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X.21 INTERFACES**

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Compiled by



**Riyaz Gangat**

**Senior Technologist**

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Approved by

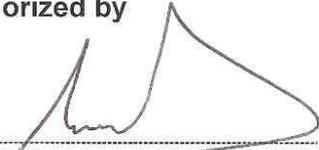


**Cornelius Naidoo**

**Manager Telecomms  
Technology and Support**

Date: 2019/02/01

Authorized by



**Richard McCurrach**

**Senior Manager PTM&C  
Engineering**

Date: 1/2/2019

Supported by SCOT/SC



**Kgomotso Setlhapelo**  
**SCOT/SC Chairperson**

Date: 31 January 2019

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## 1. Introduction

This standard provides Eskom's requirements for data cables used specifically for the interconnection of telecontrol and teleprotection systems, with the telecommunications bearer system, utilizing the X.21 interfacing standard. The operating environment is one which is subject to high electromagnetic and electrostatic interference.

## 2. Supporting clauses

### 2.1 Scope

This specification describes the technical design for the manufacture, testing and delivery of miniature data cable, commonly known in Eskom as X.21 data cable, used for telecontrol and teleprotection systems operating at data rates of up to 2MBit/s.

#### 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] ITU-T Recommendation X.21 - Interface between DTE and DCE Equipment for Synchronous Operation on Public Data Networks
- [3] SANS 1091, National colour standard.
- [4] SANS 1411-1, Materials of insulated electric cables and flexible cords Part 1: Conductors
- [5] SANS 1411-2, Materials of insulated electric cables and flexible cords Part 2: Polyvinyl chloride (PVC)
- [6] SANS 1411-6, Materials of insulated electric cables and flexible cords Part 6: Armour.
- [7]
- [8] 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.
- [9] SANS 6282-3, Test methods for bare conductors and conductors of insulated electric cables Part 3: Mechanical tests.
- [10] SANS 62230 Electric cables - Spark-test method
- [11] 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 General

This steel wire armoured cable shall consist of 6 individually screened twisted pairs of insulated conductors each comprising of 7 strands of tinned annealed copper, all included within an overall screen. The cable shall be suitable for operation up to 440 V rms at frequencies up to 1.6 MHz.

### 3.2 Technical details

#### 3.2.1 Conductors

The construction of each core must consist of 7 strands of 0.2 mm diameter tinned annealed copper wire complying with the requirements of SANS 1411-1, class 2.

#### 3.2.2 Insulation

The conductor insulation must be general purpose PVC as detailed in SANS 1411-2, with a nominal thickness of 0.3 mm.

### **3.2.3 Core Identification**

The cores of the cable must be identified by the dielectric colour code, as per SANS 1411-2, as shown below:

Pair number	Colour
1	Red/Blue
2	Green/Yellow
3	White/Black
4	Brown/Violet
5	Orange/Pink
6	Grey/Turquoise

### **3.2.4 Laying of Conductor Pairs**

Each pair shall be twisted together with a maximum lay length of 60 mm. The twists of the individual pairs shall be staggered along the length of the cable.

### **3.2.5 Individual Screen of Conductor Pairs**

These screens shall consist of a layer of aluminium/polyester tape, each fitted with a drain wire of 0.22 mm<sup>2</sup> tinned copper wire.

The screen must provide 100 % coverage to the conductors.

### **3.2.6 Overall Screen**

This screen shall also consist of a layer of aluminium/polyester tape fitted with a single drain wire of 0.22 mm<sup>2</sup> tinned copper wire.

The screen must provide 100 % coverage.

### **3.2.7 Inner Sheath / Bedding Layer**

To consist of black general purpose PVC complying with SANS 1411-2.

### **3.2.8 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.

### **3.2.9 Outer Sheath**

To consist of black flame retardant PVC complying with SANS 1411-2.

## **3.3 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:**

<b>No.</b>	<b>Component</b>	<b>Test Property</b>	<b>Reference</b>
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

### **4.3 Additional Type Tests**

The following type tests must be performed in addition to those specified in SANS 1507:

- a) The average capacitance between the cores of any pair shall be measured in a completed cable with all other cores, armouring and sheaths connected to earth.
- b) The average mutual capacitance between one pair of cores and earth shall be measured in a completed cable with all other cores, armouring, and shields connected to earth.

### **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 X.21 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.

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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 X.21 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-shipment 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:

<b>Name and surname</b>	<b>Designation</b>
Lenah Mothata	Senior Manager – Grids
Barry Clayton	Chief Engineer – Secondary Plant, Works Planning and Centralized Services
Sikelela Mkhabela	Senior Manager – DX
Prudence Madiba	Senior Manager – GX
Joe Manyisa	Senior Manager – Eskom Telecommunications (Acting)
Maureen Mokone	Senior Manager – GIT
Lloyd Chego	Senior Manager – Group Security

## **7. Revisions**

<b>Date</b>	<b>Rev</b>	<b>Compiler</b>	<b>Remarks</b>
Jan 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	REMARKS
1	Manufacturer	Specify		
2	Voltage rating (specify)	440		
3	Core details (a) number (b) conductor area mm <sup>2</sup> (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) pair to sheath µF/km (ii)between cores of a pair µF/km (h) maximum continuous conductor temperature °C	6 prs., 7/0.2 mm 0.22 Sn annealed Cu ≤ 78  Specify  Specify  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 Specify Specify Specify  Specify Specify Specify	PVC   PVC	
5	Screen and armouring (a) screen material (b) screen coverage (c) screen thickness (d) water barrier (e) individual screens thickness mm (f) individual screen resistance ohms/km (g) individual screen coverage 100% (h) overall screen resistance ohms/km (i) armouring wire material (j) armouring wire diameter mm (k) armouring tensile strength N/mm <sup>2</sup>	Specify 100% Specify N/A  Specify  Specify  YES Specify galv. steel 0.9 Specify		

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ITEM	DESCRIPTION	SCHEDULE A	SCHEDULE B	REMARKS
6	Core identification (a) colour coded (b) numbered (c) colour standards (d) colour stability	YES NO SANS 1411-2 Specify		
7	Complete cable (a) diameter in mm (b) min. bend radius mm (c) mass kg/km (d) drum length (i) average m (ii) minimum m (iii) maximumm (e) drum markings (Clause 5)	Specify Specify Specify  Specify Specify Specify YES		
8	Tests Tests conducted according to SANS 1507-6 prior to contract award. The following type test reports shall be provided: Conductor elongation at break according to SANS 6282-3. Insulation physical properties according to SANS 1411-4 Insulation spark test according to SANS 62230 Sheath physical properties according to SANS 1411-7 Finished cable voltage withstand according to SANS 6284-3 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. (ii) Insulation physical properties according to SANS 1411-4 (iii) Insulation spark test according to SANS 62230 (iv) Sheath physical properties according to SANS 1411-7 Finished cable voltage withstand according to SANS 6284-3	1507-6  YES/NO YES/NO YES/NO YES/NO YES/NO  Specify  Specify  Specify Specify Specify		

