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**TITLE SPECIFICATION FOR CONCENTRIC SERVICE CABLE WITH COMMUNICATION CORES TINNED COPPER AND COATED STEEL**

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## **FOREWORD**

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## **INTRODUCTION**

This specification covers requirements for the tinned copper and coated steel concentric type of service cable to connect customers to the low voltage reticulation system and to enable the purchaser to acquire the cable without the need for detailed and extensive contract documents.

The “more safe” cable (6mm<sup>2</sup>) shall meet SANS 1507-6 requirements and “additional” requirements as per City Power specification.

The following document contain provisions that, through reference in the text, constitute requirements of this specification. At the time of publication, the editions indicated concentric cable with communication cores for split metering. The design shall address issues of contact between wires and fusing of individual strands .The mechanical strength of the cable is addressed by steel galvanised steel wires as gap filters. Tinning of copper is required to ensure corrosion compatibility and improve the electrical contact resistance between steel and copper.

Tinning and mixed metals might reduce theft by:

- Mimicking an Al cable
- Contaminate metallurgical meltdown of stolen cable

## **1 SCOPE**

This specification specifies City Power’s requirements for the manufacture and supply of 6mm<sup>2</sup> (more safe) concentric service cable for nominal system a.c. voltages up to and including 0.6/1kV. It is intended for use in overhead, single-phase connections to a customer’s installation, but it may also be installed underground. There are two communication cores included in the design

## **2 NORMATIVE REFERENCES**

For the purpose of this specification, FOR City Power the references given in SANS 1507-6 will apply.

*ISO 9001, Quality Management Systems.*

*SANS 1507-1, Electric cables with extruded solid dielectric insulation for fixed installations (300/500V to 1900/3 300V) Part 1: General*

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

*SANS 1411-1, Materials of insulated electric cables and flexible cords Part 1; Conductors*

*SANS 1411-4, Materials of insulated electric cables and flexible cords Part 4: Cross-linked polyethylene (XLPE)*

*SANS 1411-6, Materials of insulated electric cables and flexible cords Part 6: Armour*

*SANS 1411-7, Materials of insulated electric cables and flexible cords Part 7: Polyethylene (PE)*

*IEC 50:1984, International Electrotechnical Vocabulary (IEV)Chapter 461: Electric cables*

### **3 SUPPORTING CLAUSES**

#### **3.1 Purpose**

This document is intended for use in overhead, single-phase connections to a customer's installation, but it may also be installed underground.

#### **3.2 Applicability**

This document shall apply throughout City Power Network

#### **3.3 Informative**

The following document, in addition to those listed in the specification, was a source of reference in compiling this specification. It does not constitute provisions of this specification but is referenced for further information. (IEC 50:1984, International Electrotechnical Vocabulary (IEV) Chapter 461: Electric cables).

#### **3.4 Roles and responsibilities**

The relevant sections within City Power Network are responsible to implement the new design according to the requirements as listed in this document.

#### **3.5 Process for monitoring**

Adherence to this document shall be monitored through routine inspections.

#### **3.6 Related/supporting documents**

Not applicable.

### **4 DEFINITIONS AND ABBREVIATIONS**

#### **4.1 General**

For the purpose of this specification, the definitions (for terms not given below) and abbreviations given in SANS 1507-1 shall apply.

**NOTE:** The terms used in this specification are generally consistent with the definitions given in the International Electrotechnical vocabulary (IEV)

##### **4.1.1 General Definitions**

<b>Definition</b>	<b>Description</b>
<b>Binder</b>	A layer incorporated in a cable with the specific functions of holding the components within the layer together.
<b>Breaking load</b>	The tensile load applied during testing, when the cable finally breaks or becomes permanently deformed
<b>Compacted conductor</b>	A stranded conductor in which the interstices between the component wires have been reduced by mechanical compression or by drawing
<b>Concentric cable</b>	A cable consisting of a central phase core surrounded by a concentrically applied layer of strands, comprising the neutral/earth conductor
<b>Conductor</b>	A part of a cable which has the specific function of carrying current
	The rated normal current of a cable is the r.m.s. value of current that the cable

<b>Current rating</b>	can carry continuously under the specified conditions of use and behaviour
<b>Insulation</b>	Insulating materials incorporated in a cable with the specific function of withstanding voltage
<b>Stranded conductor</b>	A conductor consisting of a number of individual wires, all or some of which generally have a helical form
<b>UV stabilized</b>	Modified by methods to withstand ultraviolet radiation

#### 4.1.2. General Abbreviations

Abbreviation	Description
<b>GSW</b>	Galvanised steel wire
<b>AL</b>	Aluminium
<b>N/E</b>	Neutral/Earth
<b>TCU</b>	Tin cooled copper wire
<b>XLPE</b>	Cross-linked polyethylene
<b>PE</b>	Polyethylene

## 5 REQUIREMENTS

### 5.1 General

The cable shall comply with this specification and SANS 1507-6 and “additional” City Power requirements.

- a) The GSW strands shall comply with this specification and SANS 1411-6.
- b) The TCU strands shall comply with this specification and SANS 1411-1

### 5.2 Construction Requirements

#### 5.2.1 Conductor

- a) The central conductor of the cable referred as the phase or live conductor see figure 1 for a typical construction shall consist of 6 circular tin coated hard drawn copper strands and 1 galvanised steel wire.
- b) The phase and neutral conductor nominal copper equivalent cross-sectional (including the GSW) area shall be 6 mm<sup>2</sup> in each case. Compliance is determined by the maximum DC resistance as per Annexure C.
- c) The central insulated core shall be surrounded by:
  - \* An arrangement of alternating GSW and annealed TCU wires and
  - \* One blue and one white PE insulated stranded copper communication cores placed next to each other and shall comply with SANS 1507.
- d) Neutral/earth strands or GSW and TCU wires shall be in electrical contact over the length of the cable and that compliance is determined by continuity testing between two bare N/E wires on either side of the two communication cores over a specified length (typically 3m) of cable.

### 5.2.2 Insulation and Outer Sheath

- a) The core insulation of the conductor shall be colour fast red UV stabilized XLPE type B that complies with the requirements of SANS 1411-4. Compliance to UV stability requirements is verified by testing to UL 1581. Colour fastness compliance is verified by positive visual identification of the red colour following the UV stability test.
- b) The concentric assembly shall be enclosed in a black sheath of a weather stabilized grade polyethylene that complies with materials PS1 (sheathing grade) in accordance with SANS 1411 - 7. A black sheath shall have a single line ridge for identification purposes.
- c) A ripcord laid under the sheath shall be provided for the stripping of the cable.

### 5.3 Dimensions

The cable shall comply with the following overall diameters:

- Minimum – 11.7mm
- Maximum – 11.82mm

### 5.4 Mechanical requirements

- a) When a cable is tested in as per SANS 1507-6, there shall be no signs of distortion or cracking of the insulation or sheath.
- b) When a cable is tested in accordance with SANS 1507-6, the slippage of the outer sheath with respect to the commercial clamps specified shall comply with the following requirements:

Slippage after 15 minutes at 0.7 kN	$S1 \leq 2\text{mm}$
Slippage after 1 hour at 1,0 kN	$S2 \leq S1 + 3\text{mm}$

### 5.5 6.5 Electrical requirements

- a) When tested in accordance with SANS 1411-1 the DC resistance of the phase and neutral conductors (including the GSW) at 20 °C shall not exceed 3, 21  $\Omega/\text{km}$  and 3, 11  $\Omega/\text{km}$  respectively.
- b) The continuous current rating in air (in direct sunlight) at 30°C shall be not less than 60A when the phase conductor is at 90°C
- c) The continuous current rating of the cable when installed in air at 30°C and when installed, underground at 25°C shall be as stated in Schedule B.

## 6 TESTS

### 6.1 Type tests

For the purpose of this specification the type tests of the cable given in SANS 1507-6 shall apply. The type tests shall be performed a recognized test authority approved by the purchaser. If a previous report on an identical cable has been produced, a copy of this report may be submitted. If any changes in the cable design are made, such as change of conductor type, change of insulation thickness, change of conductor diameter or change of insulation material, then the type test shall be repeated.

### **6.1.1 Finished cable tests**

- a) Bending radius test
- b) Test for adherence of the covering sheath

Carefully bend the sample around a mandrel of diameter equal to eight times the diameter of the cable to make a 180° turn and check for compliance with SANS 1507-6

## **6.2 Routine tests**

The Routine tests shall be performed on each completed cable drum and complied with SANS 1507-6.

### **6.2.1 Finished cable tests**

- a) Marking test
- b) Conductor resistance
- c) Voltage withstand test

### **6.2.2 Insulation tests**

- a) Spark test
- b) Core identification

## **6.3 Sample tests**

The Sample tests below shall comply with SANS 1507-6 and SANS 1411-6

**NOTE:** It is intended that the sample tests be conducted at the manufacturer's works on a regular basis.

### **6.3.1 Conductor test**

- a) Construction test
- b) Elongation at break test

### **6.3.2 Insulation tests**

- a) Physical properties test
- b) Thickness test
- c) Core identification test

### **6.3.3 Sheet test**

- a) Physical properties
- b) Thickness

### **6.3.4 Finished cable test**

- a) Dielectric resistance test

### **6.3.5 Adherence of cable sheath to concentric layer test**

Conduct the tests at an ambient temperature between 100C and 300C and at a humidity of less than 80%.

#### **6.3.5.1 Test procedure**

- (a) Mount a reference clamp and a commercially available clamp on opposite ends of a section of service cable of length about 4m, at least 2m apart.
- (b) Apply a steady increasing load (in Newton) up to a value of 0,7kN onto the cable and allow it to settle for a period of 5 minutes.
- (c) Mark the cable at the inner end of the commercial clamp so that any slippage of the cable sheath over the concentric layer is measurable.
- (d) Maintain the tension on the cable at a constant load of 0,7kN for 15 minutes.
- (e) Mark the cable at the inner end of the commercial clamp and record the slippage.
- (f) Increase the load steadily to 1,0kN.
- (g) Maintain the tension on the cable at a constant 1,0kN load for 1 hour
- (h) After the 1 hour has elapsed, mark and record the slippage from the 0,7kN point

### **6.4 Factory Acceptance Test (FAT)**

Factory acceptance Test (FAT), shall be carried out as per SANS 1507-4, with the presence of City Power Personnel before the cable can be released from the manufacturer

## **7 MARKING, LABELLING AND PACKAGING**

- 7.1 The requirements of section 5 of SANS 1507 shall apply.
- 7.2 If so specified in Schedule A, the outer sheath of the cable shall be sequentially marked at 1 m intervals. Lengths of cable may be wound on drums, commencing at any sequential mark. The "start" and "finish" lengths of sequential marking shall be shown on the drum label in those instances where the start is not zero.

## **8 QUALITY MANAGEMENT**

A quality management plan shall be set up in order to assure the proper quality management of the concentric service cable with communication cores, tinned copper and coated steel during design, development, production, installation and servicing phases. Guidance on the requirements for a quality management plan may be found in the SANS 1507-4 and ISO 9001. The details shall be subject to agreement between City Power and the Supplier.

## **9 ENVIRONMENTAL MANAGEMENT**

An environmental management plan shall be set up in order to assure the proper environmental management of concentric service cable with communication cores, tinned copper and coated steel throughout its entire life cycle (i.e. during design, development, production, installation, operation and maintenance, decommissioning and disposal phases). Guidance on the requirements for an environmental management system may be found in SANS 1507-4 and ISO 14001 standards. The

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details shall be subject to agreement between City Power and the Supplier. This is to ensure that the asset created conforms to environmental standards and City Power SHEQ Policy.

## **10 HEALTH AND SAFETY**

A health and safety plan shall be set up in order to ensure proper management of the concentric service cable with communication cores, tinned copper and coated steel compliance of the queuing system during installation, operation, maintenance, and decommissioning phases. Guidance on the requirements of a health and safety plan may be found in OHSAS 18001 standards. This is to ensure that the asset conforms to standard operating procedures and City Power SHERQ Policy. The details shall be subject to agreement between City Power and the Suppliers.

## **ANNEXURE A – BIBLIOGRAPHY**

Eskom Specification, 30 March 2017, The Standard for Concentric Service cable with Communication Cores, Tinned Copper and Coated Steel, Unique Identifier, 240-61704085

**ANNEXURE B-REVISION INFORMATION**

<b>DATE</b>	<b>REV. NO.</b>	<b>NOTES</b>
OCTOBER 2018	0	First Issue
OCTOBER 2021	1	Alignment of Annexure D with the SAP Master  General Editing

**ANNEXURE C- TECHNICAL SCHEDULES A AND B**

**ITEM 1: CAB LV 6 CSC CU – (SAP No.4171)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_271	Description	Schedule A	Schedule B
1		Quantity of cable required		
2		Approximate length per drum	Required	
3		Approximate mass per drum	Required	
4	5.2.1	Phase core		
		- Material	Required	
		- size; mm <sup>2</sup>	6	
		-no of Copper strands/ tinned hard drawn	6	
		- no of GSW	1	
		- size of Copper strands; mm <sup>2</sup>	Required	
		- size of GSW strands; mm <sup>2</sup>	Required	
		Insulation material	XLPE	
5	5.2.2	Insulation thickness	Required	
		mm		
		Communication cores (stranded)	Required	
		Tolerance	Required	
		mm		
6	5.5	Resistance at 20°C	Required	
		□		
7	5.2.1	Neutral earth conductor		
		Size of tinned anneal copper strands; mm <sup>2</sup>	Required	
		Size of GSW strands; mm <sup>2</sup>	Required	
		Material	Required	
		Number of Copper stands	Required	
		Number of GSW strands	Required	
8	5.3	Thickness of outer sheath	Required	
		mm		
9	5.3	Overall diameter of cable	Required	
		mm		
		Tolerance	Required	
		mm	□	
10		Nominal mass of cable	Required	
		kg/km	Required	
11	5.4	Minimum bending radius of cable		
		mm		
12	5.5	- in air (in direct sunlight) at 30°C	Required	
		A		



**DEVIATION SCHEDULE**

**ITEM 1: CAB LV 6 CSC CU (SAP No. 4171)**

**Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.**

Item	Sub-clause of CP_TSSPEC_271	Proposed deviation

Tender Number: \_\_\_\_\_

Tenderer's Authorised Signatory: \_\_\_\_\_  
Name in block letters Signature

Full name of company: \_\_\_\_\_

**ANNEXURE D – STOCK ITEMS**

**Material Group: COND-ABC**

<b>Item</b>	<b>SAP No.</b>	<b>SAP Short Description</b>	<b>SAP Long Description</b>
1	4171	CAB LV 6MM², CSC CU	CABLE, LV, 6MM², CONCENTRIC SERVICE CABLE WITH COMMUNICATION CORES TINNED COPPER AND COATED STEEL ITEM SPECIFICATION NO. CP_TSSPEC_271