

Title: **AERIAL BUNDLED  
CONDUCTORS WITH BARE OR  
INSULATED NEUTRAL  
SUPPORTING CONDUCTOR**

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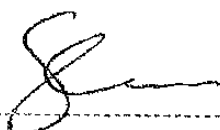
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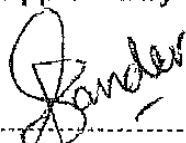


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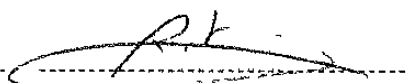


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## **1. Introduction**

The specification is based on SANS 1418, *Aerial bundle conductor systems*.

## **2. Supporting Clauses**

### **2.1 Scope**

This specification covers the requirements for aerial bundled conductor (ABC) with an insulated neutral supporting core as well as aerial bundled conductor (ABC) with a bare (un-insulated) neutral supporting core for use in Eskom's overhead single-phase, dual-phase and three-phase low voltage electricity distribution systems and is based on SANS 1418.

The requirements for the phase cores, the bare as well as insulated supporting conductor and the assembled bundles are covered.

#### **2.1.1 Purpose**

The purpose of this document is to cover the necessary requirements for aerial bundled conductors with bare or insulated neutral supporting conductor in Eskom's low voltage distribution systems

#### **2.1.2 Applicability**

This document shall apply throughout Eskom Holdings Limited, its divisions, subsidiaries and entities wherein Eskom has a controlling interest.

## **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] SANS/ISO 9001, Quality Management Systems.
- [2] ISO 868:2003, Plastics and ebonite - Determination of indentation hardness by means of a durometer (Shore hardness)
- [3] CENELEC HD 626 S1:1996, Overhead Distribution Cables of rated voltage  $U_0/U (U_m) : 0.6/1 (1.2)$  kV, Part 2 - Additional test methods
- [4] SANS 1418-1, Aerial Bundled Conductor Systems - Part 1: Cores.
- [5] SANS 1418-2, Aerial Bundled Conductor Systems - Part 2: Assembled Insulated Conductor Bundles.
- [6] SANS 60811-4-1, Insulating and sheathing materials of electric and optical cables - Common test methods. Part 4-1: Methods specific to polyethylene and polypropylene compounds - Resistance to environmental stress cracking - Measurement of the melt flow index - Carbon black and/or mineral filler content measurement in polyethylene by direct combustion - Measurement of carbon black content by thermogravimetric analysis (TGA) - Assessment of carbon black dispersion in polyethylene using a microscope

### **2.2.2 Informative**

None

## **2.3 Definitions**

### **2.3.1 General**

The definitions given in SANS 1418-1 shall apply.

### **2.3.2 Disclosure classification**

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

## **2.4 Abbreviations**

<b>Abbreviation</b>	<b>Description</b>
<b>ABC</b>	Aerial Bundled Conductor
<b>LV</b>	Low Voltage
<b>XLPE</b>	Cross-linked polyethylene

## **2.5 Roles and responsibilities**

This standard covers the technical requirements for aerial bundled conductor with bare or insulated neutral supporting core to be applied by Eskom approved manufacturers.

## **2.6 Process for monitoring**

This standard is monitored by LV Care Group and the relevant quality processes.

## **2.7 Related/supporting documents**

D-DT-3141, Low Voltage Aerial Bundled Conductor.

## **3. Requirements**

### **3.1 General**

- a) The requirements for ABC shall be in accordance with SANS 1418-1 and in SANS 1418-2 and this specification. Where conflicting requirements between this specification and SANS 1418 exists the requirements of this specification take precedence.
- b) The nominal cross sectional area of the phase conductors shall be 35 mm<sup>2</sup>, 70 mm<sup>2</sup> or 95mm<sup>2</sup>.
- c) Where applicable, the nominal cross sectional area of the auxiliary conductor shall be 25 mm<sup>2</sup>.

**Note:** In SANS 1418-1 the phase and auxiliary conductors are considered to be of the same type (i.e. properties, tests etc. are the same). The auxiliary should not be confused with a service connection stated in SANS 1418.

- d) The bare neutral conductor or insulated neutral core shall be the supporting conductor or supporting core for the complete ABC bundle respectively.
- e) When tested in according with the requirements of clause 2.9 of CENELEC HD 626 S1: Part 2, the insulation of insulated cores shall pass the insulation piercing tests.
- f) The maximum dielectric thickness for the phase and auxiliary cores shall be in accordance with Table 1 below.

**Table 1: Maximum dielectric thicknesses**

1	2	3
Type of conductor of core	Nominal conductor size mm <sup>2</sup>	Max thickness of dielectric
Phase (aluminium)	35	1,86
	70	2,08
	95	2,08
Auxiliary	25	1,64
<b>Note:</b> The maximum dielectric thickness was determined as follows: 0.1 mm + 110% of average specified thickness.		

**3.2 Insulated neutral supporting core**

- a) The nominal cross sectional area of the neutral conductor shall be 54,6 mm<sup>2</sup>.
- b) The maximum thickness of the dielectric shall be 1,86 mm.

**3.3 Bare neutral supporting conductor**

- a) The bare neutral support conductor shall comply with the relevant requirements for the supporting conductor stipulated in SANS 1418-1.
- b) The nominal cross sectional area of the bare neutral conductor shall be either 35 mm<sup>2</sup> (in the case of 35 mm<sup>2</sup> phase conductor) or 50 mm<sup>2</sup> (in the case of 70 and 95 mm<sup>2</sup> phase conductor).
- c) The construction of the bare neutral supporting conductor shall comply with the requirements given in table 2.
- d) The conductor shall not be compacted.

**Table 2: Properties of bare neutral supporting conductor**

1	2	3	4	5	6
Conductor size mm <sup>2</sup>	Number of wires and diameter in mm	Maximum resistance at 20 °C Ω / km	Diameter of conductor mm		Minimum breaking force N
			min	max	
35	7 × 2,52	0,986	7,36	7,66	10300
50	7 × 3,00	0,720	8,80	9,10	14200

**3.4 Marking requirements for the first phase core**

- 1) The following information shall also be indented or embossed on the first phase core at intervals not exceeding 100 mm.
  - a) A marking that identifies the manufacturer;
  - b) The year of manufacture;
  - c) The legend 600 / 1 000 V;
  - d) The phase conductor nominal cross-sectional size;
  - e) The purchaser's name.
- 2) The first phase core shall be identified by means of the number 1. The Roman numeral number I shall not be used.

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- 3) The character height for letters and numerals shall be a minimum of 5 mm and a maximum of 10 mm.

Example of marking of the first phase core:

“ XXXXX CABLES YEAR 600/1000 V 70 mm<sup>2</sup> 1 ESKOM ”

### **3.5 Marking requirements for phase cores other than the first phase core**

- a) Phase cores shall be identified by means of the number 2 or 3 as appropriate. The Roman numeral numbers II, III shall not be used.
- b) The phase conductor nominal cross-sectional size shall be stated on the insulation surface of each phase core.
- c) The purchaser's name shall be identified.
- d) The character height for letters and numerals shall be a minimum of 5 mm and a maximum of 10 mm.
- e) The markings shall appear at intervals not exceeding 100 mm.

Example of marking of the phase cores other than the first phase core:

“ 70 mm<sup>2</sup> 2 “ESKOM ”

### **3.6 Marking requirements for insulated supporting core**

- a) In addition to the requirements of SANS 1418, the supporting neutral conductor nominal cross-sectional size shall be stated on the insulation surface of the insulated supporting neutral core.
- b) Identification thread need not be used.
- c) The year of manufacture and purchaser's name shall be identified.
- d) A longitudinal ridge shall be provided in accordance with SANS 1418-1.
- e) The character height for letters and numerals shall be a minimum of 5 mm and a maximum of 10 mm.
- f) The markings shall appear at intervals not exceeding 100 mm.

Example of marking of the insulated supporting core:

“ XXXXX CABLES YEAR 600/1000 V 54.6 mm<sup>2</sup> ESKOM ”

### **3.7 Marking requirements for auxiliary cores**

- a) In addition to the requirements of SANS 1418-1, the auxiliary conductor nominal cross-sectional size shall be stated on the insulation surface of each auxiliary core.
- b) The character height for letters and numerals shall be a minimum of 5 mm and a maximum of 10 mm.
- c) The purchaser's name shall be identified.
- d) The markings shall appear at intervals not exceeding 100 mm.

Example of marking of the auxiliary core:

“ 25 mm<sup>2</sup> A1 ESKOM ”

## 4. Inspection and methods of test

### 4.1 Testing Requirements

The tests from SANS 1418 shall be carried out. The type of test (i.e. type, sample or routine) is given in Table 3.

**Table 3: Test requirements**

1	2	3
Test	Type of Test	Reference Clause
Electrical tests		
Conductor resistance	Routine	SANS 1418-2 Clause 6.3.1
Voltage withstand	Routine	SANS 1418-2 Clause 6.3.2
Resistance of dielectric	Routine	SANS 1418-2 Clause 6.3.3
Impulse	Type	SANS 1418-2 Appendix E
HV withstand	Type	SANS 1418-2 Appendix E
<b>Tests for physical properties</b>		
Inspection tests	Routine	SANS 1418-2 Clause 6.1
Compliance with dimensions	Sample	SANS 1418-2 Clause 6.2
Adherence of dielectric to conductor of supporting core	Type	SANS 1418-2 Clause 6.4.1
Carbon black content	Sample	SANS 1418-2 Clause 6.4.2
Tensile strength and breaking force of supporting and phase conductors	Type	SANS 1418-2 Clause 6.4.3
Performance of supporting cores	Type	SANS 1418-2 Clause 6.4.4
Tensile strength of phase conductor wires	Sample	SANS 1418-1 Clause 3.2.1 & SANS 1418-2 Clause 6.4.3
Tensile strength of supporting conductor wires	Sample	SANS 1418-1 Clause 3.3.1 & SANS 1418-2 Clause 6.4.3
Dielectric shrink-back at high temperature	Type	SANS 1418-2 Clause 4.1.4
Carbon black dispersion	Type	240-84758170 Clause 4.1.1
Insulation piercing test	Type	240-84758170 Clause 4.1.2

#### 4.1.1 Carbon black dispersion (type test)

Use SANS 60811-4-1.

#### 4.1.2 Insulation piercing test (type test)

Use clause 2.9 of CENELEC HD 626 S1: Part 2

## 5. Drum marking and labelling

- For re-used drums, all drum markings pertaining to a previous order shall be painted over or otherwise satisfactorily removed.
- All ABC drums destined for Eskom projects shall be branded with Eskom signature (logo and logotype) on one of its flat sides (the flange).

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- c) The Eskom signature shall be printed in Eskom Blue or Black only on a white-colored background. For metal drums and wooden drums, a portion of the flange surface shall be painted in white to provide a rectangular background on which the signature shall be printed.
- d) The width (or height) of the white rectangular background shall be three times the diameter of the "circle" part of the Eskom logo.
- e) The printed Eskom signature shall appear central onto the white rectangular background leaving a space equal to one signature "circle" on both front and back ends.
- f) The Eskom logo printing shall be made using silkscreen technique or other equivalent techniques which shall be demonstrated to and approved by Eskom.
- g) The dimensions of complete Eskom signature shall be a minimum length and height of 82 mm and 21 mm respectively. The copy of the Eskom signature and standard printing guidelines are shown in Annex A.
- h) All other printing on the flange shall be positioned so as to ensure a minimum clearance of one logo "circle" diameter away from the Eskom signature.
- i) Red Round Mark: The opposite side of a conductor drum (i.e. the side not bearing the Eskom logo) shall be marked (stamped) with a red circle of 200 mm diameter to augment the logo for forensic purposes.

## 6. Authorization

This document has been seen and accepted by:

Name and surname	Designation
B McLaren	MV Care Group Chairperson
R Sander	LV Care Group Chairperson
R Vajeth	Senior Manager Lines Engineering
R Asmal	MV & LV Study Committee Chairperson

## 7. Revisions

Date	Rev	Compiler	Remarks
Oct 2016	2	S Goonoa, B McLaren	Revised ABC marking requirements (incl. Eskom). Updated document to include 95 mm <sup>2</sup> ABC option. Document reformatted into new template. Unique number 34-1803 changed to 240-84758170. Updated Table 3: Test requirements. Updated Annex B - Technical Schedules.
Feb 2011	1	R Kelly	Reference to NFC 32-209 changed to CENELEC HD 626 – S1 Part 2 Clause 2.9.1 Table 2 - Wires Diameter dimensions for bare neutral supporting conductor included. Table 3 - Updated and improved SANS test references and list of tests Deleted section 5.2 and annex A
Jul 2009	0	V Singh/R Kelly	Replaces specifications SCSCAAD5

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## **8. Development team**

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

- B McLaren MV CG Chairperson
- R Sander LV CG Chairperson
- S Goonoa SI KZN OU
- J Maudu HV Plant

## **9. Acknowledgements**

Not applicable.

## Annex A – - Eskom Signature and Printing Guidelines

(Normative)

The Eskom signature (logo and logotype) printing guide and format

The Eskom Signature (logo and logotype) must be used together as a unit. The logo (“circle”) and the logotype (the word “Eskom”) must always appear together as one unit.

a) Colour specifications:

The corporate signature may only appear in the **Eskom corporate blue** or in **black**.

- Pantone 287C
- 100%C + 70%M + 0%Y + 10%K

To match colours, swatches must always be used. Previously printed material must never be used for colour matching.

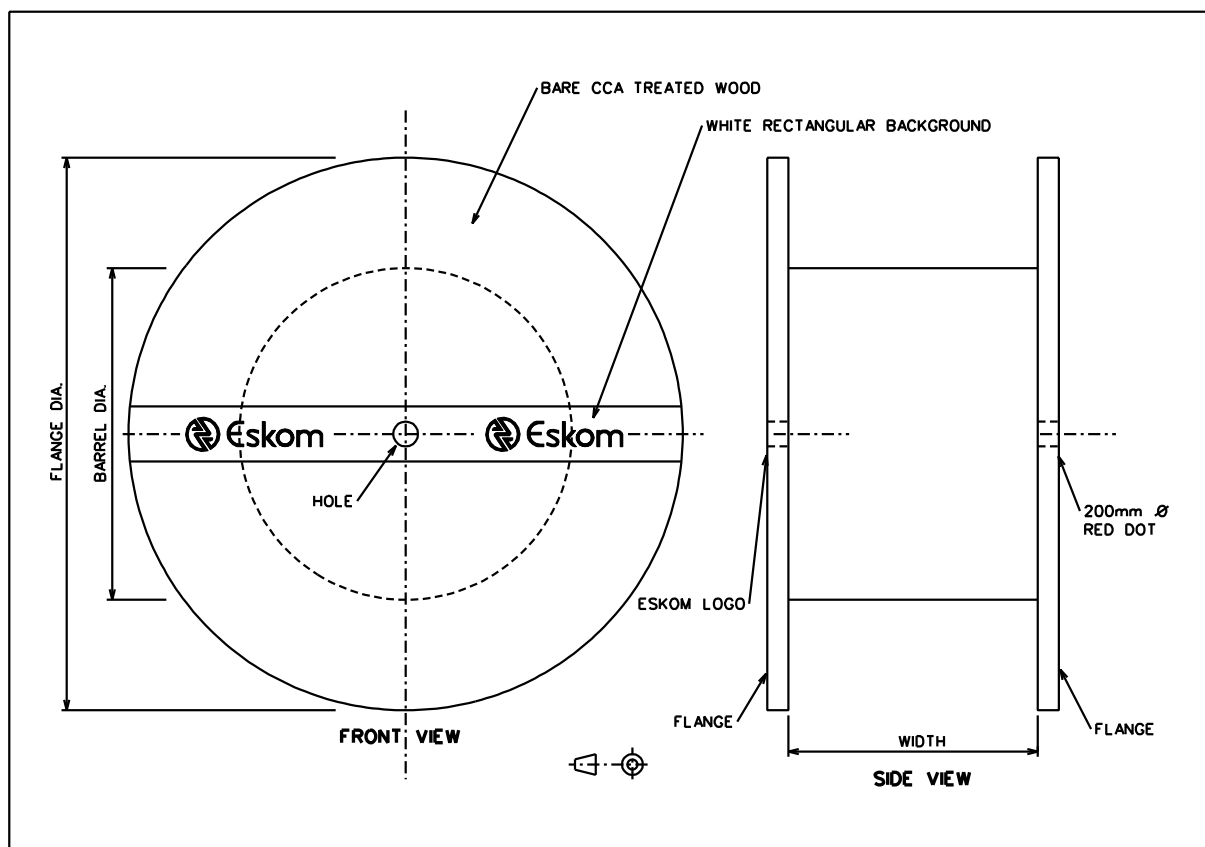
b) Corporate signature isolation area:

There should always be a minimum clear area around the signature. This minimum is equal to the full diameter of the logo (“circle”).

c) Relationship between the logo and the logotype:

The relationship between the logo and the logotype must always be followed exactly as indicated in the graphic. The measurement between the logo (“circle”) and the logotype (word “Eskom”) is twice the line-width of the “circle”.

Typical wooden drum showing Eskom branded flange



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The Eskom signature (logo and logotype) format



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**Annex B – - Technical Schedules A and B**

Bare and Insulated neutral supporting aerial bundle conductors

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

1	2	3	4	5
Item	Sub-clause	Description	Schedule A	Schedule B
1.1		Buyers Guide number	D-DT-3141	XXXXXXXXXX
1.2		Buyers Guide SAP Number	_____	XXXXXXXXXX
1.3		Product code or part number	XXXXXXXXXX	_____
2.1		Number of phase cores	_____	_____
2.2		Nominal cross sectional area of phase conductor mm <sup>2</sup>	_____	_____
2.3		Number of strands of phase conductor	XXXXXXXXXX	_____
2.4		Diameter over phase conductor mm	XXXXXXXXXX	_____
2.5		Diameter over phase core mm	XXXXXXXXXX	_____
3.1	3.1	Is auxiliary core required Yes/No	_____	_____
3.2		If applicable, diameter over auxiliary conductor mm	XXXXXXXXXX	_____
3.3		If applicable, diameter over auxiliary core mm	XXXXXXXXXX	_____
4.1	3.2 or 3.3	Is a bare or insulated neutral conductor required Bare/Insulated	_____	_____
4.2		If bare, is a 35 or 50 mm <sup>2</sup> cross section required? 35 or 50	_____	_____
4.3		If applicable, diameter over supporting conductor mm	XXXXXXXXXX	_____
4.4		If applicable, diameter over insulated supporting core mm	XXXXXXXXXX	_____
5	3.4	Provide an example of marking of first phase core	XXXXXXXXXX	_____
6	3.5	Provide an example of marking of phase cores other than first phase	XXXXXXXXXX	_____

1	2	3	4	5
Item	Sub-clause	Description	Schedule A	Schedule B
7.1	3.6	If applicable, provide an example of marking of insulated supporting core	XXXXXXXXXX	_____
7.2		Height of text mm	XXXXXXXXXX	_____
8.1	3.7	If applicable, provide an example of marking of auxiliary cores	XXXXXXXXXX	_____
8.2		Height of text mm	XXXXXXXXXX	_____
9	4	Test requirements		
9.1		Conductor resistance	Comply	_____
9.2		Voltage withstand	Comply	_____
9.3		Resistance of dielectric	Comply	_____
9.4		Impulse	Comply	_____
9.5		HV withstand	Comply	_____
9.6		Adherence of dielectric to conductor of supporting core	Comply	_____
9.7		Carbon black content	Comply	_____
9.8		Breaking force of supporting and phase conductor	Comply	_____
9.9		Tensile strength of phase conductor wires	Comply	_____
9.10		Tensile strength of supporting conductor wires	Comply	_____
9.11		Performance of supporting cores	Comply	_____
9.12		Dielectric shrink-back at high temperature	Comply	_____
9.13		Carbon black dispersion (type test)	Comply	_____
9.14		Insulation piercing test (type test)	Comply	_____
9.15		Has all test reports been submitted	Yes	_____
10	5	Provide an example of drum marking and labelling	XXXXXXXXXX	_____
		Length of cable per drum m	_____	_____