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0.1 Circulation List

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1	Research & Development Manager
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0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 3 Rev 0	2013-03-25	Cancels and replaces Issue 2 Rev 0 dated 2012-11-20	S. Kimitei	G. Owuor

FOREWORD

This specification has been prepared by the Research and Development Department of The Kenya Power and Lighting Company Limited (abbreviated as KPLC) and it lays down requirements for All Aluminium Conductors (AAC), Hard Drawn, Bare and PVC covered. It is intended for use by KPLC in procurement of the conductors.

1. SCOPE

1.1. This specification is for All Aluminium Conductors (Hard Drawn) for low voltage overhead power distribution lines.

1.2. The specification covers the following conductor sizes:

50mm² All Aluminium Conductor, Bare (Conductor 50mm² AAC HD Bare)

50mm² All Aluminium Conductor, PVC covered (Conductor 50mm² AAC HD PVC)

100mm² All Aluminium Conductor, Bare (Conductor 100mm² AAC HD Bare)

100mm² All Aluminium Conductor, PVC covered (Conductor 100mm² AAC HD PVC)

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 All Aluminium Conductors (AAC) Hard Drawn acceptable for use in the company and it shall be the responsibility of the Manufacturer to ensure adequacy of the design, good workmanship, good engineering practice and adherence to applicable standards 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 and shall be complied with by the manufacturer/ supplier.

BS 215: Aluminium Conductors and Aluminium Conductors Steel - Reinforced for Overhead Power Transmission. Part1: Aluminium Stranded Conductors

BS 2627: Wrought Aluminium for Electrical Purposes. Wire

BS 6485: PVC Covered Conductors for Overhead Power Lines.

IEC 60207: Aluminium Stranded Conductors

3. TERMS AND DEFINITIONS

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

4. REQUIREMENTS

4.1. SERVICE CONDITIONS

The conductors shall be suitable for continuous outdoor operation in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C heavy saline conditions along the coast and isokeraunic levels of up to 180 thunderstorm days per year.

4.2. MATERIALS

4.2.1. Aluminium wires used in the construction of the conductor shall be material G1E in the H9 condition as specified in BS 2627.

4.2.2. The PVC covering shall conform to the Type TI 1 compound specified in BS 6485.

4.3. CONSTRUCTION

4.3.1 Bare Conductor

4.3.1.1 The conductor shall be manufactured to BS 215 Part 1 and the requirements of this specification.

4.3.1.2 The conductor shall be concentrically stranded, with successive layers in opposite lay, but such that the outermost layer shall be in the right hand spiral (Z).

4.3.1.3 The wires in each layer shall be evenly and closely stranded. The complete conductor and its layers shall be firm and solid. The lay ratio shall not exceed 13.

4.3.1.4 In conductors having multiple layers of wires, the lay ratio of any layer shall be not greater than the lay ratio of the layer immediately beneath it.

4.3.1.5 The completed conductor shall be free from dirt, grit, excessive amounts of drawing oil and other foreign deposits. No grease shall be applied to the conductor.

4.3.2 PVC Covered Conductor

4.3.2.1 PVC covered conductors shall be manufactured in accordance with BS 6485.

4.3.2.2 The material, construction and physical properties of the conductor shall, after covering, conform to BS 215 Part 1 and clause 4.3.1 of this specification.

4.3.2.3 The PVC covering shall conform to the Type TI 1 compound as per BS 6485.

4.3.2.4 The colour of the covering shall be BLACK.

4.3.2.5 When tested in accordance with BS 6485, the thickness of the PVC covering at any point shall be not less than 0.8mm.

4.4. CONDUCTOR SIZES AND CHARACTERISTICS

4.4.1 The sizes for the aluminium wires used in the construction of the conductors and the conductors sizes shall be as follows:-

CONDUCTOR	Bare (ANT)	PVC Covered	Bare (WASP)	PVC Covered
Nominal Area of Aluminium (mm^2)	50	50	100	100
Approximate overall diameter of bare conductor (mm)	9.30	9.30	13.17	13.17
Overall diameter of covered conductors (mm)	-	11.7	-	16.0

Stranding No/mm Al.	7/3.10	7/3.10	7/4.39	7/4.39
Calculated maximum d.c. resistance at 20°C (ohm/km)	0.5419	0.5419	0.2702	0.2702
Calculated minimum breaking load (kN)	8.28	8.28	16.00	16.00
Approximate mass of conductor (kg/km)	145	200	290	360

***Note**: The current carrying capacities of each conductor shall be stated by the manufacturer in Annex A attached. The applicable installation conditions shall also be specified.*

4.4.2 Variation in diameter shall not exceed ±1% for aluminium wires.

4.5. QUALITY MANAGEMENT SYSTEM

4.5.1 The bidder shall submit a quality assurance plan (QAP) that will be used to ensure that the conductor design, material, workmanship, tests, service capability, maintenance and documentation, will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2008.

4.5.2 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.

4.5.3 The bidder shall indicate the delivery time of the conductors, 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 conductors 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 conductors shall be inspected, sampled and tested in accordance with the requirement of BS 215-1 (Bare Conductors), BS 6485 (PVC Covered Conductors) and 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 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. The following tests shall be done at the manufacturer's works in the presence of KPLC Engineers and in accordance with BS 215-1, BS 6485 and this specification.

5.3.1 **All Aluminium Conductor, Bare:**

ALUMINIUM WIRES	COMPLETE CONDUCTOR
1. Tensile test	1. Lay ratio of each layer
2. Wrapping test	2. Tensile strength
3. Resistivity test	3. Measurement of weight
	4. Resistance test

5.3.2 **All Aluminium Conductor, PVC Covered:**

a) The aluminium wires shall be tested in accordance with BS 215-1 and clause 5.3.1 above.

b) The following tests shall be carried out on the PVC covered conductor in accordance with BS 6485:

1. Spark Test
2. Conductor Resistance
3. Thickness of PVC Covering
4. Conductor Examination and Test
5. PVC material

5.3.3 **Construction/workmanship:**

The Manufacturer shall demonstrate during factory inspection/tests that the complete conductor is of good workmanship and that it shall not unwind during stringing.

5.4. Test reports shall be completed for the above tests and submitted to KPLC for approval before shipment/delivery of the conductor.

5.5. On receipt of the conductors KPLC may perform or have performed any of the tests specified in order to verify compliance with specification.

The supplier shall replace without charge to KPLC, conductors which upon examination, test or use, fail to meet any of the requirements in the specification.

6. MARKING, LABELLING AND PACKING

6.1 There shall be no laser marking on the centre strand.

6.2 Conductor Drums

6.2.1 The complete conductor shall be wound on wooden drum such as to prevent damage during transportation. The dimensions of the wooden drum shall be subject to approval by The Kenya Power & Lighting Company before manufacture.

6.2.2 The wooden drums shall be made from treated timber resistant to termite attack.

6.2.3 The conductor drums shall be firm, with wooden lagging all round and any collapsed drums shall be rejected during delivery. There shall be no gaps in the wooden lagging.

6.2.4 Each conductor drum shall contain only one continuous length of conductor.

6.2.5 Each conductor drum of 50 mm^2 AAC conductor (Bare & PVC) shall contain only one continuous length of 5000m while the drum for 100 mm^2 AAC (Bare & PVC) shall contain only one continuous length 3000m.

6.2.6 The actual length of conductor on a drum shall not be less than the length indicated on the drum.

6.2.7 Each conductor drum shall have steel plate reinforcement at the spindle hole secured by four bolts. The spindle plate shall be at least 1.6mm thick and shall be painted in black colour at the factory after fabrication.

6.2.8 Both ends of every drum length of conductor shall have been sealed to prevent the ingress of water during transportation, storage and handling. Both ends shall be secured to the drum to prevent mechanical damage.

6.2.9 The following information shall be marked (in a permanent manner) on flange of the drum:
(a) Direction of rotation of the drum
(b) Type of conductor and size (cross-sectional areas in mm^2)
(c) The continuous length of the conductor, in metres

(d) Gross weight and net weight (kg)
(e) Manufacturer's name
(f) Year of manufacture
(g) KPLC Order Number
(h) The instructions for handling and use (in English Language)
(i) The words "**PROPERTY OF THE KENYA POWER & LIGHTING CO.**"

7. DOCUMENTATION

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

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 of the conductor to be manufactured,
b) Design drawings and construction details of the conductor and drum dimensions,
c) Quality assurance plan (QAP) that will be used to ensure that the conductor design, material, workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2008
d) Test Program to be used after manufacture,
e) Marking details and method to be used in marking the conductors,
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 conductors for KPLC,
g) Packaging details (including packaging materials, lagging and length on drum).

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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, customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of type test certificates, 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 of the Manufacturer		
	Manufacturer's Address & Country of Manufacture		
1	Type and Size		
2	Service Conditions		
3	Materials	Aluminium	
		PVC covering	
4	Construction & Standard	Bare conductor	
		PVC covered conductor	
5	Nominal area of aluminium, mm^2		
6	Overall diameter of bare conductor, mm		
7	Overall diameter of covered conductor, mm		
8	Stranding, No./diameter in mm	Aluminium	
		Tolerance on diameter	
9	Calculated maximum d.c. resistance at 20°C, ohm/km		
10	Calculated minimum breaking load, kN		
11	Mass of conductor, kg/km		
12	Current carrying capacity, A (state applicable conditions)		
13	Packing, Marking & Length on drum	Packing & wood lagging	
		Marking on conductor & drum	
		Continuous length of conductor on drum	
14	List test reports submitted (indicate test report numbers, date, Testing Institution and their contact addresses)		
15	Manufacturer's ISO 9001:2008 Certificate, Guarantee and Warranty		
16	List catalogues, brochures, technical data, drawings, customer sales records, customer reference letters, manufacturer's experience and capacity submitted to support the offer		
17	Acceptance Tests to be witnessed by KPLC Engineers at the factory		
18	Statement of compliance to specification or deviations		

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Manufacturer's Name, Signature, Stamp and Date