

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

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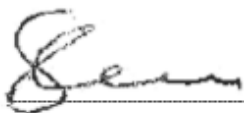
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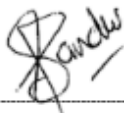
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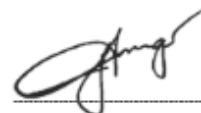
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1. Introduction

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, Overhead Distribution Cables of rated voltage $U_o/U (U_m) : 0.6/1 (1.2) \text{ kV}$, 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 60811-605, Electric and optical fibre cables - Test methods for non-metallic materials. Part 605: Physical tests – Measurement of carbon black and/or mineral filler in polyethylene compounds
- [7] BS EN 50396, Non electrical test methods for low voltage energy cables
- [8] D-DT-3141
- [9] SANS 10005, The preservative treatment of timber

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

Abbreviation	Description
ABC	Aerial Bundled Conductor
LV	Low Voltage
XLPE	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 Overhead Lines 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

- The requirements for aerial bundled conductor shall be in accordance with the requirements in SANS 1418-1, SANS 1418-2 and this standard / specification. Where conflicting requirements between this standard and SANS 1418 exists the requirements of this standard takes precedence.
- The aerial bundled conductor manufacturer shall have a valid SABS permit for manufacturing aerial bundled conductor according to SANS 1418.
- The nominal cross-sectional area of the phase conductors shall be 35 mm², 70 mm² or 95mm².
- Where applicable, the nominal cross sectional area of the auxiliary conductor shall be 25 mm².

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.

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

Table 1: Maximum dielectric thicknesses

1	2	3	4
Type of conductor of core	Nominal conductor size mm ²	Min thickness of dielectric mm	Max thickness of dielectric mm
Phase (aluminium)	35	1,34	1,86
	70	1,52	2,08
	95	1,52	2,08
Auxiliary	25	1,16	1,64

Note: The maximum dielectric thickness was determined as follows: 0.1 mm + 110% of the average dielectric thickness.

3.2 Insulated neutral supporting core

- a) The nominal cross-sectional area of the neutral conductor shall be 54,6 mm².
- b) The minimum and maximum thickness of the dielectric shall be 1,34 mm and 1,86 mm respectively.

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 mm² (in the case of 35 mm² phase conductor) or 50 mm² (in the case of 70 and 95 mm² phase conductor).
- c) The construction of the bare neutral supporting conductor shall comply with the requirements given in Table 2 below.
- d) The conductor shall not be compacted.

Table 2: Properties of bare neutral supporting conductor

1	2	3	4	5	6
Conductor size mm ²	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

3.4.1 The following information shall also be legibly and durably marked by indenting or embossing the insulation surface of the first phase core at regular intervals not exceeding 100 mm:

- a) Marking that identifies the manufacturer shall be provided
- b) The year of manufacture shall be provided
- c) The legend “600/1000 V” shall be provided
- d) The phase conductor nominal cross-sectional size shall be provided
- e) The first phase core shall be identified by means of the number 1. The Roman numeral number I shall not be used, and
- f) Marking that identifies the purchaser’s name i.e. “ESKOM” shall be provided

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3.4.2 The character height for the letters and numerals shall be a minimum of 5 mm and a maximum of 10 mm.

Example of marking of the first phase core appearing at intervals not exceeding 100 mm:

“ XXXXX XXXXX YEAR 600/1000V 70 mm² 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) Markings that identifies the purchaser's name i.e. “ESKOM” shall be provided
- d) The character height for the letters and numerals shall be a minimum of 5mm and a maximum of 10mm, and
- e) These markings shall appear at regular intervals not exceeding 100 mm

Example of marking of the phase cores other than the first phase core appearing at regular intervals:

“ 70 mm² 2 ESKOM ”

3.6 Marking requirements for insulated supporting core

- a) In addition to the relevant requirements of SANS 1418-1, the supporting neutral conductor nominal cross-sectional size shall be stated on the insulating surface of the supporting neutral core
- b) Identification thread need not be used
- c) Marking that identifies the manufacturer shall be provided
- d) The year of manufacture shall be provided
- e) The legend “600/1000 V” shall be provided
- f) Marking that identifies the purchaser's name i.e. “ESKOM” shall be provided
- g) A longitudinal ridge along the exterior surface of the supporting insulated neutral core in accordance with SANS 1418-1 shall be provided
- h) The character height for the letters and numerals shall be a minimum of 5mm and a maximum of 10mm, and
- i) The above insulated core markings shall appear at regular intervals not exceeding 100 mm
- j) In addition to the above markings, the insulated neutral core shall be marked by means of a durable “N” mark applied in white at intervals of not more than 150 mm along the surface of the insulated neutral core with durability of the markings compliant with the wiping test requirements of BS EN 50396 [7]

Example of marking of the insulated supporting core appearing at regular intervals:

“ XXXXX XXXXX YEAR 600/1000V 54.6 mm² ESKOM ” with a durable “N” mark and longitudinal ridge

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 the auxiliary core
- b) Marking that identifies the purchaser's name i.e. “ESKOM” shall be provided
- c) The character height for the letters and numerals shall be a minimum of 5 mm and a maximum of 10 mm, and

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d) These markings shall appear at regular intervals not exceeding 100 mm

Example of marking of the auxiliary core appearing at regular intervals:

“ 25 mm² A1 ESKOM”

4. Inspection and methods of test

4.1 Testing Requirements

The following tests shall be carried out, the type of test (i.e. type, sample or routine) is stated 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 4.2.1 & Clause 6.3.1
Voltage withstand	Routine	SANS 1418-2 Clause 4.2.2 & Clause 6.3.2
Resistance of dielectric	Routine	SANS 1418-2 Clause 4.2.3 & Clause 6.3.3
Impulse	Type	SANS 1418-2 Appendix E
HV withstand	Type	SANS 1418-2 Appendix E
Tests for physical properties		
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 4.1.3 & Clause 6.4.3
Performance of supporting cores	Type	SANS 1418-2 Clause 4.1.5 & 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 60811-605 [6]

4.1.2 Insulation piercing test (type test)

Use CENELEC HD 626 S1: Part 2 [3]

5. Drum marking, packing and labelling requirements

- a) Each drum of completed aerial bundled conductor shall be packed on a drum and supplied in lengths according to D-DT-3141 [8].
- b) The drum provided shall not have on its surfaces any projection that is likely to come into contact with or likely to damage the aerial bundled conductor under normal handling conditions.
- c) The moisture content of the wood used in wooden drums or reels provided shall not exceed 20%.
- d) When wooden drums or reels are used, these shall be supplied resistant to wood biological attack, the wood shall be treated with a preservative in accordance with SANS 10005 [9] or equivalent.
- e) Both ends of every core of aerial bundled conductor on a drum shall be sealed suitably to prevent the ingress of water during transportation, handling and storage.
- f) Both ends of the cable shall be secured to the drum and the inner end shall be protected against mechanical damage during transportation, handling and storage.
- g) All drums shall be marked legibly and durably according to SANS 1418-2, and for re-used drums all drum markings pertaining to previous orders shall be painted over or otherwise suitably removed.
- h) All aerial bundled conductor drums destined for Eskom projects shall be branded with Eskom signature (logo and logotype) on one of its flat sides (the flange).
- i) 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.
- j) The width (or height) of the white rectangular background shall be three times the diameter of the "circle" part of the Eskom logo.
- k) 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.
- l) The Eskom logo printing shall be made using silkscreen technique or other equivalent techniques which shall be demonstrated to and approved by Eskom.
- m) The dimensions of the 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.
- n) 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.
- o) 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
J Maudu	LV Services Care Group Chairperson
R Sander	LV Overhead Lines Care Group Chairperson
M Songo	Senior Manager Technology & Engineering
A Beutel	MV & LV Study Committee Chairperson

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7. Revisions

Date	Rev	Compiler	Remarks
May 2024	3	S Goonoa	Document reformatted Updated normative references and the marking requirements for insulated neutral and phase cores Updated the drum requirements Updated Annex B - Technical Schedules
April 2016	2	S Goonoa, B McLaren	Updated document to include 95 mm ² 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

8. Development team

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

- S Goonoa SI Engineer

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.

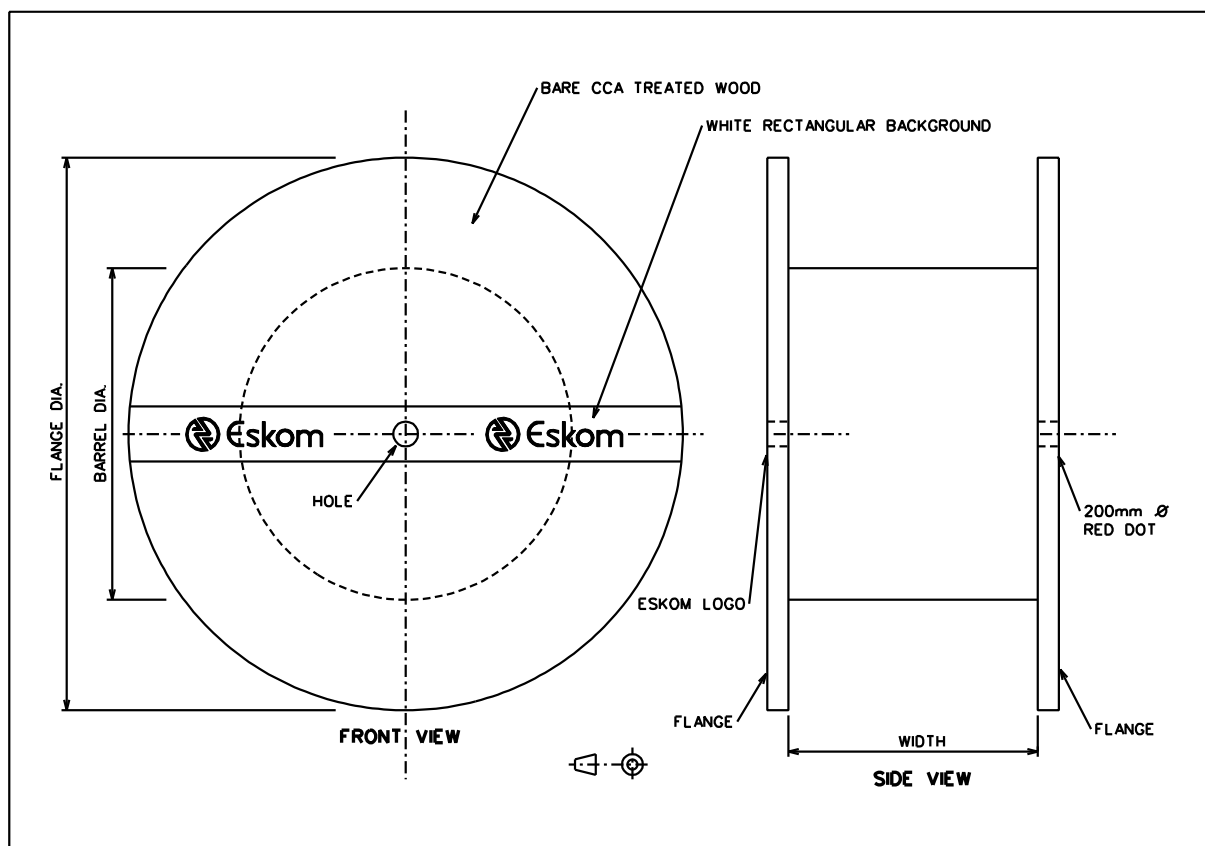
b) Corporate signature isolation area:

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	XXXXXXXXX
1.2		Buyers Guide SAP Number	_____	_____
1.3		Product code or part number	XXXXXXXXX	_____
1.4		Does the manufacturer have a valid SABS permit for the manufacturer to SANS 1418	Yes	_____
2.1		Number of phase cores	_____	_____
2.2		Number of neutral supporting conductors	_____	_____
2.3		Nominal cross sectional area of phase conductor mm ²	_____	_____
2.4		Number of strands of phase conductor	XXXXXXXXX	_____
2.5		Overall diameter of phase conductor mm	XXXXXXXXX	_____
2.6		Overall diameter of the phase core mm	XXXXXXXXX	_____
2.6		Dielectric thickness of the phase conductor mm	XXXXXXXXX	_____
3.1		Is auxiliary core required Yes/No	_____	_____
3.2		If applicable, diameter of auxiliary conductor mm	XXXXXXXXX	_____
3.3		If applicable, diameter over auxiliary core mm	XXXXXXXXX	_____
4.1		Is a bare or insulated neutral supporting conductor required Bare/Insulated	_____	_____
4.2		If bare neutral, is a 35 or 50 mm ² cross sectional area conductor required 35 or 50 mm ²	_____	_____
4.3		If insulated neutral, the overall diameter of the insulated neutral supporting conductor mm	XXXXXXXXX	_____
4.4		If insulated neutral, the cross-sectional area of the insulated neutral core 54,6 mm ²	54,6 mm ²	_____
4.5		If insulated neutral, the dielectric thickness of the insulated neutral supporting conductor mm	XXXXXXXXX	_____
5.1	3.4	Provide an example of marking of first phase	XXXXXXXXX	_____
5.2	3.5	Provide an example of marking of phase cores other than first phase	XXXXXXXXX	_____
5.3	3.4 & 3.5	Height of text mm	XXXXXXXXX	_____

1	2	3	4	5
Item	Sub-clause	Description	Schedule A	Schedule B
5.4	3.6	If applicable, provide an example of marking of insulated supporting conductor	XXXXXXXXXX	_____
5.5	3.6	Height of text mm	XXXXXXXXXX	_____
5.6	3.7	If applicable, provide an example of marking of auxiliary cores	XXXXXXXXXX	_____
5.7	3.7	Height of text mm	XXXXXXXXXX	_____
6	4	Test requirements		
6.1	4	Conductor resistance	Comply	_____
6.2	4	Voltage withstand	Comply	_____
6.3	4	Resistance of dielectric	Comply	_____
6.4	4	Impulse	Comply	_____
6.5	4	HV withstand	Comply	_____
6.6	4	Inspection tests	Comply	_____
6.7	4	Compliance with dimensions	Comply	_____
6.8	4	Adherence of dielectric to conductor of supporting core	Comply	_____
6.7	4	Carbon black content	Comply	_____
6.8	4	Tensile strength and breaking force of supporting and phase conductor	Comply	_____
6.9	4	Performance of supporting cores	Comply	_____
6.10	4	Tensile strength of phase conductor wires	Comply	_____
6.11	4	Tensile strength of supporting conductor wires	Comply	_____
6.12	4	Dielectric shrink-back at high temperature	Comply	_____
6.13	4	Carbon black dispersion (type test)	Comply	_____
6.14	4	Insulation piercing test (type test)	Comply	_____
6.15	4	Has all the supporting test reports been submitted	Yes	_____
7.1	5	Provide an example of drum marking and labelling	XXXXXXXXXX	_____
7.2	5	Length of bundled conductor per drum m	_____	_____
7.3	5	Drum provided shall not damage the ABC under normal handling conditions	Yes	_____
7.4	5	Moisture content of the drum provided shall not exceed 20%	Yes	_____
7.5	5	Drum provided shall be resistant to wood biological attack	Yes	_____
7.6	5	Both ends of ABC shall be sealed & secured	Yes	_____