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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)

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 3 Rev 1	2014-09-23	Included size 6mm^2 Single Core Concentric Copper for single phase customers in SWER system		

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 Copper 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 copper conductors for operation up to and including 1000 Volts between phases and 600 Volts to earth. The cable shall have a central phase stranded copper conductor insulated with red PVC and concentric layer comprising bare copper 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 Copper 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.

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, in air or underground.
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 copper 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

4.2.3.1 The neutral conductor shall be concentric and shall be manufactured from plain annealed copper 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 the following table.

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

Phase Conductor			*Concentric neutral conductor: number. & approx. diameter of wires No./mm*	Minim-um lay lengths *mm*	*Thickness of oversheath mm*	*Approxi-mate overall diameter mm*	*Maximum conductor dc resistance per 1000m of cable at 20°C*	
Nomin al area mm²	*No. & approx dia. of wires mm*	*Thickness of insulation mm*					*Phase ohms*	*Neutral ohms*
6	7/1.04	1.55	26/0.85	127	1.4	10.72	3.08	1.24
10	7/1.35	1.55	20/0.85	140	1.4	11.73	1.83	1.151
16	7/1.70	1.55	32/0.85	152	1.4	12.78	1.15	1.007
25	7/2.14	1.60	29/1.13	165	1.5	14.88	0.727	0.629

4.4. EMBOSSING ON CABLE

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

a) 600/1000 VOLTS PVC CU CABLE PROPERTY OF KPLC

b) Year of Manufacture
c) Size of Cable
d) Name of Manufacturer

(Example: '16 SQ MM 600/1000 VOLTS PVC CU 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 300mm.

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 (including verification of length on drum) 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 (including verification of length on drum). 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.

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 one flange of the drum:

a) The manufacturer's name;
b) The type and rating of cable;
c) The conductor cross-sectional area in mm^2;
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.

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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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 Uo/U(Um)		
	Conductor shape		
	Thickness of insulation		

	Description		Bidder's offer
	Thickness of oversheath		
	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

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ANNEX A: SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR OFFERED CONDUCTORS

(to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data & calculations, 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)

0.1 Circulation List

COPY NO.	COPY HOLDER
1	Head of Department, Standards
2	Head of Department, 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 0	2014-09-05	New Issue	Michael Apudo	Eng. S Kimitei

FOREWORD

This specification has been prepared by the Standards Department in collaboration with Design Optimization Committee all of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for ACSR conductors for single wire earth return system (SWER). It is intended for use by KPLC in purchasing the ACSR conductors.

The supplier 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 Aluminium Conductors Steel Reinforced for high voltage SWER overhead power distribution lines operated at 19.1kV 50Hz.

1.2. This specification covers the following conductor sizes:

a) 25 Sq. mm Aluminium Conductor, Steel Reinforced, Bare

b) 25 Sq. mm Aluminium Conductor, Steel Reinforced, PVC Covered.

c) 50 Sq. mm Aluminium Conductor, Steel Reinforced, Bare

d) 50 Sq. mm Aluminium Conductor, Steel Reinforced, PVC Covered.

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

1.4. The specification stipulates the minimum requirements for ACSR conductors acceptable for use in the company 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 ACSR conductors 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 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.

IEC 61089:	Round wire concentric lay overhead electrical stranded conductors.
IEC 61394:	Overhead lines – Characteristics of greases for aluminium, aluminium alloy and steel bare conductors.
BS 215:	Aluminium Conductors and Aluminium Conductors Steel - Reinforced for Overhead Power Transmission. Part 2: Aluminium conductors, steel – reinforced.
BS 2627:	Specification for wrought aluminium for electrical purposes. Wire
BS EN 50189:	Conductors for overhead lines. Zinc coated steel wires
BS 6485:	PVC Covered Conductors for Overhead Power Lines.
BS 7655-3.1:	Specification for insulating and sheathing materials for cables. PVC insulating compounds. Harmonized types

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 ACSR conductors shall be suitable for continuous outdoor operation in tropical areas at:

a) Altitudes of up to 2200m above sea level,
b) Humidity of up to 90%,
c) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C
d) Heavy saline conditions along the coast and
e) Isokeraunic levels of up to 180 thunderstorm days per year.

4.2. MATERIALS

4.2.1. Aluminium

4.2.1.1. The Aluminium wire used in the manufacture of ACSR conductor shall conform to BS 2627. Joints in the aluminium wire shall not be permitted in the final drawing.

4.2.1.2. Aluminium wires shall be uniform in quality, circular in cross section, clean, smooth and free from harmful defects, splinter irregularities and brittle places.

4.2.1.3. Aluminium wires used in the construction of the conductor shall be material G1E in the H9 condition as specified in BS 2627 and characteristics as per Table 1.

Table 1: Characteristics of aluminium wires used for construction of standard aluminium conductors, steel reinforced as per BS 2627 & BS 215-2

Particulars	Units	Aluminium	
Standard diameter	mm	2.36	3.35
Cross sectional area	mm^2	4.374	8.814
Mass	Kg/km	11.82	23.82
Standard resistance at 20^0C	Ω/km	6.461	3.207

Particulars	Units	Aluminium	
Resistivity at 20^0C, max	μΩcm	2.8264	
Minimum breaking load	N	770	1450
Density	g/cm^3	2.703	
Coefficient of linear expansion	/^{0}C	23 x 10^{-6}	
Constant mass temperature coefficient	/^{0}C	0.00403	

4.2.2. **Reinforcement Steel wire**

4.2.2.1. The galvanized steel wire used for the reinforcement of the ACSR conductor shall conform to BS EN 50189 and the tensile strength grade of the steel wire shall be 1670N/mm^2, minimum, as per Table 6 – mechanical properties of ST4A wires of BS EN 50189.

4.2.2.2. The tensile strength and stress at 1% elongation shall be 1275N/mm^2, minimum, calculated on the nominal dimensions of the finished wire, as per Table 6 of BS EN 50189.

4.2.2.3. The minimum elongation shall be 4% as per Table 6 of BS EN 50189, measured after fracture on an original gauge length of 250mm and the coefficient of linear expansion is 11.5 x 10^{-6}/^{0}C.

4.2.2.4. The steel wire shall not fracture when wrapped at a rate not exceeding 15 turns per minute around a cylindrical mandrel of diameter given in the appropriate column of Table 6 of BS EN 50189 to form a close helix of eight turns.

4.2.2.5. The numbers of twists on a length of 100 times the wire diameter that causes fracture shall confirm to Table 6 of BS EN 50189. Steel wires shall be uniform in quality, circular in cross section, clean, smooth and free from harmful defects, splinter irregularities and brittle places.

4.2.2.6. The weight and uniformity of coating and zinc adhesion shall be in accordance with Table 2 of BS EN 50189.

4.2.2.7. The tolerance on nominal diameter of the galvanized steel wire shall confirm to Table 6 of BS EN 50189.

4.2.3. **Grease**

4.2.3.1. Neutral grease shall be applied between and over the layers of steel wires only. This shall be as shown in Figure C.2 of IEC 61089.

4.2.3.2. The grease used for corrosion protection in the manufacture of ACSR shall have the following requirements satisfying IEC 61394.

a) Shall not flow or deteriorate at temperatures up to 75^0C,
b) Shall not be inimical to aluminium or galvanized steel and it shall also have good adhesive and cohesive properties and
c) Shall retain these qualities after weathering.
d) Shall not extrude a surplus to the outside of the conductor after erection.
e) Shall not present any risks to health and shall comply with all the usual health and safety standards.

NOTE: *The type of grease used in the manufacture of ACSR and technical specifications shall be furnished with the offer.*

4.3. CONSTRUCTION

4.3.1. **Bare Conductor**

4.3.1.1. The conductor shall be manufactured as per BS 215 Part 2 with stranding conforming to IEC 61089 standards.

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. Steel wires shall be formed during manufacture and during stranding so that they remain inert when the conductor is cut.

4.3.1.5. All steel wires shall lie naturally in their position in the stranded core, and where the core is cut, the wire ends shall remain in position or be readily replaced by hand and then remain approximately in position. This requirement also applies to the outer layer of aluminium wires of a conductor.

4.3.1.6. Before stranding, aluminium and steel wires shall have approximately uniform temperatures.

4.3.1.7. There shall be no joints of any kind made in the steel core wire during stranding.

4.3.1.8. It shall be demonstrated during factory inspection/tests that good workmanship has been exercised in the manufacture of the complete conductor and that caging problems shall not arise during stringing.

4.3.1.9. The completed conductor shall be free from dirt, grit, excessive amounts of drawing oil and other foreign deposits. No grease shall be accepted on the outer layer.

4.3.2. PVC Covered Conductor

4.3.2.1. PVC covered conductors shall be manufactured in accordance with BS 6485 with covering designation Type 16 of minimum thickness of 1.6mm.

4.3.2.2. The material, construction and physical properties of the conductor shall, after covering, conform to BS 215 Part 2 and clause 4.3.1 of this specification.

4.3.2.3. The PVC covering shall also conform to the Type TI 1 compound requirements of BS 7655- 3.1. The colour of the covering shall be BLACK; all other properties shall be as per BS 6485 and BS 7655-3.1.

4.3.2.4. When tested in accordance with BS 6485, the thickness of the PVC covering at any point shall be not less than 1.6mm. The covered conductor shall conform to the test values in Table 1 of this specification.

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Table 1: Test values for PVC covered conductor

Particulars		Units	Value
Spark test voltages,	a.c $_{r.m.s}$	kV	12
	d.c	kV	18
Insulation resistance, min		MΩ/km	0.5
High voltage test for 5 minutes, min		kV	25kV

4.4. CONDUCTOR SIZES AND CHARACTERISTICS

4.4.1. The sizes and characteristics for the aluminium and steel wires used in the construction of the conductors and the conductors sizes shall be as per Table 2:

Table 2: Sizes and characteristics for the Aluminium Steel Reinforced Conductors

Conductor characteriestics		Units	Bare (Gopher)	PVC Covered	Bare (Rabbit)	PVC Covered
Nominal Area of Aluminium		mm^2	**25**	**25**	**50**	**50**
Stranding No/mm	Aluminium	No/mm	6/2.36	6/2.36	6/3.35	6/3.35
	Steel	No/mm	1/2.36	1/2.36	1/3.35	1/3.35
Approximate overall diameter of bare conductors		mm	7.08	7.08	10.05	10.05
Approximate overall diameter of covered conductors		mm	-	10.7	-	14.1
Cross sectional area of conductors	Aluminium	mm^2	26.25	26.25	52.88	52.88
	Total	mm^2	30.62	30.62	61.70	61.70
Calculated maximum d.c resistance per kilometre at 20°C		Ω/km	1.093	1.093	0.5426	0.5426
Calculated minimum breaking load		kN	9.61	9.61	18.35	18.35
Approximate mass of conductor per kilometre–excluding mass of grease		Kg/km	106	190	214	330

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 and ±2% of steel wires.

4.5. Workmanship

4.5.1. The conductors shall be cleaned and free of imperfections, such as pipes, laps, cracks, kinks, bends, twists, seems excessive grease and other injurious defects.

4.5.2. Higher quality of work shall be maintained in drawing the wire and fabrication of the conductors.

4.5.3. Due precaution shall be taken to prevent the aluminium wires making contact with copper conductors, copper parts or copper residues during the process of drawing, stranding as well as storage.

4.5.4. All machines and equipment used for this purpose of drawing shall be properly cleaned, free from any copper residues.

4.6. QUALITY MANAGEMENT SYSTEM

4.6.1. The supplier 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 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.

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 conductors, manufacturer's monthly and annual production capacity and experience in the production of the type and size of conductors being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers outside the country of manufacture for the conductors sold in the last five years together with reference letters from four of the customers shall be submitted with the tender for evaluation.

5. TESTS AND INSPECTION

5.1. Type tests, sampling tests and routine tests shall be done in accordance with the requirements of IEC 61089, IEC 61394, BS 215, BS 2627, BS EN 50189 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 Type Test Certificates & Type Test 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. A copy of the accreditation certificate to ISO/IEC 17025 for the testing laboratory shall also be submitted (all in English language).

5.3. Copies of type test reports to be submitted with the tender (by bidder) for evaluation shall be as stated:

a) Aluminium Conductor, Steel-Reinforced, Bare - BS 215-2 & BS EN 50189:

Aluminium Wires	Steel Wires	Complete Conductor
1. Tensile test	1. Determination of stress at 1% elongation	1. Lay ratio of each layer
2. Wrapping test	2. Tensile test	2. Tensile strength
3. Resistivity test	3. Wrapping test	3. Measurement of weight
	4. Galvanizing test	4. Resistance test
		4. Tests on grease

b) PVC Covered Conductor - BS 6485

(i) Spark Test
(ii) High Voltage Test
(iii) Conductor Resistance
(iv) Insulation Resistance Test
(v) Thickness of PVC Covering
(vi) Conductor Examination and Test

NOTE: *Any translations of certificates and test reports into English language shall be signed and stamped by the third party ISO/IEC 17025 accredited Testing Laboratory that carried out the tests.*

5.4. The conductors shall be subject to acceptance tests at the manufacturer's works before dispatch. Acceptance tests (routine & sample tests) will be witnessed by two Engineers appointed by The Kenya Power and Lighting Company Limited (KPLC). Routine and sample test reports for the conductors to be supplied shall be submitted to KPLC for approval before shipment of the goods.

5.5. Tests to be witnessed by KPLC Engineers at the factory before shipment shall be the same as those in clause 5.3, in accordance with IEC 61089, IEC 61394, BS 215, BS 2627, BS EN 50189 and this specification.

5.6. On receipt 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. 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 AND PACKING

6.1. The complete conductor shall be packed on wooden drums such as to prevent damage during transportation and handling. The wooden drums shall be made from treated timber resistant to termite attack. The drums shall be firm, with wooden lagging all round without gaps and any collapsed conductor drums shall be rejected during delivery.

6.2. The actual length of conductor on a drum shall be one continuous length and shall not be less than the length indicated on the drum.

6.3. Each conductor drum of ACSR conductor (Bare & PVC) shall contain only one continuous length of 5000m.

6.4. Both ends of every drum length of conductor 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.

6.5. The following information shall be marked (in a permanent manner) on one flange of the drum in English Language:

a) Direction of rotation of the reel
b) Type of conductor and size (cross-sectional areas in mm^2)

c) The length of the conductor, in metres (only one continuous length is permitted)
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 KENYA POWER & LIGHTING CO.**"

6.6. When required in the tender, the letters "KPLC" shall be marked at intervals of 500mm on the centre strand by laser marking during manufacture of the conductor. The laser marking shall not change the required mechanical and electrical properties of the conductor.

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

TENDER NO.....

	Description					Bidders offer
0	Name of Manufacturer & Country of manufacture of the insulators being offered					
1	Type/Model Reference Number					
1.1	Scope: 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 insulators for KPLC					
1.2	Type and Size					
	25 Sq. mm Aluminium Conductor, Steel Reinforced, Bare					
	25 Sq. mm Aluminium Conductor, Steel Reinforced, PVC Covered.					
	50 Sq. mm Aluminium Conductor, Steel Reinforced, Bare					
	50 Sq. mm Aluminium Conductor, Steel Reinforced, PVC Covered.					
2	Service Conditions					
3	Materials		Designation G1E in the H9 condition of BS 2627			
			Standard diameter , mm	2.36	3.55	
			Cross sectional area, mm^2	4.374	8.814	
			Mass per km , kg	11.82	23.82	
			Standard resistance at 20^0C, Ω	6.461	3.207	
		Aluminium	Resistivity at 20^0C, max, μΩcm	2.8264		
			Minimum breaking load, N	770	1450	
			Density, g/cm^3	2.703		
			Coefficient of linear expansion, $/^0C$	23×10^{-6}		
			Constant mass temperature coefficient, $/^0C$	0.00403		
		Steel	Designation as per BS EN 50189	ST4A		
			Tensile strength, min. N/mm^2	1670		

			Yield stress at 1% elongation, min, N/mm^2	1275	
			Linear expansion, /^{0}C	11.5 x 10^{-6}	
			% elongation , wire gauge length of 250mm , %	4	
		PVC Covering	Designation as per BS 6485	Type TI 1	
			Colour	Black	
			Thickness, mm	1.6	
			Spark test voltages, a.c $_{r.m.s,}$ kV	12	
			Spark test voltages, d.c, kV	18	
			Insulation resistance, min, MΩ/km	0.5	
			HV test for 5 minutes, min, kV	25kV	
		Grease	Conform to IEC 61394	Y/N	
			Conform to clauses 4.2.3.2	Y/N- specifiy	
4	Construction & Standard		Bare conductor – clauses 4.3.1.1 – 4.3.1.9		
			PVC covered conductor – clauses 4.3.2.1 -4.3.2.4		

4.4	Conductor sizes and characteristics				
A	Bare (Gopher)				
	Nominal Area of Aluminium		mm^2	**25**	
	Stranding No/mm	Aluminium	No/mm	6/2.36	
		Steel	No/mm	1/2.36	
	Approximate overall diameter of bare conductors		mm	7.08	
	Approximate overall diameter of covered conductors		mm	-	
	Cross sectional area of conductors	Aluminium	mm^2	26.25	
		Total	mm^2	30.62	
	Calculated maximum d.c resistance per kilometre at 20°C		Ω	1.093	
	Calculated minimum breaking load		kN	9.61	
	Approximate mass of conductor per kilometre– excluding mass of grease		kg	106	
B	PVC Covered				
	Nominal Area of Aluminium		mm^2	**25**	
	Stranding No/mm	Aluminium	No/m	6/2.36	
		Steel	m		
			No/mm	1/2.36	
	Approximate overall diameter of bare conductors		mm	7.08	

	Approximate overall diameter of covered conductors		mm	10.7	
	Cross sectional area of conductors	Aluminium	mm^2	26.25	
		Total	mm^2	30.62	
	Calculated maximum d.c resistance per kilometre at 20°C		Ω	1.093	
	Calculated minimum breaking load		kN	9.61	
	Approximate mass of conductor per kilometre– excluding mass of grease		kg	190	
C	Bare (Rabbit)				
	Nominal Area of Aluminium		mm^2	**50**	
	Stranding No/mm	Aluminium	No/mm	6/3.55	
		Steel	No/mm	1/3.55	
	Approximate overall diameter of bare conductors		mm	10.05	
	Approximate overall diameter of covered conductors		mm	-	
	Cross sectional area of conductors	Aluminium	mm^2	52.88	
		Total	mm^2	61.70	
	Calculated maximum d.c resistance per kilometre at 20°C		Ω	0.5426	
	Calculated minimum breaking load		kN	18.35	
	Approximate mass of conductor per kilometre– excluding mass of grease		kG	214	
D	PVC Covered				
	Nominal Area of Aluminium		mm^2	**50**	
	Stranding No/mm	Aluminium	No/mm	6/3.55	
		Steel	No/mm	1/3.55	
	Approximate overall diameter of bare conductors		mm	10.05	
	Approximate overall diameter of covered conductors		mm	14.1	
	Cross sectional area of conductors	Aluminium	mm^2	52.88	
		Total	mm^2	61.70	
	Calculated maximum d.c resistance per kilometre at 20°C		Ω	0.5426	
	Calculated minimum breaking load		kN	18.35	
	Approximate mass of conductor per kilometre– excluding mass of grease		Kg	330	
4.5	Workmanship – 4.5.1 – 4.5.4				

4.5	Quality Management System	
	Quality Assurance Plan	
	Copy of ISO 9001:2008 Certificate	
	Manufacturer's experience	
	Manufacturing Capacity (units per month)	
	List of previous customers	
	Customer reference letters	
5.1	Test standards and responsibility of carrying out tests	
5.2	Copies of Type Test Reports submitted with tender	
5.3	Acceptance tests to be witnessed by KPLC at factory before shipment	
5.4	Test reports to be submitted by supplier to KPLC for approval before shipment	
5.5	Replacement of rejected insulators	
6.1	Marking	
6.2	Packing	
7.1	Documents submitted with tender	
7.2	Documents to be submitted by supplier to KPLC for approval before manufacture	
8.0	Statement of compliance to specification	

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Manufacturer's Name, Signature, Stamp and Date

NOTE: *The schedule in Annex A does not in any way substitute for detailed information required elsewhere in the specification.*