



TITLE:

**SPECIFICATION FOR 11kV  
SINGLE CORE XLPE  
ARMOURED CABLE**

Part 2: Copper conductors

Doc. No.

KP1/6C.1/13/TSP/05/006-2

Issue No.

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**0.1 Circulation List**

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**0.2 Amendment Record**

<b>Rev No.</b>	<b>Date (YYYY-MM-DD)</b>	<b>Description of Change</b>	<b>Prepared by (Name &amp; Signature)</b>	<b>Approved by (Name &amp; Signature)</b>
Issue 1 Rev 0	2015-10-09	New Issue	Michael Apudo	Eng. Dr. Peter Kimemia

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## FOREWORD

This specification has been prepared by the Standards Department of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for 11kV single core XLPE insulated copper cables. 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

1.1 This specification is for single core, stranded copper conductors XLPE insulated, aluminium wire armoured, PVC outer sheathed power cables for operation at a.c. voltages of 6350 Volts to sheath, 11000 Volts between conductors and highest system voltage of 12000 Volts for use in KPLC distribution network.

1.2 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. This specification is for the following cable sizes:

- a) 1 x 300mm<sup>2</sup> CU/XLPE/AWA/PVC.
- b) 1 x 400mm<sup>2</sup> CU/XLPE/AWA/PVC.
- c) 1 x 630mm<sup>2</sup> CU/XLPE/AWA/PVC.
- d) 1 x 800mm<sup>2</sup> CU/XLPE/AWA/PVC

1.3 The specification stipulates the minimum requirements for Single Core XLPE Copper Armoured Cable 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 documents were referred to during the preparation of this specification; in case of conflict, the requirements of this specification shall take precedence.

IEC 60502-2: Power Cables with extruded insulation and their accessories for rated voltages from 1kV (Um=1.2kV) up to 30kV (Um=36kV)- Part 2: Cables for rated voltages from 6kV (Um=7.2kV) up to 30kV (Um=36kV).

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- IEC 60228: Conductors of insulated cables.
- IEC 60230: Impulse tests on cables and their accessories
- IEC 60811-1-1: Common test methods for insulating and sheathing materials of electric cables - Part 1: Methods for general application - Section 1: Measurement of thickness and overall dimensions - Tests for determining the mechanical properties
- IEC 60885-3: Electrical test methods for electric cables - Part 3: Test methods for partial discharge measurements on lengths of extruded power cables
- IEC 60332-1-2: Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame
- IEC TR 62095: Electric cables –Calculations for current ratings –Finite element method
- BS 6622: Specification for cables with extruded cross-linked polyethylene or ethylene propylene rubber insulation for rated voltages from 3.8/6.6kV
- BS 7655-1.3, 4.2, 10.1: Specification for insulating and sheathing materials for cables. --Part 1: Elastomeric insulating compounds. XLPE. Sec1.3 XLPE to 19/33kV. Sec 4.2: PVC sheathing compounds. General application; Sec. 10.1: Polyethylene sheathing compounds Thermoplastic medium density polyethylene (MDPE) sheathing compound

### 3. TERMS AND DEFINITIONS

For the purpose of this specification the definitions given in IEC 60228 and IEC 60502-2 shall apply, together with the following abbreviations:

- Cu: Copper  
AL: Aluminium  
AWA: Aluminium Wire Armour  
PVC: Polyvinyl Chloride  
PE: Polyethylene  
XLPE: Cross-Linked PolyEthylene

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#### 4. REQUIREMENTS

##### 4.1. SERVICE AND SYSTEM CONDITIONS

4.1.1. The cables shall be suitable for continuous operation outdoors in tropical areas at:

- (i) Altitudes of up to 2200m above sea level,
- (ii) Humidity of up to 95%,
- (iii) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C,
- (iv) Heavy saline conditions along the coast - areas of coastal salt spray and / or industrial pollution with equivalent salt deposit densities in the range of 2.0 – 3.0 g/m<sup>2</sup>.
- (v) Tropical summer storms with gust wind speeds above 160km/h and an annual rainfall in excess of 1500mm.
- (vi) Isokeraunic levels of up to 180 thunderstorm days per year.
- (vii) Solar Radiation Level - 1100 watts per square metre with high ultraviolet content

4.1.2. Installation - The cable shall be suitable for laying in cable ducts, in air and in the ground with or without fine grain bedding material in KPLC distribution systems at a nominal depth of up to 1000 mm. The cable shall also be suitable for laying on slopes. Permissible continuous loading operating temperature shall be 70°C.

4.1.3. The cables shall be connected to underground system operating at a nominal voltage of 11kV, 50Hz and maximum voltage of 12kV and are solidly earthed at the transformer neutrals. The system falls under category A as defined by IEC 60502-2.

##### 4.2. MATERIALS AND CONSTRUCTION

###### 4.2.1. Design

4.2.1.1. The cable shall be designed and manufactured in accordance with BS 6622, IEC 60502-2 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 90°C and short circuit temperature of 250°C (5 seconds max duration) as per IEC 60502-2.

###### 4.2.2. Conductor

4.2.2.1. The cable shall be made from stranded compacted circular conductors of plain annealed copper that conforms to class 2 of IEC 60228.

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4.2.2.2. The ratio of the diameters of two different wires in the same conductor shall not exceed 2.

4.2.2.3. The number of wires in each conductor shall be not less than the appropriate minimum number given in Table 2.

#### 4.2.3. Conductor Screen

4.2.3.1. Conductor screen shall be an extruded layer of semi-conducting cross-linkable compound applied over the conductor and shall cover the surface completely. The minimum thickness shall be 0.3mm and the maximum resistivity shall not exceed 1000 Ohm-m at 90°C.

4.2.3.2. The extruded conductor screen shall be applied in the same operation as the insulation and shall be bonded fully to the insulation.

#### 4.2.4. Insulation

4.2.4.1. The insulation shall be cross-linked polyethylene (XLPE) conforming (GP8) as per BS 7655-1.3 and the requirements of IEC 60502-2 with extruded semi-conductive insulation screen copper tape over the core.

4.2.4.2. The insulation shall be applied by extrusion and cross-linked to form a compact and homogeneous layer.

4.2.4.3. The colour of the insulation shall be such that it is easily distinguishable from the screening materials.

#### 4.2.5. Insulation Screen

4.2.5.1. The insulation screen shall consist of a non-metallic, semi-conducting layer in combination with a metallic layer. The non-metallic layer shall be extruded directly upon the insulation of each core and consist of either a bonded or strippable semi-conducting compound.

4.2.5.2. A layer of semi-conducting tape or compound shall then be applied over the individual cores or the core assembly. The metallic layer shall be applied over either the individual cores or the core assembly collectively and shall comply with the requirements of Clause 10 of IEC 60502-2. The minimum thickness of the screen shall be 0.3 mm and the maximum resistivity is 1000 Ohm-m at 90°C as per BS 6622.

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4.2.5.3. The screen shall be tightly fitted to the insulation to exclude all air voids and can be easily hand stripped on site.

#### 4.2.6. Metallic screen

4.2.6.1. The metallic layer shall consist of either copper tapes or a concentric layer of copper wires or a combination of tapes and wires. The metallic layer shall provide an earth fault current path, capable of withstanding fault current to earth of stated in Table 3 for one second at maximum temperature 160°C.

4.2.6.2. Copper wires shall be applied over the conducting water blocking layer with a minimum diameter of 0.5mm. And over the copper wires, copper tape with minimum thickness of 0.1mm shall be applied helically with overlap. Total cross section of copper wire screen layer shall be as shown in Table 2.

#### 4.2.7. Bedding material

The bedding material shall comprise of a layer of extruded PVC or PE. The nominal thickness is calculated by  $0.02D_u + 0.6\text{mm}$  where  $D_u$  is the fictitious diameter under the sheath in mm. The nominal bedding thickness shall not be less than the values stated in Table 2.

#### 4.2.8. Armour

4.2.8.1. The armour shall consists of non-magnetic round aluminium or aluminium alloy wires applied helically with a left-hand lay with diameter specified as in Table 2. The dimensions of armour wires and tapes shall not fall below the nominal values given in Table 2 by more than 5 %.

4.2.8.2. An extruded separation layer (bedding) of black polyvinyl chloride (PVC) or Polyethylene (PE) shall be applied between the core and the armour.

#### 4.2.9. Over-sheath

4.2.9.1. Overall sheath shall comprise of a layer of extruded either PVC type 9 conforming to BS 7665-4.2 or MDPE type TS2 conforming to BS 7655-10.1. The extruded oversheath shall be black in colour and shall meet the requirements of IEC 60502-2.

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- 4.2.9.2. When a DC voltage test is performed on the over-sheath, a semi-conducting layer such as graphite coating shall be applied over the surface of the extruded over-sheath.
- 4.2.9.3. The cables shall have oversheath applied over the armour, and the nominal oversheath thickness shall be as per Table 2.
- 4.2.9.4. The oversheath PVC material shall have operating temperature range of -5°C to 90°C, short circuit temperature of 250°C and shall withstand a power frequency test voltage of 25.5kVrms.

**Table 1: Insulation material compatibility requirements as per BS 6622 Table 13**

Component	Property	Test Method	Requirements
Extruded PVC oversheath	Minimum tensile strength	IEC 60811-1-1	12.5 N/mm <sup>2</sup>
	Minimum elongation at break		150%
	Maximum variation of tensile strength <sup>A)</sup>		25%
	Maximum variation of elongation at break <sup>A)</sup>		25%
Extruded inner covering	Minimum tensile strength	IEC 60811-1-1	4 N/mm <sup>2</sup>
	Minimum elongation at break		50%
Extruded separation sheath - Bedding	Minimum tensile strength	IEC 60811-1-1	4 N/mm <sup>2</sup>
	Minimum elongation at break		50%
Insulation screen	Maximum resistivity at 90°C	BS 6622 Annex J	500 Ωm
	Forces to remove cold strippable insulation screen	BS 6622 Annex I	8 N to 45 N
Insulation	Maximum variation of tensile strength <sup>A)</sup>	IEC 60811-1-1	25%
	Maximum variation of elongation at break <sup>A)</sup>		25%
Conductor screen	Maximum resistivity at 90°C	BS 6622 Annex J	1,000 Ωm
Semiconducting lapped inner covering	Maximum resistivity at (23±5°C)	BS 6622 Annex K	1,500 Ω/square

<sup>A)</sup> The variation is the difference between the values obtained prior to and after heat treatment, respectively, expressed as a percentage of the former.

**4.3. EMBOSSING ON CABLE**

4.3.1. The external surface of the cables shall be legibly marked with the following elements:

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- |  |   |
|--|---|
| a) Electric cable:   | <b>ELECTRIC CABLE</b>                     |
| b) Voltage designation:  | <b>11,000 V</b>                           |
| c) Standards of manufacture:   | <b>BS 6622, IEC 60228 and IEC 60502-2</b> |
| d) Manufacturer's identification:  | <b>XYZ</b>                                |
| e) The number of cores, type and nominal cross-sectional area of conductors: | <b>1 x 630 Cu</b>                         |
| f) Letters "PROPERTY OF KPLC"  |   |

4.3.2. The marking of elements a) to f) shall be by embossing or indenting on the oversheath. Elements a), b) and c) shall appear on two or more primary lines along the axis of the cable, approximately equally spaced around the circumference of the cable. Elements d), e) and f) shall appear on at least one line.

4.3.3. 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 for items a), b) and c), and not greater than 1,100 for items d), e) and f).

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

#### 4.4. STANDARD SIZES AND CHARACTERISTICS

The dimensional requirement for the cables shall conform to Table 2 below:

**Table 2: Dimensional data for the XLPE cables as per IEC 60502-2, IEC 60228 and BS 6622**

Description	Units	Cable requirements				
		300	400	630	800	
Conductor nominal sectional area	mm <sup>2</sup>					
Voltage Designation U <sub>0</sub> /U (Um)		6.35/11 (12) kV				
Conductor shape		Compact round stranded				
Conductor diameter as per IEC 60228:2004, Table C.2	min	mm	19.7	22.3	28.7	33.7
	max	mm	21.6	24.6	32.5	37.6
Minimum number of wires	No.		34	53	53	53
Thickness of insulation, min	mm		3.4	3.4	3.4	3.4
Copper tape screen area, min	mm <sup>2</sup>		7.3	8.0	9.5	10.5
Copper wire screen area, min	mm <sup>2</sup>		25	35	35	40
Nominal bedding thickness, min	mm		1.2	1.2	1.4	1.4
Nominal armour wire diameter	mm		2.0	2.0	2.5	2.5
Nominal thickness of oversheath,	mm		2.2	2.4	2.6	2.8

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Description	Units	Cable requirements			
Approximate overall diameter	mm	44.1	48.2	57.4	60.2
Approximate weight	Kg/km	4490	5590	8230	10,130

**Table 3: Electrical data for the XLPE cables as per IEC 60502-2 and BS 6622**

Description	Units	Cable requirements				
Conductor nominal sectional area	mm <sup>2</sup>	<b>300</b>	<b>400</b>	<b>630</b>	<b>800</b>	
Voltage Designation U <sub>0</sub> /U (U <sub>m</sub> )	kV	6.35/11 (12)				
D.C resistance at 20°C, max	μΩ/m	60.1	47	28.3	22.1	
A.C resistance at 20°C, max	μΩ/m	80	64	42	25.8	
Short circuit rating of the conductor for 1s	kA	43.8	57.3	91.2	114	
Capacitance	pF/m	506	561	698	746	
Charging current	mA/m	1.01	1.12	1.37	1.45	
Short circuit current of copper tape screen for 1s	kA	1.0	1.1	1.3	1.5	
Short circuit current of copper wire screen for 1s	kA	4.3	5.8	5.8	6.2	
Test Voltage (after installation), D.C.	kV/5 min	15				
Four hour test voltage, A.C on complete cable	kVrms	25.5				
Impulse voltage test as per IEC 60230	kVpeak	112				
Partial discharge test	Voltage of test,	kVrms				
	Magnitude of discharge	pC				
Tan δ in relation to voltage	Maximum Tan δ at U <sub>0</sub>	-				
	Maximum increase in Tan δ (0.5U <sub>0</sub> to 2.0U <sub>0</sub> )	-				
Tan δ in relation to temperature	Maximum Tan δ at ambient temperature	-				
	Maximum Tan δ elevated temperatures (95°C to 100°C)	-				
Reactance	Trefoil cable arrangement, max	μΩ/m	100	94	91	87
	Flat spaced cable arrangement, max	μΩ/m	157	154	148	136
Inductance	Trefoil cable arrangement, max	nH/m	320	300	290	274
	Flat spaced cable arrangement, max	nH/m	500	490	470	450
Impedance	Trefoil cable arrangement, max	μΩ/m	126	113	97	94
	Flat spaced cable arrangement, max	μΩ/m	174	164	151	142

Current Rating Conditions:

(i) Ground Temperature: 20°C

(ii) Ambient Temperature (air): 30°C

(iii) Depth of Soil: 0.8m

Thermal Resistance of Soil: 1.5K·m/W

**NOTE:** The Current Carrying Capacity of the cable in the ground and in air shall be stated by the manufacturer in the clause-by-clause statement of compliance as per Appendix A.

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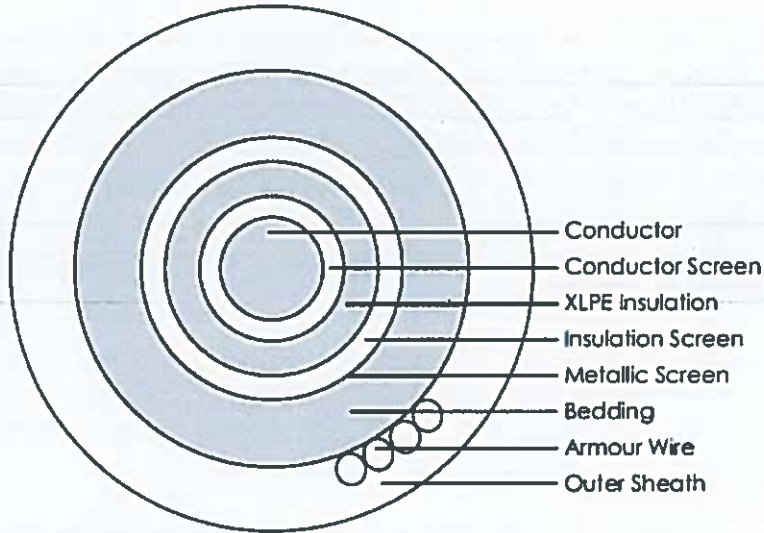
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**4.5. BASIC CONSTRUCTION**





**Fig. 1: Cable construction as per IEC 60502-1 and BS 6622**

**Key:**

- a) Conductor - Copper
- b) Conductor shape - Compacted Circular Stranded
- c) Insulation – XLPE
- d) Insulation screen, semi-conducting cross-linkable compound
- e) Metallic screen, copper tapes or a concentric layer of copper wires or a combination of tapes and wires
- f) Bedding - PVC or Polyethylene
- g) Armour wire - Aluminium Wires
- h) Sheath material - PVC or Polyethylene
- i) Conductor screen - Copper

**4.6. QUALITY MANAGEMENT SYSTEM**

4.6.1. The bidder shall submit a 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. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.

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- 4.6.2. The Manufacturer's Declaration of Conformity to reference standards and copies of quality management certifications including copy of valid and relevant ISO 9001: 2008 certificate shall be submitted with the tender for evaluation.
- 4.6.3. The bidder shall indicate the delivery time of the cables, manufacturer's monthly & annual production capacity and experience in the production of the type and size of conductor being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar rating of cables sold in the last five years as well as reference letters from at least four of the customers shall be submitted with the tender for evaluation.

**5. TESTS AND INSPECTION**

- 5.1. The cable shall be inspected and tested in accordance with BS 6622, IEC 60332-1-2, IEC 60502-1, IEC 60230, IEC 60811-1-1, IEC 60885-3 and the requirements of this specification. It shall be the responsibility of the supplier to perform or to have performed all the tests specified.
- 5.2. Copies of previous Test Reports confirming full conformance to clause 4 requirements for the cable 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 for the third party testing laboratory shall also be submitted with the tender (all in English Language).
- 5.3. Test Reports for the cable to be supplied under the contract shall be submitted to The Kenya Power & Lighting Company for approval before shipment/delivery and shall include the following:
- A. Material tests as per BS 6622, IEC 60502-1 and IEC 60811-1-1
    - a) Conductor screen resistivity
    - b) Insulation material grade test
    - c) Insulation screen resistivity,
    - d) Insulation screen cold strippability,
    - e) Semiconductor lapped inner covering resistivity,
    - f) Separation (bedding) sheath material
    - g) Armour
      - > Tensile test for aluminium wires
    - h) Oversheath material grade test
      - > Material
      - > shrinkage
    - i) Compatibility test

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j) Test under fire conditions

B. Electrical tests as per BS 6622, IEC 60502-1, IEC 60230 and IEC 60885-3

- a) Partial discharge test
- b) Bending test
- c) Tan  $\delta$  in relation to voltage
- d) Tan  $\delta$  in relation to temperature
- e) Heating cycle test
- f) Impulse voltage test
- g) Four voltage test
- h) Adherence of screens in short circuit temperature.

5.4. The cable shall be subject to acceptance tests at the manufactures' works before dispatch. Acceptance tests (routine & sample tests) will be witnessed by two Engineers appointed by The Kenya Power and Lighting Company Limited (KPLC).

5.5. Routine and sample test reports for the cable to be supplied shall be submitted to KPLC for approval before shipment of the goods. Tests to be witnessed by KPLC Engineers at the factory before shipment shall be in accordance with BS 6622, IEC 60332-1-2, IEC 60502-1, IEC 60230, IEC 60811-1-1, IEC 60885-3 and the requirements of this specification and shall include:

- a) Conductor material and construction
- b) Insulation resistance tests
- c) Conductor and armour resistance tests
- d) Laid up cores and core identification
- e) Dimensional checks
- f) Compatibility checks
- g) Fire test on single cable
- h) Spark resistance tests

5.6. Upon delivery of the cable, KPLC will inspect them and may perform or have performed any of the relevant tests in order to verify compliance with the specification. The supplier shall replace/rectify without extra or additional charge to KPLC, cables which upon examination, test or use fail to meet any of the requirements in the specification.

#### 6.0. 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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TITLE:  
**SPECIFICATION FOR 11kV  
 SINGLE CORE XLPE  
 ARMoured CABLE**  
 Part 2: Copper conductors

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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 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 permanent manner on the flange of the drum:
- The manufacturer's name
  - The type and rating of cable
  - The conductor cross-sectional area in mm<sup>2</sup>
  - The length of cable in metres
  - The year of manufacture
  - The gross mass and net mass in Kilograms
  - The instructions for handling and use (in English language)
  - The words "PROPERTY OF THE KENYA POWER & LIGHTING CO."

**NOTE:** *The cable shall have been marked in accordance with clause 4.4.*

**7.0. DOCUMENTATION**

- 7.1. The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:
- Guaranteed Technical Particulars fully filled and signed by the manufacturer;
  - Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
  - Sales records and customer reference letters;
  - Details of manufacturing capacity and the manufacturer's experience;
  - Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025;
  - Copy of accreditation certificate to ISO/IEC 17025 for the testing laboratory.
  - Manufacturer's warranty and guarantee
  - 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.
- 7.2. The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:
- Guaranteed Technical Particulars,
  - Design Drawings and construction details of the cable,

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- 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. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008
- d) Detailed test program to be used during factory testing,
- e) Marking details and method to be used in marking the cable,
- f) Manufacturer's undertaking to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the cables for The Kenya Power & Lighting Company
- g) Packaging details (including packaging materials, lagging and length on drum).

7.3. The supplier shall submit recommendations for use, care, storage and routine inspection/testing procedures, all in the English Language, during delivery of the cables to KPLC stores.

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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 for past five years, four 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 third party testing laboratory for tender evaluation, all in English Language)

Tender No. ....

Clause number	KPLC requirement		Bidder's offer
Manufacturer's Name and address			specify
Country of Manufacture			specify
Bidder's Name and address			specify
Type designation of cable			specify
Operating voltage Uo/U			specify
1.	Scope		specify
	Cable type and system voltages		
	Cable sizes		
2.	Applicable Standards		specify
3.	Terms & Definitions		specify
4.	<b>REQUIREMENTS</b>		specify
4.1	Service Conditions		specify
4.2	Material and construction		
4.2.1	Design	Design and manufacture standard	State and attach test reports
		All materials suitable for continuous operating temperature of the cable of 90°C	specify
4.2.2	Conductor shape		specify
	Conductor diameter as per IEC 60228:2004, Table C.2		specify
	Minimum number of wires		specify
4.2.3	Conductor Screen	Minimum thickness	state
		Resistivity at 90°C	state
		Extruded layer of semi conducting cross linkable compound	state
		Fully bonded to insulation	specify
4.2.4	Insulation	XLPE	specify
		Colour of insulation and screen distinguishable	state
		Thickness of insulation (mm)	
4.2.5	Insulation Screen	Bonded or cold strippable	state
		Extruded layer of semi conducting cross linkable compound	state
		Tightly fitted and can be hand stripped for jointing/termination	specify
		Minimum thickness (mm)	state
		Resistivity at 90°C	state

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Clause number	KPLC requirement		Bidder's offer	
4.2.6	Metallic Screen	Semi conducting tape applied	specify	
		Made of copper tapes or copper wire or both	specify	
		Earth fault current withstand value and temperature	state and provide test report	
		Copper tape screen area (mm)	state	
		Copper wires over conducting water blocking layer	Diameter	state
			Copper tape applied over overlap	specify
4.2.7	Bedding material	PVC or PE	specify	
		Nominal thickness	state	
4.2.8	Armour	Material used	state	
		Application method	state	
		Lay type	state	
		Separation layer material between core and armour	state	
4.2.9	Over-sheath	Material used and type	state	
		Overall diameter in mm	state	
		Norminal Oversheath thickness	state	
		Operating temperature range	state	
		Shorth circuit temperature	state	
		Power frequency test voltage	state	
4.3	Embossing on cable	11000 VOLTS XLPE S/C AWA POWER CABLE PROPERTY OF KPLC	Specify if it will all appear	
		Name of manufacturer		
		Year of manufacture		
		Number of cores, type and nominal area of conductors		
		Size of characters	state	
		Gap between inscriptions	state	
		Gap between a complete set of marking	state	
		Marking every 1 meter	state	
Table 1: Compatibility test			State and attach test report to prove compliance.	
Extruded PVC oversheath	Minimum tensile strength, N/mm <sup>2</sup>			
	Minimum elongation at break, %			
	Maximum variation of tensile strength <sup>A)</sup> , %			
	Maximum variation of elongation at break <sup>A)</sup> , %			
Extruded inner covering	Minimum tensile strength, N/mm <sup>2</sup>			
	Minimum elongation at break, %			
Extruded separation sheath - Bedding	Minimum tensile strength, N/mm <sup>2</sup>			
	Minimum elongation at break, %			
Insulation screen	Maximum resistivity at 90°C, Ωm			
	Forces to remove cold strippable insulation screen, N			
Insulation	Maximum variation of tensile strength <sup>A)</sup> , %			

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Clause number	KPLC requirement	Bidder's offer	
	Maximum variation of elongation at break <sup>A)</sup> , %		
	Conductor screen Maximum resistivity at 90°C, Ωm		
	Semiconducting lapped inner covering Maximum resistivity at (23±5°C), Ωm		
4.4	Cable weight per km	state	
Electrical data	Voltage Designation U <sub>0</sub> /U (U <sub>m</sub> ), kV	state	
	D.C resistance at 20°C, max, μΩ/m	state	
	A.C resistance at 20°C, max, μΩ/m	state	
	Short circuit rating of the conductor for 1s, kA	state	
	Capacitance, pF/m	state	
	Charging current, mA/m	state	
	Short circuit current of copper tape screen fo 1s, kA	state	
	Short circuit current of copper wire screen for 1s, kA	state	
	Test Voltage (after installation) D.C, kV/5 min	state	
	Partial discharge test	Voltage of test	state
		Magnitude of discharge	state
	Four hour test voltage, A.C	state	
	Impulse voltage test	state	
	Tan δ in relation to voltage	Maximum Tan δ at U <sub>0</sub>	state
		Maximum increase in Tan δ (0.5U <sub>0</sub> to 2.0U <sub>0</sub> )	state
	Tan δ in relation to temperature	Maximum Tan δ at ambient temperature	state
		Maximum Tan δ elevated temperatures (95°C to 100°C)	state
	Reactance	Trefoil cable arrangement, μΩ/m	state
		Flat spaced cable arrangement, μΩ/m	state
	Inductance	Trefoil cable arrangement, nH/m	state
		Flat spaced cable arrangement, nH/m	state
	Impedance	Trefoil cable arrangement, μΩ/m	state
Flat spaced cable arrangement, μΩ/m		state	
Current rating conditions	Ground Temperature :20°C	state	
	Ambient Temperature (air) :30°C	state	
	Depth of soil: 0.8m	state	
	Thermal resistance of soil: 1.5Km/W	state	
Current carrying capacity	In ground	state	
	In air	state	
4.5	Cable construction	Provide drawing	
4.6	Quality Assurance Plan	provide	
	Copy of ISO 9001:2008 Certificate	provide	
	Manufacturer's experience	provide	
	Manufacturing Capacity (units per month)	provide	
	List of previous customers	provide	
	Customer reference letters	provide	

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Clause number	KPLC requirement	Bidder's offer
5.1	Test standards and responsibility of carrying out tests	provide
5.2	Copies of Type Test Reports submitted with tender	provide
5.3	Test reports to be submitted by supplier to KPLC for approval before shipment	provide
5.4	Acceptance tests to be witnessed by KPLC at factory before shipment	provide
5.5	Routine and sample tests to be done	provide
5.6	Replacement of rejected cables	provide
6.1	Markings	provide
6.2	Packing	provide
7.1	Documents submitted with tender	provide
7.2	Documents to be submitted by supplier to KPLC for approval before manufacture	provide
8.0	Statement of compliance to specification	provide

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

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

**Manufacturer's Declaration:** I .....on behalf of .....  
 declare that the above specifications matrix conforms to a typical tender item type  
 ..... as clearly marked in the attached technical brochures & drawings, and being  
 offered for this tender.

**Signature** ..... **Date** ..... **Stamp** .....

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