

	Standard	Technology
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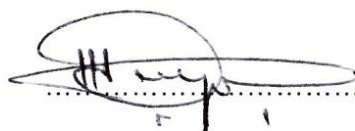
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1. INTRODUCTION

This document consists of Current Transformers Eskom Specific Requirements for Voltages up to 132kV in Accordance with NRS 029.

1.1 KEYWORDS

Current Transformers (CTs); measuring; protective devices; accuracy class; burden.

2. SUPPORTING CLAUSES

2.1 SCOPE

This specification details the specific requirements applicable to Current Transformers (CTs) used in Eskom for nominal system voltages up to 132 kV.

2.1.1 Purpose

None

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

South African national documents

Document Number	Document Title	Preparer/Author	Revision or Date of Issue
[1] SANS 60044-1 [Equivalent to IEC]	Instrument Transformers, Part 1: Current Transformers	SANS	Latest
[2] SANS 60815 [Equivalent to IEC]	Selection and Dimensioning of High-voltage Insulators Intended for Use in Polluted Conditions	SANS	Latest

Eskom national document(s)

Document Number	Document Title	Preparer/Author	Revision or Date of Issue
[3] NRS 030	Inductive Voltage Transformers	National Workgroup	Latest

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Eskom divisional document(s)

Document Number	Document Title	Preparer/Author	Revision or Date of Issue
[4] DSP_34-1658	Corrosion Protection Specification for New Indoor and Outdoor Distribution Equipment, Components, Materials and Structures Manufactured from Steel	D Janse van Rensburg	Draft
[5] DSP_34-224	KIPTS Natural Ageing and Pollution Performance Test Procedure for Outdoor Insulation Products Section 0 - General Requirements	W Vosloo	Rev. 0/Jan 2007

2.2.2 Informative References

Document Number	Document Title	Preparer/Author	Revision or Date of Issue
[6] 32-9	Definition of Eskom Documents	Eskom Document Centre	Latest
[7] 32-644	Eskom Documentation Management Standard	Eskom Document Centre	Latest
[8] 474-65	Operating Manual of the Steering Committee of Wires Technologies (SCOWT)	Vinod Singh	Latest

2.3 DEFINITIONS

Definition	Description
Standard reference atmospheric conditions	The standard reference atmosphere is defined as reference temperature ($t_0 = 20\text{ }^{\circ}\text{C}$), absolute pressure ($p_0 = 1\,013\text{ hPa}$ or $1\,013\text{ mbar}$) and absolute humidity ($h_0 = 11\text{ g/m}^3$).

2.3.1 Disclosure Classification

Controlled Disclosure: Controlled Disclosure to External Parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

Abbreviation	Description
AMSL	Above Mean Sea Level
CAP	Committee for Accepted Products
CT	Current Transformer
GM	General Manager
HV	High Voltage
IARC	Industry Association Resource Centre (formerly 'Distribution Technology')
KIPTS	Koeberg Insulator Pollution Test Station

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Abbreviation	Description
LAP	List of Accepted Products
MV	Medium Voltage
n/a	not applicable
rms	Root mean square
SANS	South African National Standards
SCD	Specific Creepage Distance
SCOWT	Steering Committee of Wires Technologies

2.5 ROLES AND RESPONSIBILITIES

None

2.6 PROCESS FOR MONITORING

None

2.7 RELATED/SUPPORTING DOCUMENTS

None

3. CURRENT TRANSFORMERS ESKOM SPECIFIC REQUIREMENTS FOR VOLTAGES UP TO 132KV IN ACCORDANCE WITH NRS 029

3.1 REQUIREMENTS

3.1.1 General

CTs shall comply with the requirements of [3] NRS 030 and the Eskom-specific requirements as set out in Schedule A of an enquiry document. Model technical schedules are contained in Annex B. Where there are discrepancies between the two, Schedule A shall take precedence.

CTs utilized in Eskom for systems with nominal voltages up to 132 kV have been rationalized to the following nominal voltage ratings: 22 kV, 33 kV, 66 kV and 132 kV (refer to Table 1 for a summary of the items).

Table 1: Rationalized Voltage Ratings

Nominal System Voltage (kV)	Equipment Nominal Voltage Rating (kV)	Equipment Maximum Continuous Voltage (kV)	Lightning Impulse Withstand (kV peak at 1 000 m AMSL)	Short Duration Power Frequency Withstand (kV rms at 1 000 m AMSL)
6,6, 11, 22	22	24	150	50
33	33	36	200	70
44, 66	66	72,5	350	140
88, 132	132	145	650	275

Note: The rated insulation withstand levels for lightning impulse and short time power frequency withstand are specified in Table 1. The service conditions for South Africa are rationalized for altitudes up to 1 800 m. Although the insulation levels in **Table 1** are specified at an altitude of 0 m to 1 000 m, the values have been selected for

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appropriate insulation coordination for altitudes up to 1 800 m and need not be corrected for altitude. The CTs should be supplied with standard values as per Table 1. Test values must, however, be corrected for deviations from the standard reference atmospheric conditions.

3.1.1.1 Primary terminals connections

The primary terminals shall be tinned copper studs ('stems') with dimensions in accordance with the continuous current rating as specified in Table 2 of [3] NRS 030, unless otherwise stated in an enquiry document.

3.1.1.2 Corrosion protection

Corrosion protection shall be in accordance with [4] **DSP_34-1658**.

3.1.1.3 External insulation pollution performance

a. Minimum creepage distances

The external insulation creepage for CTs for nominal voltages up to 132 kV has been rationalized to the 'very heavy' pollution class as defined in [2] SANS 60815, specified as a Specific Creepage Distance (SCD) of 31 mm/kV.

b. Pollution performance and ageing test requirements

The equipment is to be tested to comply with the requirements of the Koeberg Insulator Pollution Test Station (KIPTS) in accordance with [5] **DSP_34-224**. The test commencement date and test duration shall be as defined in [5] **DSP_34-224**.

3.1.2 Description of Items

Table 2 summarizes the Eskom standard requirements:

Table 2: Summary of the Various CT Options Required by Eskom

Item	Short Description	Core Layout	Protection Core (P)	Bus Zone Core (B)	Measuring Core (M)
1.	CT 22 kV 1 600 A 25 kA 2P2M	PPMM	1/1 600T MR	–	1 600/1 MR
2.	CT 22 kV 2 500 A 25 kA 2P2M	PPMM	1/2 400T MR	–	2 400/1 MR
3.	CT 33 kV 1 600 A 31.5 kA 2P2M	PPMM	1/1 600T MR	–	1 600/1 MR
4.	CT 66 kV 1 600 A 31.5 kA 2P2M2B (500)	PBBPMM	1/1 600T MR	1/500T	1 600/1 MR
5.	CT 66 kV 1 600 A 31.5 kA 2P2MR2B (1 600MR)	PBBPMM	1/1 600T MR	1/1 600T MR	1 600/1 MR
6.	CT 66 kV 200 A 10 kA/1 s 2MR	MM	–	–	200/1 MR
7.	CT 132 kV 2 500 A 40 kA 2P2M2B (500)	PBBPMM	1/2 400T MR	1/500T	2 400/1 MR
8.	CT 132 kV 2 500 A 40 kA 2P2MR2B (1 600MR)	PBBPMM	1/2 400T MR	1/1 600T MR	2 400/1 MR
9.	CT 132 kV 2 500 A 40 kA 2P2M2B (2 400) 4	PBBPMM	1/2 400T MR	1/200T	2 400/1 MR
10.	CT 132 kV 3 150 A 40 kA 2P2M2B (2 400)	PBBPMM	1/3 200T MR	1/2 400T	3 200/1 MR

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11.	CT 132 kV 200 A 10 kA/1 s 2MR	MM	–	–	200/1 MR
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Notes:

1. Full details of the secondary core layouts and specifications are provided in paragraph 3.1.3.
2. The insulation creepage for CTs rated up to 145 kV has been rationalized to the very heavy pollution class.
3. For capacitor banks, the core layout shall be PPBBPM. **Comment:** Include this range in the table, especially at 132 kV, where this core arrangement is predominantly used.
4. The bus zone 1/ 400 CTs is required for application in Transmission substations.

3.1.3 Secondary Cores

3.1.3.1 Core layout

Figure 1 and Figure 2 show the core layouts for Protection (P), Measuring (M) and Bus zone (B). It is important to note the primary terminal polarity markings (i.e. P1, P2) with respect to the core layout.

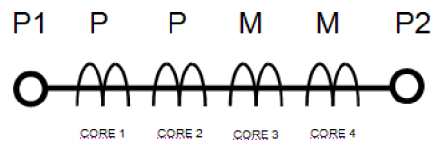


Figure 1: Core Layout – Four-core Current Transformers

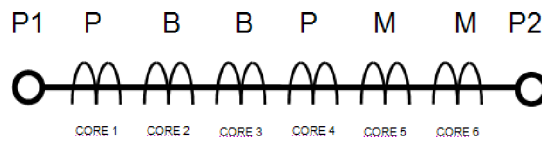


Figure 2: Core Layout – Six-core Current Transformers

3.1.3.2 Tapping arrangements

The secondary core tapping arrangements shall be as indicated in Figure 3 to Figure 7:

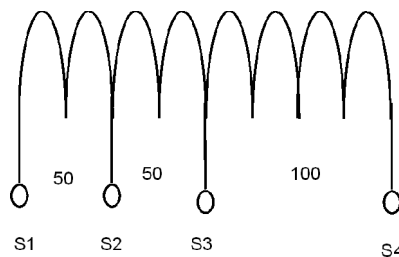


Figure 3: Tapping Arrangements for Multi-ratio 1/200 Measuring Cores

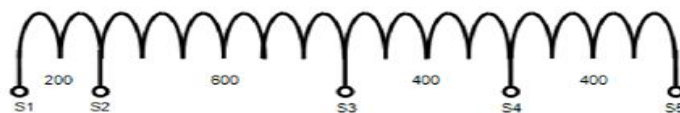


Figure 4: Tapping arrangements for Multi-ratio 1/1 600 protection/measuring

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Figure 5: Tapping Arrangements for Multi-ratio 1/1 600t bus zone cores

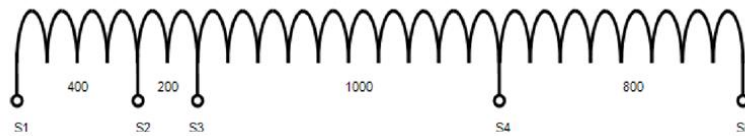


Figure 6: Tapping Arrangements for Multi-ratio 1/2 400t

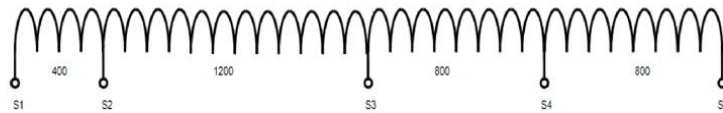


Figure 7: Tapping Arrangements for Multi-ratio 1/3 200T

3.1.3.3 Core specifications

The specifications listed in Table 3, Table 4 and Table 5 are in accordance with [1] **SANS 60044-1:**

Table 3: Protection Core Specifications

Maximum Core Ratio	Tapping	Ratio	Class	Ek min. (V)	Ie max. (mA)	Rct (f2) @ 75 °C
MR 1 600/1	S1 – S2	1/200T		200	300	0,8
	S3 – S4	1/400T		400	150	1,6
	S2 – S3	1/600T		600	100	2,4
	S1 – S3	1/800T		800	75	3,2
	– S4	1/1 000T		1 000	60	4,0
	S1 – S4	1/1 200T		1 200	50	4,8
	S2 – S5	1/1 400T		1 400	43	5,6
	S1 – S5	1/1 600T		1 600	38	6,4
MR 2 400/1	S2 – S3	1/200T		200	300	0,8
	S1 – S2	1/400T		400	150	1,6
	S1 – S3	1/600T		600	100	2,4
	S4 – S5	1/800T		800	75	3,2
	S3 – S4	1/1 000T		1 000	60	4,0

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	- S4	1/1 200T	1 200	50	4,8
	S1 – S4	1/1 600T	1 600	38	6,4
	S3 – S5	1/1 800T	1 800	33	7,2
	S2 – S5	1/2 000T	2 000	30	8,0
	S1 – S5	1/2 400T	2 400	25	9,6
MR 3 200/1	S1 – S2	1/400T	400	150	1,2
	S3 – S4	1/800T	800	75	2,4
	S2 – S3	1/1 200T	1 200	50	3,6
	S1 – S3	1/1 600T	1 600	38	4,8
	- S4	1/2 000T	2 000	30	6,0
	S1 – S4	1/2 400T	2 400	25	7,2
	S2 – S5	1/2 800T	2 800	22	8,4
	S1 – S5	1/3 200T	3 200	19	9,6

Note: The instrument security factor is specified at the 400/1 ratio, except for the MR 200/1, where the security factor is specified at the 50/1 ratio.

Table 4: Metering Core Specifications

Maximum Core Ratio	Tapping	Ratio	Class	Burden	Security Factor
MR 200/1	S1 – S2	50/1	0,2	5 VA	FS 20
	S3 – S4	100/1		10 VA	
	S1 – S4	200/1		10 VA	
MR 1 600/1	S1 – S2	200/1	0,2	2,5 VA	-
	S3 – S4	400/1		5 VA	FS 20
	S2 – S3	600/1		10 VA	-
	S1 – S3	800/1		10 VA	-
	S2 – S4	1 000/1		10 VA	-
	S1 – S4	1 200/1		10 VA	-
	S2 – S5	1 400/1		10 VA	-
	S1 – S5	1 600/1		10 VA	-
MR 2 400/1	S2 – S3	1/200T	0,2	2,5 VA	-
	S1 – S2	1/400T		5 VA	FS 20
	S1 – S3	1/600T		10 VA	-
	S4 – S5	1/800T		10 VA	-
	S3 – S4	1/1 000T		10 VA	-
	S2 – S4	1/1 200T		10 VA	-
	S1 – S4	1/1 600T		10 VA	-
	S3 – S5	1/1 800T		10 VA	-
	S2 – S5	1/2 000T		10 VA	-
	S1 – S5	1/2 400T		10 VA	-
	S1 – S2	1/400T		5 VA	FS 20
	S3 – S4	1/800T		10 VA	-
	S2 – S3	1/1 200T		10 VA	-

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	S1 – S3	1/1 600T		10 VA	-
	S2 – S4	1/2 000T		10 VA	-
	S1 – S4	1/2 400T		10 VA	-
	S2 – S5	1/2 800T		10 VA	-
	S1 – S5	1/3 200T		10 VA	-

Table 5: Bus Zone Core Specifications

Maximum Core Ratio	Tapping	Ratio	Class	Ek min. (V)	I.e max. (mA)	Rct (f2) @ 75 °C
500/1	S1 – S2	1/500T	PX	550	50	2
MR 1 600/1	S1 – S2	1/1 000T	PX	550	50	2
	S1 – S3	1/1 200T		660	42	2,4
	S1 – S4	1/1 600T		880	31	3,2
2 400/1	S1 – S2	1/2 400T	PX	550	50	2

Note: The CT's name plate shall reflect the manufacturer's design values for the core excitation current, i.e. rather than the maximum allowable values specified above.

3.2 TESTS

Type and routine tests are to be carried out in accordance with [3] **NRS 030**.

3.2.1 Test Certificates

Single copies of all certificates of type tests performed by a test authority acceptable to Eskom shall be submitted with a tender offer, unless Eskom waives this requirement due to a previous evaluation of the product. The test certificate for any insulator shall be easily traceable by reference to the insulator markings. The test certificates shall be in English.

Although routine test certificates are not required for submission and approval, Eskom reserves the right to call for duplicate copies of routine test certificates for a period of one year after the date of delivery.

3.2.2 Works Inspections and Witnessing of Tests

Eskom reserves the right to appoint a representative to inspect the post insulators at any stage of manufacture, or to be present at any of the tests specified.

Marking, Labelling and Packaging

The marking, labelling and packaging details are to be submitted for approval during enquiries.

Imported CTs shall be packaged in robust wooden crates and suitably supported in order to protect the CT from the stresses of normal handling that can be expected from the point of despatch to the point of construction. The crates must be designed such that inspection can be effected without opening or damaging the crate. The crate must be able to be lifted by slings with lifting points clearly marked. Any special handling requirements shall be clearly specified to purchaser before delivery and shall be clearly specified on packaging.

The packaging shall not disintegrate due to exposure to rain and direct sunlight during outdoor storage and the construction period of 18 months in total. The manufacturer/supplier shall notify the purchaser of

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any special methods recommended for storage prior to delivery, and on packaging materials.

If CTs are packed in crates on pallets, the gross weight of the pallets shall not exceed 1 800 kg. Pallets shall be suitable for handling by forklift trucks, capable of entry from both sides. All boxes, pallets or containers shall be clearly marked in accordance with the following example, or similar approved template:

Eskom Order No.:

Eskom SAP No.:

Project Name:

Project Number:

Delivery Address:

Supplier's Name:

Supplier's Serial

No.:Description of

Material:

Gross Weight:

Spares

No spares are applicable for hermetically sealed CTs.

Drawings

A full set of drawings, as specified in [3] **NRS 030**, shall be submitted at tendering. The drawing shall contain, as a minimum, the information specified in [3] **NRS 030**. The following additional information shall be included in the outline drawings:

- a. Nominal voltage, normal current, short-circuit withstand current and durations in the title block.
- b. Type of insulating material.
- c. Shed profile.
- d. Creepage distance.
- e. Centre of gravity.
- f. Allowance for the inclusion of:
 1. Eskom contract number;
 2. Eskom SAP number; and
 3. Eskom drawing number.

Note: The numbers shall be incorporated in the drawing upon issue

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4. AUTHORISATION

This document has been seen and accepted by:

Name & Surname	Designation
	Document Approved by TDAC ROD 13 March 2013

5. REVISIONS

Date	Rev.	Compiler	Remarks
November 2012	0	Insert initials and surname.	Draft document for review created from DSP 34-1689
May 2013	1	Insert initials and surname.	Final for Publication

6. DEVELOPMENT TEAM

None

7. ACKNOWLEDGEMENTS

None

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APPENDIX A: TECHNICAL SCHEDULES

(See excel spreadsheet on Web site Part 7 Substations)

<Reference or Detail to be added>

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