



The Kenya Power & Lighting
Co. Ltd.

TITLE:

SPECIFICATION FOR 33kV
THREE CORE ALUMINIUM
CABLE

Doc. No.	KPLC/1/3CB/TSP/05/023
Issue No.	1
Revision No.	0
Date of Issue	2007-05-09
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Issued by: Research & Development Department

Authorized by: Chief Manager – PR&PM

Signed:

Signed:

Date:

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Date:

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0.1 Circulation List

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

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)

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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 33kV three core aluminium cables. It is intended for use by KPLC in purchasing the cables.

It shall be the responsibility of the manufacturer to ensure adequacy of the design and good engineering practice in the manufacture of the cables for KPLC. The manufacturer shall submit information which confirms satisfactory service experience with products which fall within the scope of this specification.

1. SCOPE

1.1 This specification is for three core, stranded aluminium conductors XLPE insulated, galvanized steel wire armoured, PVC outer sheathed power cables for operation at a.c. voltages of 19000 Volts to sheath, 33000 Volts between conductors and highest system voltage of 36000 Volts for use in KPLC distribution network.

1.2 This specification covers the following cable sizes:

3 x 95 mm² AL/XLPE/SWA/PVC
3 x 185 mm² AL/XLPE/SWA/PVC
3 x 300 mm² AL/XLPE/SWA/PVC

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).

IEC 60228: Conductors of insulated cables.

BS 6622: Specification for cables with extruded cross-linked polyethylene or ethylene propylene rubber insulation for rated voltages from 3.8/6.6kV to 19/33kV.

3. TERMS AND DEFINITIONS

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

- AL: Aluminium
- PVC: Polyvinyl chloride
- SWA: Steel Wire armour
- XLPE: Cross-linked polyethylene

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°C to +40°C, humidity of up to 90% and saline conditions along the coast).
- b) The cable shall be suitable for laying in cable ducts and in the ground in switching stations.
- c) The cable shall also be suitable for laying on slopes.
- d) Permissible continuous loading operating temperature shall be 90°C.
- e) Permissible emergency loading temperature shall be 130°C for at least 8 hours.
- f) Permissible short circuit temperature shall be 250°C (for short-circuit duration up to 5 sec.).

4.1.2 The cables shall be connected to an overhead system operating at a nominal voltage of 33kV, 50Hz and maximum voltage of 36kV and solidly earthed at the transformer neutrals. The system falls under category A as defined by IEC 60502-2.

4.1.3 The system design fault level is 25kA, 3 seconds.

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.

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4.2.2. Conductor

The cable shall be made from stranded circular plain aluminium conductors that conform to IEC 60228.

4.2.3. Conductor Screen

4.2.3.1 A conductor screen consisting of an extruded layer of cross-linkable semi-conducting compound shall be applied over the conductor and cover the surface of the conductor completely.

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

4.2.4. Insulation

4.2.4.1 The insulation shall be cross-linked polyethylene (XLPE) conforming to the requirements of IEC 60502-2.

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.

4.2.4.4 Individual cores shall be identified by coloured tape over the insulation and the colours shall be Red, Yellow and Blue.

4.2.5. Insulation Screen

4.2.5.1 There shall be an insulation screen consisting of a cross-linked extruded semi-conducting layer in combination with a metallic layer.

4.2.5.2 The extruded semi-conducting layer shall consist of a strippable semi-conducting compound capable of removal for jointing and terminating. It shall be applied in the same operation as the insulation, directly over the insulation and shall cover the surface of the core completely.

4.2.6. Metallic Layer

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A metallic layer shall be applied around each core and shall consist of helically applied overlapped copper tape.

4.2.7. Laying up

4.2.7.1 The cores shall be laid-up with a right hand direction of lay. Fillers of non-hygroscopic material shall be used to form a substantially compact and circular cable.

4.2.7.2 The metallic screens of the three cores shall be in contact with each other.

4.2.8. Water Barriers

Water barriers shall be provided to prevent water penetration between and along the various layers in the cable.

4.2.9. Armour

4.2.9.1 An extruded separation layer of black polyvinyl chloride (PVC) shall be applied between the laid-up cores and the armour.

4.2.9.2 The armour shall consist of a single layer of round galvanized steel wires applied helically with a left-hand lay.

4.2.10. Over sheath

4.2.10.1 There shall be an extruded over sheath of suitable material for intended service conditions in 4.1.1.

4.2.10.2 The cable shall be clearly and permanently embossed with the following information throughout the length of the over sheath.

- i) 33000 VOLTS XLPE CABLE PROPERTY OF KPLC;
- ii) Name of manufacturer;
- iii) Year of manufacture;
- iv) The number of cores, type and nominal area of conductors.

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.

4.3. STANDARD SIZES AND CHARACTERISTICS

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The standard sizes and characteristics for the cables shall be as follows:

Conductor nominal sectional area	mm ²	95	185	300
Voltage Designation U ₀ /U (U _m)		19/33 (36) kV		
Conductor shape		Stranded circular		
Thickness of insulation	mm	8.0	8.0	8.0
Thickness of separation layer	mm	1.9	2.1	2.3
Armour wire diameter	mm	3.15	3.15	3.15
Thickness of over sheath, minimum	mm	3.6	3.9	4.3
Maximum conductor resistance	Ω/km	0.320	0.164	0.100

Note: The Current Carrying Capacity of the cable in all conditions shall be stated.

5. TESTS AND INSPECTION

- 5.1 The cable shall be inspected and tested in accordance with the requirements of this specification, IEC 60228 and IEC 60502-2. It shall be the responsibility of the manufacturer to perform or to have performed the tests specified and whatever other tests he normally performs at works.
- 5.2 Certified true copies of previous type test reports by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited laboratory) shall be submitted with the offer for 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.

6. MARKING, LABELLING AND PACKING

- 6.1 The finished cable shall be wound on wooden drums in lengths of 200m and 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 cable shall not be less than the length indicated on the drum.
- 6.3 Both ends of every drum length of cable shall have been sealed to prevent the ingress of water during transportation, storage, handling and installation. Both ends shall be secured to the drum to prevent mechanical damage.

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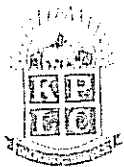
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6.4 The following information shall be marked legibly and in a permanent manner on the flange of the drum:

- a) The manufacturer's name;
- b) The type and rating of cable;
- c) The conductor cross-sectional areas 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 installation (in English Language);
- h) The words "PROPERTY OF KENYA POWER & LIGHTING CO."

Note: The cable shall have been marked in accordance with clause 4.2.10.2

ANNEX A: Statement of Compliance and 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)

Clause Number	Bidder's offer	Reference page on Manufacturer's catalogue, drawing, technical data or test report to support the offer.

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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