DOCUMENT NO.: KP1/13D/4/1/TSP/03/019-1

Kenya Power

COMPOSITE POLES - PART 1: WITH AND WITHOUT EARTHING – SPECIFICATION

A Document of the Kenya Power & Lighting Co. Plc
October 2020

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0.1 CIRCULATION LIST

COPY NO.	COPY HOLDER
1	Manager, Standards
2	Electronic copy (pdf) on Kenya Power server (http://172.16.1.40/dms/browse.php?fFolderId=23)

REVISION OF KPLC STANDARDS

To keep abreast of progress in the industry, KPLC Standards shall be regularly reviewed. Suggestions for improvements to approved Standards, addressed to the Manager, Standards Department, are welcome.

0.2 AMENDMENT RECORD

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue Rev	2020-10-05	New issue	S. Nguli	Dr. Eng. Peter Kimemia

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 Composite Poles for use on overhead power lines, including street/public lighting. It is intended for use by the company in purchasing Composite Poles.

The other specification in this series are:

i) *KP1-3CB-TSP-03-005-1: Prestressed Concrete Poles Without Holes & Without Joints*
ii) *KP1-3CB-TSP-03-005-2: Specification for Concrete poles- Part 2- Prestressed Concrete Poles with holes (10m-12m)*
iii) *KP1/3CB/TSP/03/001-1: Specification for treated wood poles. part 1: Eucalyptus Poles*

The specification stipulates the minimum requirements for Composite Poles with earthing and without earthing acceptable for use in the company. It shall be the responsibility of the supplier and/or manufacturer, as appropriate, to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the Composite Poles for KPLC.

Users of Kenya Power specifications are responsible for their correct interpretation and application.

The following are members of the team that developed this specification:

Name	Designation	Department
Eng. Stephen Nguli	Senior Engineer	Standards

1. SCOPE

1.1. This specification is for solid Composite Poles for use on overhead power lines, pole mounted substations, street/public lighting, line switchgear and equipment, etc. there are two categories:

(i) Composite Poles

(ii) Composite Poles with Earth

1.2. The specification covers pole sizes 8m, 9m 10m, 11m, 12m and 14m.

1.3. The specification also covers requirements, sampling, inspection and tests of the Composite Poles as well as schedule of Guaranteed Technical Particulars.

2. NORMATIVE REFERENCES

The following standards contain provision which through reference in this text constitute provisions of this specification. For dated editions the cited edition will apply; for undated editions the latest edition of the referenced documents shall apply.

KS 2513:2014	Kenya Standard –Composite pole for telephone, Power and lighting purposes
KS 1933:2005	Kenya Standard – Concrete poles for telephone, power and lighting purposes - Specification - Civil
AS 4065: 1992	Australian Standard- Composite Poles for overhead lines and street lighting
KS 516:2008:	Kenya Standard –Wood poles for power and Telecommunication lines.
KS 04-503	Kenya standard code of practice for the protection of structures against lightning
IEC 60228:	Conductors of insulated cables
IEC 60502-1:	Power Cables with extruded insulation and their accessories for rated voltages from 1kV (Um=1.2kV) up to 30kV (Um=36kV) - Part 1: Cables for rated voltages 1kV (Um=1.2kV) and 3kV (Um=3.6kV)
ISO 9001:2015:	Quality management systems — Requirements
ISO/IEC 17025:	General requirements for the competence of testing and calibration laboratories

3. DEFINITIONS, SYMBOLS AND ABBREVIATIONS

For the purpose of this specification the definitions and abbreviations given in the reference standards shall apply and the following abbreviations:

4. REQUIREMENTS

4.1. Service Conditions

The Composite Poles shall be suitable for continuous outdoor use in Kenya in tropical areas and harsh climatic conditions including areas exposed to:

a) Altitudes of up to 2200m above sea level;

b) Humidity of up to 95%;

c) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C

d) Pollution: Design pollution level to be taken as "Heavy" (Pollution level III) for inland and "Very Heavy" (Pollution level IV) for coastal applications.

e) Isokeraunic levels of up to 180 thunderstorm days per year.

4.2. Materials and Construction

4.2.1. The Composite Poles shall be designed, manufactured and tested to KS 2513:2014 and the requirements of this specification. The earthing details shall be as per this specification based on AS 4065-1992 and KS 04-503.

4.2.2. The poles shall be round, with uniform diameter, and suitable for direct embedment into the ground without special foundations as per KS 2513:2014

4.2.3. The pole shall be so designed and manufactured that its strength in transverse direction shall be sufficient to take the load due to wind on conductors, fittings and the pole.

4.2.4. Materials for composite pole manufacture shall be selected as to produce high density, low porosity and light weight recyclable poles. They include pole outer material, fibre and polyurethane. The composite material shall be as per Table 1.

Table 1: Composite Pole components & properties

Component	Specification
Fiber	Industrial, Biological and/or organic nature such as fiberglass, carbon-fiber, plant-fiber, organic materials, etc.
Pole outer Material	UV stabilized and recyclable. Resistant to termites' attack, rodents and boring insects Resistant to corrosion, Minimum water porosity
Polyurethane Material(PUR)(if used)	Flexible and recyclable Shall maintain the Flexural Properties the entire working life

4.2.5. The finished pole shall have a smooth and even external surface that is free from kinks and swells.

4.2.6. Composite Poles to be used for street lighting shall have an embedded PPR conduit of diameter 23mm in accordance with drawing no. TSP/03/06-01 for street light underground cable entry and lantern termination in Annex A.

4.2.7. For Composite Poles to be used for earthing, they shall incorporate an integral earthing system in accordance with drawing no. TSP/03/06-02 and TSP/03/06-03 in Annex A.

4.2.8. The earthing ferule for external connection of equipment and line hardware shall be as detailed in TSP/03/06-04 in Annex A.

4.2.9. The earthing conductor shall be soft drawn copper conductors suitable for grounding electrical systems where high conductivity and flexibility are required as detailed in table 2.

Table 2: Earthing Conductor Parameters (IEC 60228)

Cross-sectional area(mm^2)	No x Ø (mm)	Max. DC resistance at 20°C(Ohm/km)	Approx. diameter (conductor)(mm	Nominal PVC covering(mm)	Pole size, m
6	7/1.04	3.08	4.9	1.0	8,9
10	7/1.35	1.83	6.8	1.0	9,10
16	7x1.68	1.15	5.1	1.0	9, 10

Cross-sectional area(mm^2)	No x Ø (mm)	Max. DC resistance at 20°C(Ohm/km)	Approx. diameter (conductor)(mm	Nominal PVC covering(mm)	Pole size, m
50	19x1.80	0.387	9.0	1.4	11, 12, 14
70	19x2.10	0.268	10.5	1.4	Substation
95	19x2.48	0.193	12.4	1.6	Substation

4.2.10. The quantities of the normal composite poles, composite street lighting poles, composite poles with integral earthing required shall be stated in the tender.

4.3. **Design Parameters**

4.3.1. All the composite poles shall be of uniform cross-section from top to bottom

4.3.2. The minimum design requirements shall be as per Table 3 and 4.

Table 3: Pole design parameters based on KS 2513:2014

Pole size(m)	Diameter ϕ(mm	Clamping length (m) from Butt	Approx. weight of pole(kg)	Working Load(kN)	Ultimate Load (kN)
8	160	1.4	75	1.30	1.95
	180	1.4	105	1.97	3.00
9	160	1.5	85	1.16	1.74
	180	1.5	120	1.75	2.67
	200	1.5	130	2.00	3.00
	225	1.5	165	27.8	4.17
10	160	1.6	95	1.40	1.56
	180	1.6	130	1.58	2.40
	200	1.6	140	1.80	2.70
	225	1.6	185	2.50	3.75
11	200	1.7	155	1.64	2.45
	225	1.7	205	2.27	3.40
12	200	1.8	170	1.50	2.25
	225	1.8	220	2.08	3.12
14	300	2.0	600	3.00	6.50

Note: *The size of pole to be procured shall be specified in the tender document. Procurement department is guided to define codes in accordance with the table.*

4.4. **Length and Colour Coding**

4.4.1. The Composite Poles shall conform to the standard sizes and strengths as per Table3.

4.4.2. Each pole shall be colour coded (on top side) to facilitate size identification during handling and storage.

Table 4: Pole construction parameters as per KS 2513:2014

Item	Unit	Requirement
Length tolerance	%	± 1 total pole length
Outside diameter tolerance	mm	±5
Density	kg/m^3	$300 \leq 600$
Straightness	%	< 0.5 total pole length
Safety (Load) factor (S.F)	No.	1.5

4.4.3. The paint used for colour coding shall be indelible and in accordance with the Table 4

Table 5: Color Codes

STANDARD POLE LENGTH (M)	PAINT COLOUR
8	ORANGE
9	BROWN
10	GREEN
11	NAVY BLUE
12	YELLOW
14	RED

4.5. **Environmental Requirements**

The pole shall adhere to the requirements stipulated in Environmental Management and Coordination Act 1999. It shall:

a) not contaminate or be harmful to the soil, ground water, flora and fauna;

b) be made of sustainable and or recyclable materials

5. TEST REQUIREMENTS

5.1. The Composite Poles shall be inspected and tested in accordance with the requirement of KS 2513:2014 and this specification.

5.2. The length of the pole shall be measured to the nearest 5mm and the measured length shall not differ from the specified length by more than 10mm.

5.3. When a pole is tested under the proof load appropriate to the pole length and the strength as per KS 2513:2014 it shall comply with the requirements in Table 3 and table 5

5.4. When a pole is tested under the ultimate load appropriate to the pole length and the strength as per KS 2513:2014, it shall comply with the requirements in Table 3.

Table 6: Proof Load Test for Composite Pole

Pole Length (M)	Clamping Length C=0.1L+0.6	H =L-C	Deflection of pole tip at proof load ≤16%H	Permanent Set ≤5%	Failure Load
8	1.4	6.6	1.10	0.33	No Failure
9	1.5	7.5	1.20	0.38	No Failure
10	1.6	8.4	1.34	0.42	No Failure
11	1.7	9.3	1.50	0.47	No Failure
12	1.8	10.2	1.63	0.51	No Failure
14	2.0	12.0	1.92	0.60	No Failure

6. SAMPLING

6.1. In a consignment, 100 poles or a part thereof of the same overall length, same dimensions and belonging to the same batch of manufacture shall be grouped together to constitute a lot.

6.2. For ascertaining the conformity of the poles in the consignment to the requirements of this specification, samples shall be tested from each lot separately.

6.3. The number of poles to be selected from the lot shall depend on the size of the lot and shall be according to the sampling Table 6 below.

6.4. All the poles selected according to 6.3 shall be tested for defects, physical dimensions and straightness as per KS 2513: 2014. A pole failing to satisfy one or more of these requirements shall be considered as defective. All the poles in the lot shall be considered as conforming to

these requirements if the number of defective poles found in the sample is less than or equal to the corresponding acceptance number given in Column 3 of the sampling table.

6.5. The lot having been found satisfactory according to 6.4 shall be further tested for proof strength and ultimate load of the poles. For this purpose, the number of poles given in column 4 and 5 of the sampling table shall be tested, these poles may be selected from those already tested according to 6.4 and found satisfactory. All these poles tested for proof strength and ultimate load shall satisfy the corresponding specification requirements. If one or more poles fail, twice the number of poles required for proof strength and ultimate load tests shall be selected from the lot again and subjected to this test. If there is no failure among these poles, the lot shall be considered to have satisfied the requirements of this test. If there is failure, then the entire lot shall be rejected.

6.6. The poles shall also be subjected to Drop Test as per KS 2513:2014. The acceptance criteria shall be as per clause 6.5.

Table 7: Sampling Table

No. of poles in the lot	Sample size	Defects and Dimensional	Proof of Strength Test	Ultimate load test	Drop Test
Up to 100	5	1	2	1	3
101 to 200	10	2	3	1	3
201 to 300	15	3	4	2	5
301 to 500	20	5	5	2	5

For quantities greater than 500 the sampling shall be done in sub-lots of those defined in the table above. For example, if the total offered is 753 poles, then the lot size shall be 20 + 15 = 35.

7. MARKING

7.1. Each Composite Poles shall be marked permanently by impressing on the pole (or by use of a permanently secured plate) at a position 2m above the pole Ground line with the following details:

a) Manufacturer's name/initials to be impressed on the pole during manufacture.
The impressing shall not to interfere with technical and physical properties of the pole.

b) Date of manufacture (mm/yy)

c) Length of pole (meters) and diameter dimensions (mm)

d) Ultimate/Working load(kN)

e) Weight of pole

f) Kenya Standard to which the pole complies

g) The words "Property of KPLC"

7.2. Each bottom of the pole shall be embossed or impressed with the following information, both in plain English and in Braille (contracted):

a) Manufacturer's name

b) Length and diameter of the pole

c) Letters KPLC

7.3. Ground line reference mark as determined in 5.4 and table 5 shall be conspicuous on the pole. Where a plate is used it shall be made of stainless steel, securely affixed to the pole. The mode of marking to be permanent

7.4. In all cases the lettering shall be not less than 5mm high, legibly impressed.

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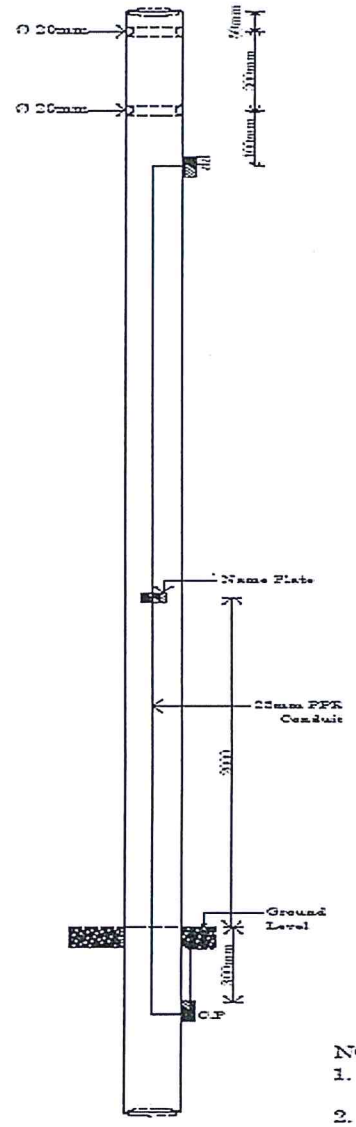
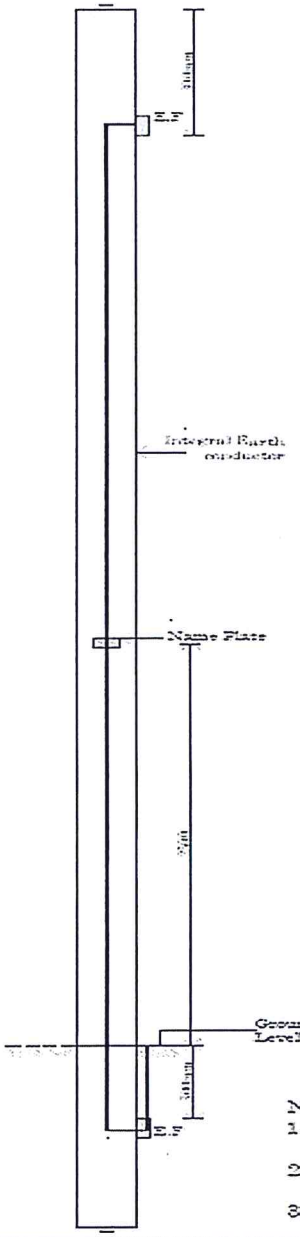
APPENDICES

A. DRAWINGS (NORMATIVE)



NOTES:
1. Diameter(s) shall be as per the specifications.
2. C.P Cable Entry part

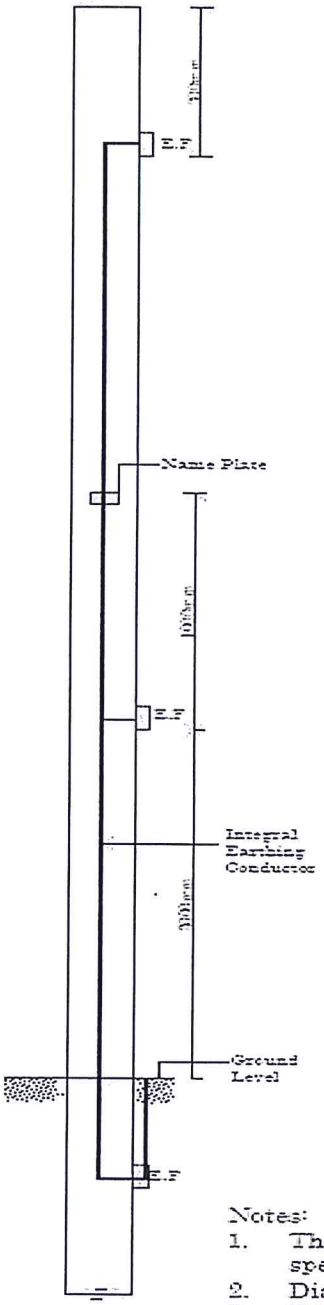
SM - 10M COMPOSITE POLE FOR STREET LIGHTING	Checked by: S.Ngali	Kenya Power
	Drawn by: J.M Kahare	
	Drawing No. TSP/03/06-01	



Notes:
1. The Earthing conductor to be as per the specifications.
2. Diameter(s) shall be as per the specifications.
3. E.F- Earthing ferrule.

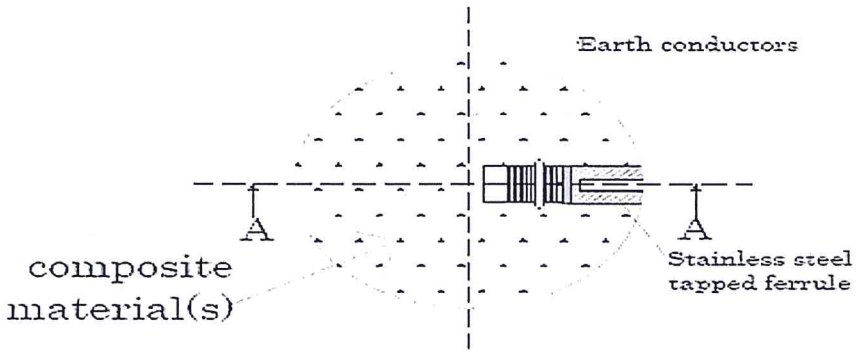
8M - 10M COMPOSITE POLES EARTHING CONFIGURATION

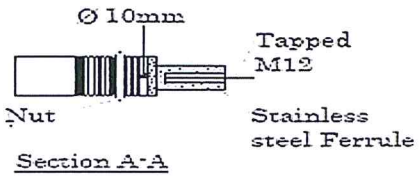
Checked by: S.Nguli	
Drawn by: J.M Kahare	
Drawing No. TSP/03/06-02	Kenya Power



Notes:
1. The Earthing conductor to be as per the specifications.
2. Diameter(s) shall be as per the specifications.
3. E.F- Earthing ferrule.

11M,12M & 14M COMPOSITE POLE EARTHING CONFIGURATION	Checked by: S.Ngufi	Kenya Power
	Drawn by: J.M Kahare	
	Drawing No. TSP/03/06-03	





EARTHING FERRULE DETAILS FOR COMPOSITE POLES	Checked by: S.Nguli	Kenya Power
	Drawn by: J.M Kahare	
	Drawing No. TSP/03/05-04	

B. TESTS AND INSPECTION (NORMATIVE)

B.1 It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified.

B.2 Copies of previous Test Certificates and 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. The Test Reports to be submitted with the tender shall not be more than five years old. A copy of the accreditation certificate for the third-party testing laboratory shall also be submitted with the tender (all in English Language).

B.3 After manufacture, Sampling, Inspection and Methods of Test shall be in accordance with KS 2513:2014 and this specification. The tests shall be done at the manufacturer's works in the presence of KPLC Engineers. Complete test reports for the poles shall be submitted to KPLC for approval before delivery. The test reports shall include ultimate load test.

B.4 Upon delivery of the Composite Poles, 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, Composite Poles which upon examination, test or use fail to meet any of the requirements in the specification and reference standards.

C. QUALITY MANAGEMENT SYSTEM (NORMATIVE)

C.1 The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the Composite Poles design, materials, manufacture, 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 9001:2015 for imported poles and the Diamond Mark of Quality for locally produced poles.

C.2 The Manufacturer's Declaration of Conformity to reference standards and copies of quality management certifications including copy of valid and relevant ISO 9001:2015 certificate (or for locally manufactured poles, the Diamond Mark of Quality from KEBS) shall be submitted with the tender for evaluation.

D. DOCUMENTATION (NORMATIVE)

D.1 The bidder shall submit its tender complete with technical documents for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

a)Fully-filled clause by clause Guaranteed Technical Particulars (GTPs) - Appendix D - stamped and signed by the manufacturer.

b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;

c)Quality assurance plan (QAP) that will be used to ensure that the 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 9001:2015

d) Sales records for the last five years and at least four customer reference letters. For local companies sales records for the last one or more years, and customer letters for same or similar goods will be considered.

e)Details of manufacturing capacity and the manufacturer's experience;

f) Copies of required certificates and test reports by a third party testing laboratory accredited to ISO/IEC 17025. The certificates and test reports shall not be more than five years old.

g) Copy of accreditation certificate for the testing laboratory.

D.2 The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

a) Fully filled clause by clause Guaranteed Technical Particulars (GTPs) stamped and signed by the manufacturer **(these are not the ones submitted with the tender)**;

b) Detailed hard copy Design Drawings with details of Composite Poles to be manufactured for KPLC, together with copies of the manufacturer's catalogues, brochures and technical data;

c) Detailed test program to be used during factory testing,

d) Marking details and method to be used in marking the Composite Poles

e) 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 Composite Poles for The Kenya Power & Lighting Company

E. GUARANTEED TECHNICAL PARTICULARS (NORMATIVE)

(to be filled, stamped and signed by the Supplier and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, four customer reference letters, details of suppliers' capacity and experience; and copies of complete test certificates and test reports for tender evaluation or approval, all in English Language, as per clauses D.1 and D.2)

Tender No. .....

Bidder's Name.....

Clause	Guaranteed Technical Particulars Conductor offered	Bidder's offer
	Name and address of the Manufacturer	state
	Country of manufacture	state
	Manufacturer's Letter of Authorization	provide
	Model/Type Reference No. of the offered poles	state
	Drawing Reference Number	state
	Manufacturer's warranty and guarantee certificate for the offered poles	provide
1.0	Type and Size of composite poles on offer	state
2.0	Reference Standard of manufacture	state
3.0	Definitions and abbreviations	specify
4.	Requirements	
4.1	Service Conditions	specify
4.2	Material and construction	
4.2.1	Design, manufacture and Test Standard	state
4.2.2	Nature of pole offered	state
4.2.3	Design Strength	State
4.2.4	Material of manufacture of composite pole	State

	Materials used for composite produce high density, low porosity poles		State
	Composite components specification	Fiber	Specify
		Pole outer Material	Specify
		Polyurethane material used	Specify
4.2.5	Type of finish		State
4.2.6	Composite poles for street light, with embedded 23mm PPR conduit		Specify/ provide drawing
4.2.7	Earthing Conductor Provided (where requested)		State
4.2.8	Material and standard of manufacture for earth conductor used		State
	Earthing (conductor material and size, and stainless steel ferrules)		Specify/ provide drawing
	Provision of Earthing Ferrules(where specified)		state
	Composite Poles with /without earth		state
4.2.9	Earthing conductor used		Specify size and technical parameters.
4.2.10	Quantities required of each type		State
4.3	**Design parameters**		
4.3.1	Composite Pole cross section		State
4.3.2	**Minimum design requirements**		

Pole size (m)	8	9	10	11	12	14
Diameter(mm)	state	state	state	state	state	state
Approx. Weight(kg)	state	state	state	state	state	state
Proof load(kN)	state	state	state	state	state	state
Ultimate Load(kN)	State	state	state	state	state	state

	Pole construction parameters		
	Length tolerance, %	± 1 total pole length	State
	Outside diameter tolerance, mm	±5	State
	Density, kg/m^3	300 ≤ 600	State
	Straightness, %	< 0.5 total pole length	State
	Safety (Load) factor (S.F)	1.5	State
	Thickness of the outer cover	mm	State
4.4	Colour codes		
	Standard pole length		Colour of paint
	8.0		state
	9.0		state
	10.0		state
	11.0		state
	12.0		state
	14.0		state
4.5	Environmental requirements		
	Compliance to Environmental Management and Coordination Act 1999		state
	Not to contaminate or be harmful to the soil, ground water, flora and fauna		state
	Be made of sustainable and or recyclable materials		state
5	**Test Requirement**		
5.1	Test standard		State
5.2	Tolerance of length of the pole		State
5.3	Proof load test to KS 2513:2014		Provide test reports
5.4	Ultimate load test to KS 2513:2014		Provide test reports
6	Sampling procedure for test		State compliance
6.1	Grouping to comprise a lot		state

6.2	Mode of test	state
6.3	No of poles selected	State
6.4	Tests to be performed	state
	Acceptance criteria	state
6.5	Acceptance criteria	state
6.6	Drop test	state
7.1	Marking (indicate parameters and method of marking to be used during manufacture).	Specify
7.2	Bottom marking in plain English and in Braille (contracted)	State
7.3	Ground Level marking and size of letter used	specify
7.4	Size of lettering, ≥ 5mm	state
A	Drawings	Provide
B	Test and Inspection	
B.1	Responsibility of carrying out tests	State
B.2	Copies of previous Test Certificates and Test Reports issued by a third party testing laboratory that is accredited to ISO/IEC 17025	Provide
B.3	List Acceptance Tests to be witnessed by KPLC Engineers at the factory	List
B.4	Inspection and Acceptance at KPLC stores	State compliance
	Replacement of rejected poles at no extra cost to KPLC	State compliance
C	Quality Management System	
C.1	Quality Assurance Plan	Provide

C.2	Copy of ISO 9001:2015 Certificate/ Diamond Mark of Quality for locally produced poles	Provide
D	Documentation	
D.1	Documents submitted with tender	list
D.2	Documents to be submitted to KPLC for approval before manufacture	specify
Other details required with the tender	List of catalogues, brochures, technical data, drawings and customer sales records submitted to support the offer.	specify
	Deviations from tender specifications and supporting data, test reports, technical documents etc.	specify

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Manufacturer's Name, Signature, Stamp and Date