Eskom	Standard	Technology

Title: **MINIATURE CONTROL CABLE REQUIRED FOR TELEPROTECTION SIGNALS ("12Z" AND "18Z" CABLES)**

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SCOT Study Committee Number/Name: **Telecommunications**

Content

Tables

1. Introduction

This standard provides for control cables required for teleprotection signals ("Z" cables) for power line carrier and teleprotection applications.

2. Supporting clauses

2.1 Scope

Cables covered by this standard consist of either 12 or 18 cores, as specified in the contract document.

2.1.1 Purpose

This standard provides for the manufacture, testing at works, user documentation, supply and delivery to Eskom's stores and off-loading.

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 1091, National colour standard.

[3] SANS 1411-1, Materials of insulated electric cables and flexible cords Part 1: Conductors

[4] SANS 1411-2, Materials of insulated electric cables and flexible cords Part 2: Polyvinyl chloride (PVC)

[5] SANS 1411-6, Materials of insulated electric cables and flexible cords Part 6: Armour.

[6] SANS 1507-6, Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V) Part 6: Service cables Electric cables.

[7] SANS 6282-3, Test methods for bare conductors and conductors of insulated electric cables Part 3: Mechanical tests.

[8] SANS 62230 Electric cables - Spark-test method

[9] SANS 6284-3 Tests on finished cable.

2.2.2 Informative

None

2.3 Definitions

2.3.1 General

Definition	Description
Technical Terms	For the purpose of this specification, technical terms used shall be as defined in the documents listed in clause 2.2.1 Normative References.

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
PVC	Polyvinyl Chloride

2.5 Roles and responsibilities

Not applicable.

2.6 Process for monitoring

This standard shall be updated periodically according to Eskom's policy and the latest version shall be available for use at all times.

2.7 Related/ supporting documents

Not applicable.

3. Requirements

3.1 Conductors

The construction of each core must consist of 16 strands of 0.2 mm diameter tinned annealed copper wire complying with the requirements of SANS 1411-1, class 2.

3.2 Insulation

The conductor insulation must be general purpose PVC as detailed in SANS 1411-2 with a nominal thickness of 0.45 mm and a nominal diameter of 1.83 mm.

3.3 Stranding

12 Core Cable:

The 12 cores are to be stranded as follows to form a circular cable core:

- Centre Core – 3 Cores (1-3)
- 1st Layer – 9 Cores (4-12)

18 Core Cable:

The 18 cores are to be stranded as follows to form a circular cable core:

- Centre Core – Dummy Core
- 1st Layer – 6 Cores (1–6)
- 2nd Layer – 12 Cores (7-18)

Polypropylene fillers may be required.

3.4 Screen

The cores must be collectively screened with braided 0.50mm^2 tinned copper wire.

The screen must provide a 100% coverage to the conductors even if the cable is bent through a radius of four times its overall diameter.

3.5 Bedding Layer

The bedding layer shall consist of black general purpose PVC to SANS 1411-2.

3.6 Armouring

The overall armouring of the cable must consist of 0.9 mm diameter galvanised steel wire strands in accordance with the requirements of SANS 1411- 6.

3.7 Outer Sheath

The outer sheet shall consist of black general purpose PVC to SANS 1411-2.

3.8 Core Identification

The cores of the cable must be identified by the dielectric colour code as shown below:

	12 Core Cable		**18 Core Cable**	
Layer	**Core Number**	**Colour**	**Core Number**	**Colour**
Centre	1	RED	Dummy	
	2	BLUE		
	3	GREEN		
1st layer	4	YELLOW	1	RED
	5	WHITE	2	BLUE
	6	BLACK	3	GREEN
	7	BROWN	4	YELLOW
	8	VIOLET	5	WHITE
	9	ORANGE	6	BLACK
	10	PINK		
	11	TURQUOISE		
	12	GREY		
2nd layer			7	BROWN
			8	VIOLET
			9	ORANGE
			10	PINK
			11	TURQUOISE
			12	GREY
			13	RED/BLUE
			14	GREEN/RED

	12 Core Cable		18 Core Cable	
Layer	**Core Number**	**Colour**	**Core Number**	**Colour**
			15	YELLOW/RED
			16	WHITE/RED
			17	RED/BLACK
			18	RED/BROWN

3.9 Quality Assurance

Eskom's Quality Assurance requirements are specified by Eskom's Quality department.

4. Tests

4.1 Test Methods

The cable supplied in this specification must be tested at the works, as detailed in the SANS 1507-6 as a minimum requirement. Eskom will, however, accept standard European or American test methods on imported cable if evidence provided indicates that these are equal to, or more stringent, than the test specified.

In view of the above requirements, all details of the manufacturer's intended "Type", "Sample" and "Routine" tests are to be supplied with the tender document.

4.2 Type Tests

All type tests must be performed in accordance with Table 1, as specified in SANS 1507-6.

Table 1:

No.	Component	Test Property	Reference
1	Conductor	Elongation at Break	According to SANS 6282-3, Section 2. Elongation at break of wire
2	Insulation	Physical properties	According to SANS 1411-2 Polyvinyl chloride (PVC)
3	Insulation	Spark test	According to SANS 62230
4	Sheath	Physical properties	According to SANS 1411-2 Polyvinyl chloride (PVC)
5	Finished Cable	Voltage withstand	According to SANS 6284-3

4.2.1 Additional Type Tests

The following additional electrical type tests are required:

a) The average capacitance between wire cores shall be measured in a completed cable with all other cores, armouring and sheaths connected to earth.

b) The average capacitance between each core and earth shall be measured in a completed cable with all other cores, armouring, and shields connected to earth.

4.3 Routine Tests

The following tests shall be performed on all cables and cores, in accordance with SANS 1507-6.

4.3.1 Voltage Test on Conductors

Each insulated conductor shall be voltage tested before assembly of the cable.

4.3.2 Insulation Resistance

The insulation resistance of each conductor shall not be less than the guaranteed figure stated in Schedule A (Annexure A). The volume resistivity of the thermoplastic dielectric calculated from the measured insulation resistance shall not be less than the minimum volume resistivity detailed in SANS 1507-6.

4.3.3 Spark Test

A spark test performed to the requirements of SANS 1507 may be done on all cores as an alternative to the routine core voltage and insulation resistance tests specified above. When spark testing is used, the core voltage and insulation resistance tests 4.3.1 and 4.3.2 above shall be performed as type tests.

4.3.4 Voltage Test on Completed Cable

a) Core to core

b) All cores connected together to screen

c) Screen to armouring

4.3.5 Material Tests

Material tests shall be carried out on each batch as frequently as is required to determine and maintain the quality of the product.

The tests required shall be performed in accordance with SANS 1507-6.

4.4 Test certificates

Records of all test results must be available for inspection by Eskom's representative at any time during the validity of the contract period.

The coaxial cable shall be subject to the manufacturer's standard works tests, details of which must be supplied with the tender.

4.5 Witnessing of Tests

Eskom reserves the right to appoint a representative to inspect the cable at any stage of manufacture or to be present at any time that tests are performed. If witnessed type tests apply, the samples must be selected according to the procedure detailed in SANS 1507-6. Such inspection shall not relieve the manufacturer of his responsibility for meeting the requirements of the specification, and it shall not prevent the subsequent rejection if the goods are later found to be defective.

Eskom must be informed of inspection or witnessed tests, and Eskom requires not less than 7 days prior notice of such tests.

4.5.1 Cable Samples

If requested, a sample of the item covered in this specification shall be submitted for comparative evaluation within 30 days of the notification of the request. The sample will be regarded as being identical with the item offered against this specification.

5. Packaging and Delivery

5.1 Packaging

Cables shall be supplied in drum lengths of 500m unless otherwise indicated. All cables shall be marked with the following:

- Eskom order number.
- Eskom cable code and specification to which the cable is manufactured.
- Gross mass of drum and cable in kilograms.
- The words "Not to be laid flat" shall be written visibly on the drum.
- The name of the Manufacturer and Trade mark
- Arrow indicating the correct direction of rolling
- The length of the cable

The Z cable supplied in each drum shall be in one continuous length and shall have no joints.

5.2 Delivery

a) The equipment shall be delivered to the destination stated in the enquiry document

b) The ex-work delivery dates, and delivery dates to site shall be indicated in the relevant schedule of the enquiry document.

c) The equipment shall be protectively packed in such a way that it can be safely transported, handled and stored at site, as it will not necessarily be possible for installation to commence immediately upon delivery.

d) Attention is drawn to the fact that Eskom will accept delivery at the specified destination only, and that the supplier shall make all necessary arrangements for acceptance, off-loading and trans-shipping at all intermediate points, as well as the ultimate off-loading at the specified destination.

5.3 Documentation

The supplier shall furnish Eskom with the following product documentation:

a) Cable specification

b) Cable construction details

5.4 Statement of Compliance or Deviation

The Tenderer must complete Schedule B of Annex A - Schedules A and B by stating compliance with or deviation from the requirements of this specification and Schedule A. Any deviations from this specification or Schedule A shall be listed in Annex B - Statement of Non-Compliance, on a section by section and clause by clause basis.

6. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Lenah Mothata	Senior Manager – Grids
Barry Clayton	Chief Engineer – Secondary Plant, Works Planning and Centralized Services
Sikelela Mkhabela	Senior Manager – DX

Name and surname	Designation
Prudence Madiba	Senior Manager – GX
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7. Revisions

Date	Rev	Compiler	Remarks
Feb 2019	2	R. Gangat	Included SANS 1507-6 Type Test requirements, SANS 6282-3 Mechanical tests, SANS 1411-2 Polyvinyl Chloride (PVC), SANS 62230 Electric cables - Spark-test method and SANS 6284-3 Tests on finished cable.
Aug 2013	1	T. Gosai	First issue.

8. Development team

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

- R. Gangat
- T. Gosai
- A. Pereira (Tony)

9. Acknowledgements

Not applicable.

Annex A – Schedules A and B

ITEM	DESCRIPTION	SCHEDULE A	SCHEDULE B	
1	Manufacturer	Specify		
2	Voltage rating (V)	440		
3	Core details: number of cores (12 or 18) (b) conductor area mm^2 (c) conductor material (d) DC resistance at 20°C ohms/km (e) 50 Hz resistance at 20°C ohms/km (f) inductive reactance at 50 Hz ohms/km (g) capacitance (i) all cores to sheath µF/km (ii) between cores µF/km (h) maximum continuous conductor temperature °C	 To be specified in contract document 0.5 Sn annealed Cu 40.1 max Specify. 0.736 max Specify Specify Specify		
4	Insulation material (a) core insulation compound used (b) screen insulation compound used (c) cable sheath compound used (d) fire propagation properties of finished cable. (e) smoke/acid gas emission for - core insulation - bedding and screen insulation - finished cable	 Specify PVC type Specify PVC type Specify PVC type Specify Specify Specify Specify		
5	Screen and armouring (a) screen material (b) screen coverage screen thickness (d) overall screen resistance ohms/km (e) armouring wire material (f) armouring wire diameter mm (g) armouring tensile strength N/mm^2	 Cu braid 80% min. Specify Specify galv. steel 0.9 Specify		
6	Core identification (a) colour coded (b) numbered (c) colour standards (d) colour stability	 Yes No Specify Specify		

ITEM	DESCRIPTION	SCHEDULE A	SCHEDULE B	
7	Complete cable			
	(a) diameter mm	Specify		
	(b) mass kg/m	Specify		
	(c) drum length			
	(i) average m	Specify		
	(ii) minimum m	Specify		
	(iii) maximumm	Specify		
	(d) drum markings	Specify		
8	Tests			
	Tests conducted according to SANS 1507-6 prior to contract award.	1507-6		
	The following type test reports shall be provided			
	(i) Conductor elongation at break according to SANS 6282-3.	YES/NO		
	(ii)Insulation physical properties according to SANS 1411-4	YES/NO		
	(iii)Insulation spark test according to SANS 62230	YES/NO		
	(iv)Sheath physical properties according to SANS 1411-7	YES/NO		
	(v)Finished cable voltage withstand according to SANS 6284-3	YES/NO		
	Additional tests as in 3.2.1			
	State the location within the tender documentation where the Type Test Certificates for the following tests can be found:			
	(i)Conductor elongation at break according to SANS 6282-3.	Specify		
	(ii) Insulation physical properties according to SANS 1411-4	Specify		
	(iii) Insulation spark test according to SANS 62230	Specify		
	(iv) Sheath physical properties according to SANS 1411-7	Specify		
	(v)Finished cable voltage withstand according to SANS 6284-3	Specify		

Annex B – Statement of Non-Compliance

The equipment supplied on this contract complies in all respects with the requirements of the specification and Schedule A/B, with the exemption of the following points:

Specification		Details of Deviation or Non – Compliance
Page	**Paragraph**	