



The Kenya Power & Lighting
Co. Ltd.

TITLE:

SPECIFICATION FOR SOFT
DRAWN COPPER
CONDUCTORS (Bare & PVC
Covered) – for Earthing

Doc. No.

KPLC1/3CB/TSP/06/026

Issue No.

2

Revision
No.

0

Date of
Issue

2010-06-04

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Issued by: Head of Section, Technical Stds & Specs

Authorized by: Head of Department, R&D

Signed:

Signed:

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0.1 Circulation List

COPY NO.	COPY HOLDER
1	Research & Development Manager
2	Procurement Manager
3	Stores & Stock Control Manager
4	Chief Manager, Distribution
5	Deputy Manager, Technical Audit

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 2 Rev 0	2010-06-03	Cancels & replaces KPLC 1/3CB/TSP/05/030 Issue 1 Rev 1 of 2007-05-11		<i>S. M. M. M.</i> <i>S. M. M. M.</i>

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FOREWORD

This specification has been prepared by the Research & Development Department of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for soft drawn copper conductors for grounding electrical systems. It is intended for use by KPLC in purchasing the conductors.

The manufacturer shall submit information which confirms satisfactory service experience with products which fall within the scope of this specification.

1. SCOPE

This specification is for plain bare soft drawn copper conductors for grounding electrical systems. The specification covers bare and PVC covered conductors.

The specification also covers inspection and test of the conductors as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation.

The specification stipulates the minimum requirements for soft drawn copper conductors acceptable for use in the company and it shall be the responsibility of the Manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the conductors for KPLC.

The specification does not purport to include all the necessary provisions of a contract.

2. REFERENCES

The following standards contain provisions which, through reference in this text constitute provisions of this specification. Unless otherwise stated, the latest editions (including amendments) apply.

IEC 60228: Conductors of insulated cables

IEC 60502-1: Power Cables with extruded insulation and their accessories for rated voltages from 1kV ($U_m=1.2kV$) up to 30kV ($U_m=36kV$)- Part 1: Cables for rated voltages 1kV ($U_m=1.2kV$) and 3kV ($U_m=3.6kV$)

3. TERMS AND DEFINITIONS

For the purpose of this specification, definitions given in the reference standard shall apply.

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4. REQUIREMENTS

4.1 Service Conditions

The soft drawn copper conductors shall be suitable for continuous operation outdoors in tropical areas and average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C.

4.2 Materials and Construction

4.2.1 The soft drawn copper conductors shall be suitable for grounding electrical systems where high conductivity and flexibility are required.

4.2.2 The conductors shall be as per IEC 60228. Sizes and electrical characteristics shall be in accordance with clause 4.3.

4.2.3 PVC covering shall be type PVC/A as per IEC 60502-1. The nominal thickness shall be in accordance with IEC 60502-1 (same values given in clause 4.3)

4.3 Sizes

Nominal cross-sectional area mm ²	Number & nominal diameter of wires No x Ø (mm)	Max. DC resistance at 20°C Ohm/km	Approx. overall diameter (uncovered conductor) mm	Nominal thickness of PVC covering mm
16	7x1.68	1.15	5.1	1.0
35	7x2.48	0.524	7.4	1.2
50	19x1.80	0.387	9.0	1.4
70	19x2.10	0.268	10.5	1.4
95	19x2.48	0.193	12.4	1.6
120	37 No. As per IEC 60228	0.153	14.5	1.6
150	37 No. As per IEC 60228	0.124	16.2	1.8

5. TESTS AND INSPECTION

5.1 The soft drawn copper conductors shall be tested and inspected in accordance with the requirements of this specification, IEC 60502-1 and IEC 60228. It shall be the responsibility of the manufacturer to perform or to have performed the tests specified

5.2 Copies of previous Test Reports (in English Language) from the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC

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17025 accredited independent laboratory) shall be submitted with the tender for the purpose of technical evaluation. A copy of accreditation certificate for the laboratory shall also be submitted (all in English Language).

- 5.3 Routine and sample test reports for the cables to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods.
- 5.4 During delivery of the conductors, KPLC will inspect them and may perform or have performed any of the relevant tests in order to verify compliance with the specification (including verification of length on drum). The manufacturer shall replace/rectify without charge to KPLC, conductors which upon examination, test or use fail to meet any or all of the requirements in the specification.

6. MARKING, LABELLING AND PACKING

- 6.1 The finished conductor shall be wound on wooden drum such as to prevent damage during transportation and handling. The drums shall be made from treated timber resistant to termite attack.
- 6.2 The actual length of conductor shall not be less than the length indicated on the drum.
- 6.3 The following information shall be marked legibly and in a permanent manner on the flange of the drum.
- a) The manufacturer's name.
 - b) The type of conductor.
 - c) The conductor cross-sectional areas in mm².
 - d) The length of the conductor, in metres.
 - e) The year of manufacture.
 - f) The gross mass and net mass, in kilogram.
 - g) The instructions for handling and use (in English Language).
 - h) The words "PROPERTY OF THE KENYA POWER & LIGHTING CO."
- 6.4 PVC covered conductors shall be marked with the manufacturer's name, type of conductor, cross-sectional area, year of manufacture and the words "PROPERTY OF KENYA POWER & LIGHTING CO." An indelible marking shall also be given at every one meter interval to assist field personnel in cutting required length.

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ANNEX A: Guaranteed Technical Particulars (to be filled and signed by the Manufacturer for all clauses and submitted together with catalogues, brochures, drawings, technical data and test reports for tender evaluation)

Tender No

Clause Number	Bidder's offer	Reference documents to support the offer.
Manufacturer's Name & Address		
Clause 1		
Clause 2		
Clause 3		
Clause 4 1		
Clause 4 2 1		
Clause 4 2 2		
Clause 4 2 3		
Clause 4 3 (give details for sizes on tender & offered)		
Clause 5 1		
Clause 5 2 (list copies of test reports submitted with tender)		
Clause 5 3		
Clause 5 4		
Clause 6 1		
Clause 6 2		
Clause 6 3		
Clause 6 4		

NB: - This schedule does not in any way substitute for detailed information required elsewhere in the specification.

.....
Manufacturer's Name, Signature, Stamp and Date

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Kenya Power

TITLE:

**SPECIFICATION FOR ALUMINUM
4-CORE PVC INSULATED,
STEELWIRE ARMoured CABLE**

Doc. No.

KP1/3CR/TSP/05/001

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6. SEALING, MARKING AND PACKING
7. DOCUMENTATION

ANNEX A: Guaranteed Technical Particulars (to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, four customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of complete type test certificates and type test reports for tender evaluation, all in English Language)

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TITLE:
**SPECIFICATION FOR ALUMINUM
 4-CORE PVC INSULATED,
 STEELWIRE ARMoured CABLE**

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0.1 Circulation List

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0.2 Amendment Record

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Issue 4 Rev 0	2013-04-30	Cancels and replaces 3rd Issue Rev 2 dated 2003-07-02	S. Kimitai <i>[Signature]</i>	G. Owuor <i>[Signature]</i>

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TITLE:

**SPECIFICATION FOR ALUMINUM
4-CORE PVC INSULATED,
STEELWIRE ARMoured CABLE**

Doc. No.

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FOREWORD

This specification has been prepared by the Research and Development Department of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for Aluminium 4-core, PVC insulated, steel wire armoured cables. It is intended for use by KPLC in purchasing the cables.

1. SCOPE

1.1 This specification is for four core, stranded and compacted circular aluminium conductors, PVC insulated, galvanized steel wire armoured, PVC outer sheathed power cables for operation at a.c. voltages of 600 Volts to sheath, 1000 Volts between conductors and highest system voltage of 1200 Volts for use in KPLC distribution network.

1.2 This specification covers the following cable sizes:

4x 25 mm² AL/PVC/SWA/PVC
4 x 70 mm² AL/PVC/SWA/PVC
4 x 120 mm² AL/PVC/SWA/PVC
4 x 185 mm² AL/PVC/SWA/PVC
4 x 300 mm² AL/PVC/SWA/PVC

1.3 The specification also covers inspection and test of the cables as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation.

The specification stipulates the minimum requirements for Aluminum 4-core PVC insulated, steel wire armoured cables acceptable for use in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good engineering practice, adherence to the specification, applicable standards and applicable regulations as well as ensuring good workmanship in the manufacture of the cables for The Kenya Power & Lighting Company.

The specification does not purport to include all the necessary provisions of a contract.

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TITLE:
**SPECIFICATION FOR ALUMINUM
4-CORE PVC INSULATED,
STEELWIRE ARMoured CABLE**

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2. REFERENCES

The following standards contain provisions which, through reference in this text constitute provisions of this specification. Unless otherwise stated, the latest editions (including amendments) apply.

- BS 6346: 600/1000V and 1900/3300V armoured electric cables having PVC insulation;
- IEC 60502-1: Power cables with extruded insulation and their accessories for rated voltages from 1kV ($U_m=1.2kV$) up to 30kV ($U_m=36kV$) - Part 1: Cables for rated voltages from 1kV ($U_m=1.2kV$) up to 3kV ($U_m=3.6kV$);
- IEC 60228: Conductors for insulated cables;
- IEC 60811-1-1: Common test methods for insulating and sheathing materials of electric cables:-
Part 1: Methods for general application;
Section 1: Measurements of thickness and overall dimensions -
Tests for determining the mechanical properties;
- KS 04-187: Specification for conductors of insulated cables.

3. TERMS AND DEFINITIONS

For the purpose of this specification the definitions given in BS 6346, IEC 60228, IEC 60502-1 and KS 04-187 apply, together with the following:

- Al: Aluminium
PVC: Polyvinyl Chloride
SWA: Steel Wire Armour

4. REQUIREMENTS

4.1 SERVICE AND SYSTEM CONDITIONS

4.1.1 Cable Application

- a) The cable shall be a distribution cable for use in outdoors installations and tropical conditions (temperature range of $-1^{\circ}C$ to $+40^{\circ}C$, humidity of upto 90% and saline conditions along the coast).

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TITLE:

**SPECIFICATION FOR ALUMINUM
4-CORE PVC INSULATED,
STEELWIRE ARMoured CABLE**

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- b) The cable shall be suitable for laying in cable ducts and in the ground in power stations and customer installations.
- c) The cable shall also be suitable for laying on slopes.
- d) Permissible continuous loading operating temperature shall be 70°C.

4.1.2 Operating Voltage

The rated operating voltage (U_0/U), required by this specification is 600/1000 V at 50Hz a.c.

4.2. CABLE CONSTRUCTION

4.2.1. Design

- 4.2.1.1 The cable shall be designed and manufactured in accordance with requirements of IEC 60228 and IEC 60502-1 and the requirements of this specification.
- 4.2.1.2 All materials used shall be compatible and suitable for the continuous operating temperature of the cable of 70°C and short circuit temperature of 160°C (5 seconds max duration) as per IEC 60502-1.

4.2.2. Conductors

The cable shall be made from stranded circular compact plain aluminium conductors, class 2 in accordance with IEC 60228 and KS 04-187, and as specified in the table 1 in clause 4.3 of this specification.

4.2.3. Insulation

4.2.3.1 Material

The insulation shall be extruded dielectric of type PVC/A in accordance with the requirements of IEC 60502-1.

The insulation shall be applied by extrusion to form a compact and homogeneous layer.

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TITLE:
**SPECIFICATION FOR ALUMINUM
4-CORE PVC INSULATED,
STEELWIRE ARMoured CABLE**

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4.2.3.2 Insulation Thickness

The average thickness of insulation when determined in accordance with IEC 60811-1-1, shall not be less than the nominal values given in table 1 of clause 4.3 as appropriate, and the smallest of the measured values shall not fall below the nominal value by more than (10%+0.1mm).

4.2.3.3 Identification of Cores

Cores shall be identified by colouring throughout the insulation material. Colours of the cores shall be in the following sequence:- Red, Yellow, Blue and Black.

Black colour shall be used only for Neutral.

4.2.4. Laying up

Cores shall be laid up with a right hand direction of lay. Non-hygroscopic fillers shall be applied integrally with the bedding of armoured cable to form a compact and circular cable.

A plastic binder tape shall be applied over the laid up cores of the cable.

There shall be no adhesion between the bedding of armoured cable or the sheath and insulation. Where the bedding or sheath is applied integrally with fillers, it shall be possible to strip it from the cable without damaging the insulation.

4.2.5. Bedding

4.2.5.1 Material

Bedding of four core cables shall comprise of extruded layers of polymeric material compatible with the underlying insulation and suitable for use at the operating temperatures of the cable.

The bedding shall not adhere to the underlying cores.

4.2.5.2 Bedding Thickness

The average thickness of the bedding, when determined in accordance with IEC 60811-1-1 shall not be less than the nominal value given in table 1 of clause 4.3 as

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**SPECIFICATION FOR ALUMINUM
 4-CORE PVC INSULATED,
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appropriate and the smallest of the measured values shall not fall below the nominal value by more than (20%+0.2mm).

4.2.6. Armour

4.2.6.1 General

Armour for the four core cable shall comprise a single layer of circular galvanized steel wires. The armour wires shall be applied helically with a left hand lay and shall fully comply with the requirements of BS 6346 and IEC 60502-1.

4.2.6.2 Wire diameter

The nominal diameter of the wires shall be as specified in clause 4.3 table 1.

4.2.6.3 Electrical Resistance

When measured and corrected to 20⁰ C, the electrical resistance of the armour of the completed cable shall not exceed the appropriate value given in clause 4.3 table 1.

4.2.7. Outer Sheath

4.2.7.1 General

The outer sheath of the cable shall comprise an extruded layer of BLACK PVC in accordance with the requirements of BS 6346. The PVC shall be of type ST1 with maximum conductor temperatures in normal operations of 80⁰C as per the requirements of IEC 60502-1.

4.2.7.2 Thickness

The average thickness of the outer sheath, when determined in accordance with IEC 60811-1-1, shall be not less than the nominal value given in table 1 of clause 4.3 as appropriate and the smallest of the measured values shall not fall below the nominal value by more than (20%+0.2mm).

4.2.7.3 Marking

The external surface of the cable shall be legibly embossed with the following information on two lines running parallel to the length of the cable, approximately equally spaced around the circumference of the cable.

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**SPECIFICATION FOR ALUMINUM
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Electric Cable 600/1000 V Manufacturers Name Description of Cable
PROPERTY OF KPLC

For example, for 4-core, 25mm², PVC insulated cable manufactured by manufacturer XYZ, the legend would read as follows: Electric Cable 600/1000V XYZ 4x25mm² AL PVC/SWA/PVC **PROPERTY OF KPLC**

Note: The bedding material is not included in the PVC/SWA/PVC naming convention.

Letters and figures shall be raised and consist of upright block characters. Minimum size of characters shall be not less than 15% of average overall cable diameter and the distance between one set of markings and the next shall not exceed 500mm. In addition, each cable shall be sequentially marked by indelible printing, indenting or other suitable means, at 1m intervals, to indicate the approximate length of cable remaining on the drum. The numbers shall start with 001, 1m from the inner end of cable and continue every metre to the outer end.

4.3. STANDARD SIZES AND CHARACTERISTICS

Table 1: Mechanical and Electrical characteristics of standard sizes of PVC cables

Conductor nominal sectional area	mm ²	25	70	120	185	300
Number of cores		4	4	4	4	4
Voltage Designation U _o /U (U _m)		600/1000 (1200) V				
Conductor shape		Stranded shaped compacted				
Nominal insulation thickness	mm	1.2	1.4	1.6	2.0	2.4
Bedding thickness	mm	1.0	1.2	1.4	1.6	1.6
Average outer sheath thickness	mm	1.8	2.1	2.4	2.6	3.0
Armour wire diameter	mm	1.8	2.0	2.5	2.5	2.5
Armour wire resistance at 20°C	Ω/km	2.1	1.2	0.71	0.59	0.47
Minimum number of wires in the conductor	no	6	12	15	30	30
Minimum diameter of the conductors	mm	5.6	9.3	12.3	15.3	19.7
Maximum diameter of the conductors	mm	6.5	10.2	13.5	16.8	21.6
Outer diameter of cable	mm	27.8	39.2	49.3	59	72
Maximum conductor resistance at 20°C	Ω/km	1.2	0.443	0.253	0.164	0.100
Minimum insulation resistance of cable for 1000m at 20°C	MΩ	10	10	10	10	10
Approximate weight of cable	Kg/Km	1440	2830	4850	6440	9240
Approximate length of cable on drum	m	3000	2000	1000	750	500

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Kenya Power

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**SPECIFICATION FOR ALUMINUM
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Note:

The Current Carrying Capacity of the cable underground, in ducts and in air shall be stated by the manufacturer in the Guaranteed Technical Particulars as per Annex A

Table 2: Mechanical characteristics of Insulating and Sheathing compounds (before and after ageing)

Designation of compound	Unit	PVC/A	ST1
Maximum conductor temperature in normal operation	°C	70	80
Without ageing (IEC 60811-1-2, sub clause 9.1)			
Tensile strength, minimum	N/mm ²	12.5	12.5
Elongation-at-break, minimum	%	150	150
After ageing in air oven IEC 60811-1-2, sub clause 8.1 After ageing without conductor Treatment			
> Temperature	°C	100	100
> Tolerance	°C	±2	±2
> Duration	h	168	168
Tensile strength			
> Value after ageing, minimum	N/mm ²	12.5	±2.5
> Variation, maximum	%	±25	±25
Elongation-at-break			
> Value after ageing, minimum	%	150	150
> Variation, maximum	%	±25	±25

5. TESTS AND INSPECTION

- 5.1 The cable shall be inspected and tested in accordance with the requirements of this specification, BS 6346, IEC 60811-1-1 and IEC 60502-1. It shall be the responsibility of the supplier to perform or to have performed the tests specified and whatever other tests he normally performs at works.
- 5.2 Copies of previous Type Tests Reports Issued by a third party testing laboratory that is accredited to ISO/IEC 17025 shall be submitted with the tender for the purpose of technical evaluation. The accreditation certificate to ISO/IEC 17025 for the same third party testing laboratory used shall also be submitted with the tender (all in English Language)

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TITLE:

**SPECIFICATION FOR ALUMINUM
4-CORE PVC INSULATED,
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5.2.1 Copies of type test reports to be submitted with the tender (by bidder) for evaluation shall include the following:

5.2.1.1 Electrical Type Tests

- a) Insulation resistance measurement at ambient temperature tests.
- b) Insulation resistance measurement at maximum conductor temperature test.
- c) Voltage test for 4h.
- d) Impulse test for completed cable.

5.2.1.2 Non Electrical Type Tests

5.2.1.2.1 Mechanical strength tests for PVC/A insulation and ST1 over sheath.

- a) Tensile strength and elongation-at-break tests: without ageing; after ageing in an air, oven and after ageing of pieces of complete cable.

5.2.1.2.2 Thermoplastic properties of insulation and over sheath.

- a) Hot pressure tests (indentation) test.
- b) Behavior at low temperatures tests.

5.2.1.2.3 Heat shock tests

5.2.1.2.4 Water absorption tests

5.2.2 Routine and sample test reports for the cables to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. KPLC Engineers will witness tests at the factory before shipment.

5.2.3 Tests to be witnessed by KPLC Engineers at the factory before shipment shall be in accordance with BS 6346, IEC 60228, IEC 60502-1, this specification and shall include the following:

5.2.3.1 Routine Tests

- a) Spark test on cores.
- b) Spark test on over sheath of armoured cables.
- c) Voltage test on completed cables.
- d) Insulation resistance tests.

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Authorized by: Head of Department, R & D

Signed:

Signed:

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TITLE:

**SPECIFICATION FOR ALUMINUM
4-CORE PVC INSULATED,
STEELWIRE ARMoured CABLE**

Doc. No. KP1/3CB/TSP/05/001

Issue No. 4

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- e) Conductor resistance tests.
- f) Armour resistance tests.

5.2.3.2 Sample Tests

- a) Measurement of insulation thickness
- b) Measurement of extruded bedding and over sheath thickness
- c) Conductor examination – physical tests and check of dimensions

6. SEALING, PACKING AND MARKING

6.1 Sealing

Before dispatch, the ends of the cable shall be sealed with closing fitting PVC end caps to prevent the ingress of water during transportation and storage.

The sealing shall enclose the oversheath completely.

6.2 Packing

Cables shall be wound on to non-returnable wooden drums, close battened to prevent damage during transportation or storage. The wood shall be treated to resist biological attacks. The drums shall have wooden lagging all round, with no gaps.

Each drum shall contain only one continuous length of cable which shall be of the length indicated in table 1, clause 4.3 above in length. The actual length of cable shall not be less than the length indicated on the drum

Both ends of the cable shall be secured to the drum to prevent mechanical damage

6.3 Marking

6.3.1 Each drum shall be legibly and indelibly marked with the following information on the flange:

- a) The manufacturer's trade name;
- b) The year of manufacture.
- c) The rated voltage of the cable, 600/1000 (1200) V
- d) The type of cable. For example AL 4 core PVC/SWA/PVC;
- e) The conductor cross-sectional areas in mm²;

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**SPECIFICATION FOR ALUMINUM
4-CORE PVC INSULATED,
STEELWIRE ARMoured CABLE**

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- f) The length of the cable, in metres;
- g) The identifying serial number;
- h) The words "NOT TO BE LAID FLAT" or a suitable pictogram;
- i) An arrow and words, "ROLL THIS WAY", on each flange of the drum to indicate in which direction the drum shall be rolled in order to prevent the cable from unwinding.
- j) A capital letter "T" approximately 50mm high surrounded by a circle with an approximate outside diameter of 65mm, if the wood has been treated to resist biological attack.
- k) The gross mass of the drum and net mass cable, in kilogram;
- l) The words "PROPERTY OF THE KENYA POWER & LIGHTING CO."

6.3.2 The following information shall be printed on a suitable label. This label shall be firmly attached to one of the flanges of the drum:

- a) The year of manufacture;
- b) The rated voltage of the cable 600/1000 V;
- c) The type of cable. For example 4-core PVC/SWA/PVC;
- d) The conductor size in mm²;
- e) The length of the drum in metres;
- f) The gross mass of the cable and drum in Kg.
- g) An identifying serial number;
- h) The purchasers name. For example, "PROPERTY OF KENYA POWER & LIGHTING CO."
- i) The order number;
- j) Any other contract particulars.

Note: The cable shall have been marked in accordance with clause 4.2.7.3

7. DOCUMENTATION

7.1 The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) for tender evaluation.

- a) Guaranteed Technical Particulars;
- b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
- c) Sales records for the last five years and at least four customer reference letters;
- d) Details of manufacturing capacity and the manufacturer's experience;
- e) Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025; the Type Test Reports shall not be more than five years old.

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**SPECIFICATION FOR ALUMINUM
4-CORE PVC INSULATED,
STEELWIRE ARMoured CABLE**

Doc. No.

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f) Copy of accreditation certificate for the testing laboratory.

7.2 The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

- a) Guaranteed Technical Particulars,
- b) Design drawings and construction details of the cable,
- c) Quality Assurance Plan (QAP) that will be used to ensure that the cable design, material, workmanship, tests, service capability, maintenance and documentation will fulfill the requirements stated in the contract documents, standards, specifications and regulations.
- d) Test Program to be used after manufacture,
- e) Marking details and method to be used in marking the cables,
- f) Manufacturer's undertaking to ensure adequacy of the design, good workmanship, good engineering practice and adherence to applicable standards in the manufacture of the cables for KPLC,
- g) Packaging details (including packaging materials, lagging and length on drum).

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TITLE:
**SPECIFICATION FOR ALUMINUM
 4-CORE PVC INSULATED,
 STEELWIRE ARMoured CABLE**

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ANNEX A: Guaranteed Technical Particulars (to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records, four customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of complete type test certificates and type test reports for tender evaluation, all in English Language)

Table 3: Guaranteed Technical Particulars.

1 Item	2 Description	Units	3 Schedule 1 (KPLC)	4 Schedule 2 (Tenderer)
1	Manufacturer		Specify	
2	Country of manufacture		Specify	
3	Name and address of Bidder		Specify	
4	Service conditions			
	a) Cable application		Specify	
	b) Operating voltage	V	Specify	
5	Cable construction			
	a) Design			
	• Standards applicable		Specify	
	• Materials characteristics		Specify	
	b) Conductors types	mm ²	25, 70, 120, 185, 300	
	c) Insulation			
	• Materials		PVC/A	
	• Insulation thickness	mm	Specify	
	• Identification of cores	no	Specify	
	d) Laying up		Specify	
	e) Bedding			
	• Bedding material		Specify	
	• Bedding thickness	m	Specify	
	f) Armour			
	• Armour material		Galvanized steel	
	• Armour wire diameter	mm	Specify	
	• Armour wire electrical resistance at 20°C	Ω/km	Specify	
	g) Outer sheath			

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**SPECIFICATION FOR ALUMINUM
4-CORE PVC INSULATED,
STEELWIRE ARMoured CABLE**

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	<ul style="list-style-type: none"> Outer sheath material Thickness Marking 	mm	PVC type ST1 Specify Specify
6	Standards and Characteristics		
	a) Conductor nominal x-sectional area	mm ²	Specify
	b) Number of cores	no	Specify
	c) Voltage designation U ₀ /U(U _m)	V	Specify
	d) Conductor shape		Specify
	e) Nominal insulation thickness	mm	Specify
	f) Inner sheath thickness	mm	Specify
	g) Average sheath thickness	m	Specify
	h) Armour wire thickness	mm	Specify
	i) Number of wires in the conductor	no	Specify
	j) Average diameter of the conductors	mm	Specify
	k) Outer diameter of conductors	mm	Specify
	l) Maximum conductor resistance at 20°C	Ω	Specify
	m) Minimum insulation resistance of cable for 1000m at 20°C	MΩ	Specify
	n) Approximate weight of cable	Kg	Specify
	o) Approximate length of cable on drum	m	Specify
	p) Current carrying capacity		
	<ul style="list-style-type: none"> air duct underground 	A	Specify Specify Specify
	q) Power frequency withstand voltage	V	Specify
7	Copies of type test reports to be submitted with tender for evaluation		As per clauses 5.2.1.1 and 5.2.1.2
8	List of Tests to be witnessed by KPLC Engineers at the factory before shipment		As per clauses 5.2.3.1 and 5.2.3.2
9	Embossing of the cable over sheath (parameters to be indicated and method of marking)		Specify
10	Marking of cable drum (parameters to be indicated and method of marking)		Specify
11	Packing (treated wooden drum and lagging)		Specify

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TITLE:
**SPECIFICATION FOR ALUMINUM
 4-CORE PVC INSULATED,
 STEELWIRE ARMoured CABLE**

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12	Length of cable on the drum (shall be in one continuous length)	Specify		
13	Installation and technical manuals to be provided during delivery	Specify		
14	List of catalogues, brochures, drawings, technical data and customer sales records submitted to support the offer.	Specify		
15	Statement of compliance to tender specifications	Specify		
16	Deviations from tender specifications	Specify		
17	Inspection/Tests by KPLC during delivery before acceptance to stores/slte.	Specify		

NB: - This schedule does not in any way substitute for detailed information required elsewhere in the specification.

.....
Manufacturer's Name, Signature, Stamp and Date

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TITLE:
**SPECIFICATION FOR PVC
INSULATED SINGLE PHASE
CONCENTRIC ALUMINIUM
CABLES (LOW VOLTAGE)**

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ANNEX A: SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR OFFERED CABLES

(to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records, customer reference letters, details of manufacturing capacity, the manufacturer's experience, copies of complete type test reports and accreditation certificate to ISO/IEC 17025 for the testing laboratory for tender evaluation, all in English Language)

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**SPECIFICATION FOR PVC
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0.1 Circulation List

COPY NO.	COPY HOLDER
1	Head of Department, Standards
2	Supply Chain Manager, Procurement
Electronic copy (pdf) on KPLC server currently: http://172.16.1.40/dms/browse.php?fFolderId=23	

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 2 Rev 1	2014-09-23	Included size 10mm ² Single Core Concentric Aluminium for single phase customers in SWER system		

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FOREWORD

This specification has been prepared by the Standards Department in collaboration with The Design Optimization Committee both of The Kenya Power & Lighting Company Ltd (abbreviated as KPLC) and it lays down requirements for PVC Insulated Single Phase Concentric Aluminium Cables (LV). It is intended for use by KPLC in purchasing the cables.

The bid shall be submitted complete with information that confirms satisfactory service experience of the manufacturer with products which fall within the scope of this specification.

1. SCOPE

This specification is for PVC insulated single phase concentric cables with circular stranded aluminium conductors for operation up to and including 1000 Volts between phases and 600 Volts to earth. The cable shall have a central phase stranded aluminium conductor insulated with red PVC and concentric layer comprising bare aluminium wires (combined neutral-earth conductor) and outer sheath in black PVC.

The specification also covers inspection and test of the cables as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation.

The specification stipulates the minimum requirements for PVC Insulated Single Phase Concentric Aluminium Cables (LV) acceptable for use in the company (KPLC) and it shall be the responsibility of the supplier to ensure adequacy of the design, good workmanship, good engineering practice and adherence to standards, specifications and applicable regulations in the manufacture of the cables for The Kenya Power & Lighting Company Ltd.

The specification does not purport to include all the necessary provisions of a contract.

2. REFERENCES

The following standard contains provisions which, through reference in this text constitute provisions of this specification. Unless otherwise stated, the latest editions (including amendments) apply.

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KS 04-1022:-Kenya Standard Specification for 600/1000V PVC-insulated single-phase concentric cables with copper or aluminium conductors for electricity supply

3. TERMS AND DEFINITIONS

For the purpose of this specification the definitions given in the reference standards shall apply.

4. REQUIREMENTS

4.1 SERVICE AND SYSTEM CONDITIONS

- a) The cable shall be a service cable for continuous operation outdoors and tropical conditions (temperature range of -1°C to +40°C, humidity of upto 90% and saline conditions along the coast).
- b) The cable shall be suitable for laying in cable ducts and in air.
- c) Permissible continuous loading operating temperature shall be 70°C.

4.2. MATERIALS AND CONSTRUCTION

4.2.1. The cable shall be designed and manufactured to Kenya Standard KS 04-1022 and the requirements of this specification.

4.2.2. Phase Conductor

4.2.2.1 The phase conductor shall be circular stranded annealed aluminium conductors (class 2) as specified in KS 04-1022. The phase conductor shall have a left-hand direction of lay.

4.2.2.2 The insulation of the phase conductor shall be red PVC compound specified in KS 04-1022. It shall be applied by an extrusion process and shall be spark tested in accordance with KS 04-1022.

4.2.2.3 The thickness of insulation, determined in accordance with KS 04-1022, shall be not less than the value given in Table 1 of this specification and the smallest of the measured values shall not fall below the value given in the said table by more than (10% + 0.1mm).

4.2.3. Concentric Layer

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SPECIFICATION FOR PVC INSULATED SINGLE PHASE CONCENTRIC ALUMINIUM CABLES (LOW VOLTAGE)

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4.2.3.1 The neutral conductor shall be concentric and shall be manufactured from plain annealed aluminium wires in accordance with KS 04-1022. The number of wires and the resistance of the neutral conductor shall comply with Table 1 of this specification.

4.2.3.2 The concentric layer shall be applied with a right hand direction of lay.

4.2.4. Oversheath

4.2.4.1 The oversheath shall be an extruded layer of black PVC compound as specified in KS 04-1022. The oversheath shall be spark tested in accordance with KS 04-1022.

4.2.4.2 The minimum thickness of the oversheath shall not fall below the value given in Table 1 of this specification by an amount more than (15% + 0.1mm).

4.3. STANDARD SIZES AND CHARACTERISTICS

4.3.1 The characteristics of the cables shall comply with Table 1.

Table 1: Characteristics (as per KS 04-1022)

Phase Conductor			Concentric neutral conductor: number. & approx. diameter of wires <u>No./mm</u>	Minimum lay lengths <u>mm</u>	Thickness of overshath <u>mm</u>	Approximate overall diameter <u>mm</u>	Maximum conductor dc resistance per 1000m of cable at 20°C	
Nominal area <u>mm²</u>	No. & approx dia. of wires <u>mm</u>	Thickness of insulation <u>mm</u>					Phase <u>ohms</u>	Neutral <u>ohms</u>
10	7/1.35	1.55	23/1.13	146.5	1.4	12.21	3.08	1.335
16	7/1.70	1.55	26/1.13	155	1.4	13.34	1.91	1.808
25	7/2.14	1.60	29/1.13	165	1.5	14.88	1.20	1.0586
35	19/1.53	1.65	27/1.35	178	1.6	16.75	0.868	0.7966

4.4. EMBOSING ON CABLE

The cable shall be embossed with the following information throughout the length of the oversheath.

- a) 600/1000 VOLTS PVC CABLE PROPERTY OF KPLC
- b) Year of Manufacture
- c) Size of Cable

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d) Name of Manufacturer

(Example: '16 SQ MM 600/1000 VOLTS PVC AL CABLE PROPERTY OF KPLC 2004' xxx)

'xxx' being the manufacturer's name.

Letters and figures shall be raised and consist of upright block characters which shall be legible. Minimum size of characters shall be 3mm. The gap between the end of one inscription and the beginning of the next shall be not greater than 25mm and the gap between each complete set of markings shall be not greater than 500mm.

An indelible marking shall also be given at every one meter interval to assist field personal in cutting required length.

5. TESTS AND INSPECTION

- 5.1 The cable shall be inspected and tested in accordance with the requirements of this specification and KS 04-1022. It shall be the responsibility of the supplier to perform or to have performed the tests specified.
- 5.2 Copies of previous test certificates and test reports by a third party testing laboratory accredited to ISO/IEC 17025 shall be submitted with the offer for evaluation. A copy of the accreditation certificate for the testing laboratory shall also be submitted with the tender (all in English Language).
- 5.3 Routine and sample test reports for the cables to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. KPLC Engineers (2) will witness these tests at the factory before shipment.
- 5.4 During delivery of the cables, KPLC will inspect them and may perform or have performed any of the relevant tests in order to verify compliance with the specification. The manufacturer shall replace/rectify without charge to KPLC, cables which upon examination, test or use fail to meet any or all of the requirements in the specification.

6. MARKING AND PACKING

- 6.1 The finished cable shall be wound in one continuous length on wooden drum such as to prevent damage during transportation and handling. The drums shall be made from treated timber resistant to termite attack and shall be lagged all round to prevent damage to the cable. There shall be no gaps in the wooden lagging around the drum.

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- 6.2 Each drum shall contain only one continuous length of cable of 2500m in length. The actual length of cable shall not be less than the length indicated on the drum.
- 6.3 Both ends of the cable shall have been sealed to prevent the ingress of water during transportation, storage, handling and installation. The sealing shall enclose the oversheath completely and shall be by close fitting plastic caps. Both ends of the cable shall be secured to the drum to prevent mechanical damage.
- 6.4 The following information shall be marked legibly and in a permanent manner on the flange of the drum:
- a) The manufacturer's name;
 - b) The type and rating of cable;
 - c) The conductor cross-sectional area in mm²;
 - d) The length of the cable, in metres;
 - e) The year of manufacture;
 - f) The gross mass and net mass, in kilogram;
 - g) The instructions for handling and use (in English Language);
 - h) The words "PROPERTY OF THE KENYA POWER & LIGHTING CO."

Note: The cable shall have been marked in accordance with clause 4.4

7. DOCUMENTATION

- 7.1 The bidder shall submit its tender complete with technical documents required by the tender document and Annex A (Guaranteed Technical Particulars) for tender evaluation. The documents to be submitted (all in English language) for tender evaluation shall include the following:
- a) Guaranteed Technical Particulars fully filled and signed by the manufacturer;
 - b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
 - c) Sales records and customer reference letters;
 - d) Details of manufacturing capacity and the manufacturer's experience;
 - e) Copies of required type test certificates and type test reports by a third party testing laboratory accredited to ISO/IEC 17025;
 - f) Copy of accreditation certificate to ISO/IEC 17025 for the testing laboratory;
 - g) Manufacturer's warranty and guarantee;
 - h) Manufacturer's letter of authorization, copy of the manufacturer's ISO 9001:2008/KEBS Diamond Mark certificate and other technical documents required in the tender.

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7.2 The successful bidder (supplier) shall submit the following documents/details (from the manufacturer as per tender) to The Kenya Power & Lighting Company for approval before manufacture:

- a) Guaranteed Technical Particulars fully filled and signed by the manufacturer,
- b) Design drawings and construction details of the cable,
- c) Quality assurance plan (QAP) that will be used to ensure that the cable design, material, workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations.
- d) Test Program to be used after manufacture,
- e) Marking details and method to be used in marking the cables,
- f) Manufacturer's undertaking to ensure adequacy of the design, adherence to applicable standards/specification, good workmanship and good engineering practice in the manufacture of the cables for The Kenya Power and Lighting Company Limited,
- g) Packaging details (including packaging materials, lagging and length on drum).

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SPECIFICATION FOR PVC INSULATED SINGLE PHASE CONCENTRIC ALUMINIUM CABLES (LOW VOLTAGE)

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ANNEX A: SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR OFFERED CABLES

(to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records, customer reference letters, details of manufacturing capacity, the manufacturer's experience, copies of complete type test reports and accreditation certificate to ISO/IEC 17025 for the testing laboratory for tender evaluation, all in English Language)

TENDER NO.BIDDER'S NAME & ADDRESS

Description		Bidder's offer
Name and address of the Manufacturer		
Country of manufacture		
Manufacturer's Letter of Authorization		
Model/Type Reference No. of the offered cable		
Manufacturer's warranty and guarantee for the offered cable		
Service conditions & application		
Applicable Standard(s)		
Type and design		
Phase Conductor (material & construction)	Material of phase conductor	
	No. of wires in phase conductor and diameter of each wire	
Neutral Conductor (material & construction)	Material of neutral conductor	
	No. of wires in neutral conductor and diameter of each wire	
Phase Conductor Insulation	Material	
	Colour	
Oversheath (outer sheath)	Material	
	Colour	
	Marking, embossing	
RATINGS/CHARACTERISTICS		
Conductor nominal cross-sectional area		
Voltage designation U ₀ /U(U _m)		
Conductor shape		
Thickness of insulation		
Thickness of oversheath		

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Description	Bidder's offer
Maximum phase conductor resistance at 20°C	
Maximum neutral conductor resistance at 20°C	
Current carrying capacity	In air at 40°C
	In duct at 40°C
Power frequency withstand voltage	
List of Type Test Reports submitted with tender (indicate Test Report Numbers)	
List of Tests to be witnessed by KPLC Engineers at the factory before shipment	
Embossing on the cable oversheath (parameters to be indicated and method of marking)	
Marking on cable drum (parameters to be indicated and method of marking)	
Packaging (wooden drum & lagging)	
Length of cable on drum	
Installation and technical manuals to be provided during delivery	
List of catalogues, brochures, drawings, technical data and customer sales records submitted to support the offer.	
Statement of compliance to Tender Specifications	
Deviations from Tender Specifications	
Inspection/test by KPLC during delivery before acceptance to stores/site	

.....
Manufacturer's Name, Signature, Stamp and Date

Issued by: Asst Engineer, Technical Stds & Specs

Authorized by: Chief Engineer, Technical Stds & Specs

Signed:

Signed:

Date: 2014-09-23

Date: 2014-09-23