clearly indicate conformance.

3.4.1.4 Where type test certificates and test reports are not available for the specific model of equipment being offered, evidence of equivalent tests performed on substantially similar equipment may be accepted subject to Eskom's approval.

3.4.1.5 Where required, type testing will be at the Tenderer's expense.

3.4.2 Protective Intelligent Electronic Devices and /or similar (i.e. bay controllers, etc.)

Selection and type testing of IED's for protective systems shall be performed in accordance to procedure 240-64685228: Generic specification for protective intelligent electronic devices (IED's) standard, point 4.2, "Type test requirements".

3.4.3 Other Electronic Devices and/or tripping or critical function equipment

Note: A suite of tests or all as listed below shall be performed dependant on the technology type and application of the device under test. The tests performed shall be selected and listed by the tester in the template (Appendix 1).

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3.4.3.1 Electromagnetic Compatibility Tests

Table 2: EMC Testing

EMC immunity test level requirements	
1MHz burst disturbance test, class III <ul style="list-style-type: none"> Common mode Differential mode 	According to IEC60255-22-1 2,5 kV 1,0 kV
Electrostatic discharge test, class 3 <ul style="list-style-type: none"> For contact discharge For air discharge 	According to IEC61000-4-2, IEC60255-22-2 and ANSI C37.90.3-2001 6 kV 8 kV
Radio frequency interference tests <ul style="list-style-type: none"> Conducted, common mode Radiated, amplitude-modulated Radiated, pulse-modulated 	According to IEC61000-4-6 and IEC60255-22-6 (2000) 10V (rms), f=150 kHz...80 Mhz According to IEC61000-4-3 and IEC60255-22-3 (2000) 10 V/m (rms), f=80...1000 MHz According to the ENV 50204 and IEC60255-22-3 (2000) 10 V/m, f=900 Mhz
Fast transient disturbance tests <ul style="list-style-type: none"> Power outputs, energising inputs, power supply, I/O ports Communication ports 	According to IEC60255-22-4 and IEC61000-4-4 2 kV 1 kV
Surge immunity test <ul style="list-style-type: none"> Power outputs, energising inputs, power supply, I/O ports Communication ports 	According to IEC60255-22-5: 1.2/50 μ s voltage and 8/20 μ s current surges. 0.5, 1 and 2 kV line-to-earth and 0.5 and 1 kV line-to-line applied 0.5 and 1 kV line-to-earth applied
Power frequency (50 Hz) magnetic field IEC61000-4-8	Class 5: 100 A/m continuous, 1000A/m for 1 to 3 s, 50Hz
Voltage dips and short interruptions	According to IEC60255-11: <ul style="list-style-type: none"> Voltage dip: a 20 ms interruption has no effect on operation Interruption: no mal operation for a 5 s interruption. Gradual start-up/shut-down: no mal operation for decaying DC to zero over 60 s, rising over 60 s. AC ripple: the device shall function correctly with 12 % 100Hz AC signal superimposed on the DC supply.
Electromagnetic emission tests <ul style="list-style-type: none"> Conducted, RF-emission (Power supply) Radiated RF-emission 	According to the IEC60255-25: 0.15 – 0.5 MHz 79 dB (μ V) quasi peak, 66 dB (μ V) average and 0.5 – 30 MHz 73 dB (μ V) quasi peak, 60 dB (μ V) average. 30 – 230 MHz 40 dB (μ V) quasi peak at 10 m and 230 – 1000 MHz 47dB (μ V) quasi peak at 10 m.
Capacitor discharge	1.5 x Vn Master trip circuits — 10 μ F Other protection & control circuits — 2 μ F Carrier/channel interface — 0,2 μ F

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3.4.3.2 Insulation Resistance Tests

Table 3: Insulation Resistance Test

Insulation tests	
Dielectric tests <ul style="list-style-type: none"> Test voltage 	According to IEC60255-5 2 kV, 50 Hz, 1 min
Electrical impulse voltage test <ul style="list-style-type: none"> Test voltage 	According to IEC60255-5 5 kV, unipolar impulses, waveform 1,2/50 μ s, source energy 0,5 J
Insulation resistance measurements <ul style="list-style-type: none"> Isolation resistance 	According to IEC60255-5 >20 M Ω , 500 V dc

3.4.3.3 Environmental Tests

Table 4: Environmental Tests

Environmental test	
Vibration tests (sinusoidal)	According to IEC60255-21-1, Class 1
Shock and bump test	According to IEC60255-21-1, Class 1
Seismic	According to IEC60255-21-3, Class 1
Cold	According to IEC60068-2-1, Operate with tolerance at -10°C (LCD screen operative)
Dry heat	According to IEC60068-2-2, Operate with tolerance at +55°C
Cyclic temperature and humidity	According to IEC60068-2-30, 25°C and 95% relative humidity/ 55°C and 95% relative humidity, 12 + 12 hour cycle

3.4.4 Measurement/Metering Equipment Testing

All tests done adhering to Eskom Specification documents, 32-310 (240-56032475), Specifications for analogue transducer based measurement systems for electrical quantities, 240-51999977, Specification for digital transducer-based measurement system for electrical quantities and IEC60688:Edition 2.2 2002-05 Electrical measuring transducers for converting AC electrical quantities to analogue or digital signals.

3.4.5 Criteria to change device status from “Approved” to “On Hold”

- A device upon activation of the “watch dog” function or generating of a fault code issued an incorrect trip signal.
- If two or more consecutive device failures/codes generated of the same type/function on different devices within a time frame of three months without causing incorrect trip signals.
- Protection function/application not in line with Eskom practices/philosophies.
- Any device that can/may cause a negative impact on quality of supply or safe and reliable operation of the Eskom Generation assets.
- When operation/information documentation with regard to a specific device/function are not clearly stated or described.

3.4.6 Criteria to change device status from “On Hold” to “Approved”

- Upon receiving a re-engineered or later version firmware device and tested by Eskom according to the testing guidelines of this document and found to be in order.
- When protection functions/application are re-engineered or revised to be in line with Eskom practice.

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- Upon receiving and verifying that documentation/manuals regarding a device/function is clearly described and understood by Eskom staff.

3.5 LISTS OF EQUIPMENT

Note: OpenText link - <http://mp2vmsa1772.elec.eskom.co.za/OTCS/cs.exe/app/nodes/12062622>

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5. REVISIONS

Date	Rev.	Compiler	Remarks
November 2012	0	PI Heera	Draft document for Review created from GST 36-726
May 2013	1	PI Heera	Final Document for Authorisation and Publication
May 2015	1.1	J Strydom	Add 3.4.1 General Revise 3.4.2 Revise 3.4.3 Revise 3.4.4 Include new tested devices. Add "Bay controller" to annexure 16 description. Add annexure 26
June 2015	1.2	J Strydom	Add OT and IT procedures under references.
July 2015	2	J Strydom	Final Document for Authorisation and Publication
September 2016	2.1	J Strydom	Add Comap GenSet Controllers to Appendix 19 Add Vecto II to Appendix 17 Add ION 8800 to Appendix 25 Add Iskra MT540 to Appendix 24 Add Measurelogic DTS 305 to Appendix 24 Add ABB RED67* to Appendix 8
October 2016	3	J Strydom	Final Document for Authorisation and Publication
June 2019	3.1	J Strydom	Add ABB UMC100.3 LV motor controller to Appendix 3 Add Arcteq AQ 2** series IED's to Appendices 4,6 and 10 Add Artech auxiliary devices to Appendix 13 Add Vecto III to Appendix 17 Add GE 350 IED to Appendix 6 Add ABB RE*-6** IED's to Appendix 4, 6 and 10 Add 2RMLG test block to Appendix 22 Add SEL 849 & 3421 to Appendix 3 Add SEL 710 to Appendix 4 Add SEL 2411 to Appendix 22 Add SEL 487E to Appendix 2 Add Siemens 7K*8* to Appendix 16 Add Siemens 7S*8** to Appendix 6 Add Siemens 7U*8** to Appendix 1, 2 and 4 Put DTS 305 in Appendix 24 "On Hold"
July 2019	3.2	J Strydom	No comments from PTM Technical Committee, Generation Electrical Protection and Control Care Group and Protection and Automation Study Committee. Final Draft for signature.
July 2019	4	J Strydom	Final Rev 4 Document for Authorisation and Publication

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October 2021	4.1	J Strydom	Appendix 1: Update REG670 “functions” and “comments”. Appendix13: Add Schrack MT321***. Appendix 14: Add Ashida ADE-TX and Schneider Preventa safety relay. Appendix 22: Add Siemens/Reyrolle 7SR23, Weidmuller WAS1 and WDU 10. Appendix 24: Add Schneider PM 8000, Camille Bauer I538, CEWE DPT100 and PCi MT025225 transducers. Appendix 25: Move ION8800 from Appendix 24.
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November 2023	5.1	J Strydom	Appendix 12: Add ABB Synchrotact 6*** and Siemens 7VE8**. Remove Appendices 1 to 25 and add OpenText link at point 3.5. Update “Normative” and “Informative” references.
November 2023	5.2	J Strydom	No comments received Final Draft for signatures
November 2023	6	J Strydom	Final Rev 6 Document for Authorisation and Publication

6. DEVELOPMENT TEAM

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

- Murray van Niekerk

7. ACKNOWLEDGEMENTS

The following members who provided valuable input when finalising the document:

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APPENDIX 1: TYPE TEST CHECK SHEET

[illegible]

Compliance testing and/or verification done by:

Signature:

Date:

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