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Kenya Power

# TREATED WOOD POLES.

# Part 1: EUCALYPTUS POLES — SPECIFICATION

A Document of the Kenya Power & Lighting Company Plc.

**July 2023**

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## 01. Circulation List

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## REVISION OF KPLC STANDARDS

In order 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.



| Issued by: Head of Section, Standards Development | Authorized by: Head of Department, Standards |
|---|---|
| Signed: | Signed: |
| Date: 2023-07-13 | Date: 2023-07-13 |

## 02. Amendment Record

| Rev No. | Date (YYYY-MM-DD) | Description of Change | Prepared by (Name & Signature) | Approved by (Name & Signature) |
|---|---|---|---|---|
| Issue 6 Rev 1 | 2014-03-30 | Included pole top diameter of 140mm for 10m poles for low voltage lines | Head of Section TS&S & Senior Wood Scientist | Head of Department, R&D |
| Issue 6 Rev 2 | 2015-02-19 | Included requirement on maturity, testing capacity, nail plates & steel wire banding | Head of Section Standards Dev, CE QA&C & Wood Scientist | Head of Department, Standards |
| Issue 6 Rev 3 | 2023-04-20 | i. Clause 4.1.2: Maturity period and evidence<br>ii. Clause 4.1.3: seasoning period and evidence<br>iii. Clause 4.1.6: Hole drilling positions<br>iv. Clause 4.2.4: Include ACQ as an alternative preservative<br>v. Clause 4.3: Mandatory requirement for Strength Test Facility | Eng. S. Nguli | Dr. Eng. Peter Kimemia |
| Issue 6 Rev 4 | 2023-07-13 | i. Clause 4.2.6.1: Added how the length shall be measured<br>ii. Clause 4.4.3, Table 3: Colour coding: reintroduced top diameters of 140 mm and 160 mm for 10m poles.<br>iii. Clause 4.5, Table 4: reintroduced top diameters of 140 mm and 160 mm for 10m poles.<br>iv. Clause A.3: Amended the composition of the FAT team to include the user and a representative from Standards Department. | Rotich Benard | Dr. Eng. Peter Kimemia |

| Issued by: Head of Section, Standards Development | Authorized by: Head of Department, Standards |
|---|---|
| Signed: | Signed: |
| Date: 2023-07-13 | Date: 2023-07-13 |

## FOREWORD

This Specification has been prepared by the Standards Department in collaboration with the Supply Chain – Logistics Department and Distribution Division, all of the Kenya Power and Lighting Company PLC (abbreviated as KPLC) and it lays down requirements for treated wooden poles (eucalyptus).

The specification stipulates the minimum requirements for treated wood poles of eucalyptus species acceptable for use in KPLC. It shall be the responsibility of the supplier to ensure adequacy of the design, good workmanship, good engineering practice and adherence to applicable standards, regulations and specifications in the manufacture of the treated wood poles for the Kenya Power and Lighting Company PLC.

Users of this KPLC specification are responsible for its correct interpretation and application.

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

| No | Name | Department |
|---|---|---|
| 1. | Rotich Benard | Standards, IESR |
| 2. | Philemon Langat | Quality Control, Supply Chain |

## 1. SCOPE

This specification covers treated wood poles of eucalyptus timber preserved with creosote or a solution of copper, chromium and arsenic(CCA) or a solution of Alkaline Copper Quaternary (ACQ) compounds salts (or oxides), and intended to be used as upright supports for power transmission and distribution lines.

## 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.

| | |
|---|---|
| AWPA P69-21: | American Standard for the Field Use of Preservatives in Wood |
| AWPA U1-21: | American Standard for Use Category System: User Specification for Treated Wood |
| KS 02-93 | Glossary of terms used in timber |
| KS 02-94 | Kenya standard specification for Preservation of timber |
| KS 516:2008 | Kenya standard specification for Wood poles for power and telecommunications lines |
| ISO 1461:2022: | Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods |
| ISO 9001:2015: | Quality Management System-Requirements |
| ISO/IEC 17025: | General requirements for the competence of testing and Calibration laboratories |

## 3. TERMS AND DEFINITIONS

For the purpose of this specification, the definitions given in the reference standards shall apply including the following:

| | |
|---|---|
| ACQ: | Alkaline Copper Quaternary Compounds |
| CCA: | copper, chromium and arsenic Compounds |
| TGL: | Theoretical Ground Line |

## 4. REQUIREMENTS

### 4.1. SERVICE CONDITIONS

The treated wooden poles shall be suitable for use outdoors 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 +30ºC 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 in accordance with IEC 60815.

### 4.2. PREPARATION AND SEASONING

#### 4.2.1. Species

Wood Poles shall be of any species of wood given in KS 516 as shown in Table 1.

***Table 1: Species of Wood***

| Standard or Trade Name | Scientific Name | Other Names |
|---|---|---|
| Iron Bark | *Eucalyptus paniculata* | Gum or Eucalyptus |
| Spotted Gum | *Eucalyptus citriodora (corymbia citiodora) or Eucalyptus maculata (corymbia maculate)* | Lemon Scented Gum or Eucalyptus |
| Tallow Wood | *Eucalyptus microcorys* | Spotted Gum or eucalyptus blue gum |
| Blue Gum | *Eucalyptus blobulus* | |
| Regnans saligna gum | *Eucalyptus regnans*<br>*Eucalyptus saligna*<br>*Or*<br>*Eucalyptus grandis* | Giant Gum (mountain ash)<br>Blue gum (Saligna gum)<br>Or<br>River Red Gum |

#### 4.2.2. Felling

Only mature trees (≥ 15years) shall be felled and the trees shall be cut as close to the ground level as possible. The ends shall be sawn to give a flat section and branches shall be dressed down flush with the trunk. The poles shall then be stacked in open crib formation on flat clear ground.

***Notes:***

1) *Full details on planting dates and felling dates shall be submitted with the tender as evidence of maturity (Templates for this shall be as provided by Quality Control Section and shall be as developed in conjunction with Standards Department).*
2) *Only approved poles/forest shall be harvested for treatment.*

4.2.3. **Moisture Content**

The average moisture content of individual poles at the time of treatment shall not exceed 25%. Care shall be taken to ensure the poles are fully seasoned and shall not develop checks after treatment. For air seasoning, the minimum period shall be 6 months. Use of Kiln dryers may be used to enhance seasoning.

***Note:*** *Documented evidence for seasoning period shall be submitted to KPLC before tender evaluation (Templates for this shall be as provided by Quality Control Section and shall be as developed in conjunction with Standards Department).*

4.2.4. **Defects**

The poles shall be of sound wood, free from decay, insect attack, rot pockets and any damages caused by handling and processing that would affect the strength of the poles. Growth and seasoning defects (knots, spiral grain, end check, surface check and ring shakes) shall be limited to the requirements as set in KS 516:2008.

4.2.5. **Straightness**

A straight line from the center of the butt to the center of the tip shall lie entirely within the body of the pole. Poles shall be free from crooks that deviate more than 75mm from straightness in any 2m length as shown in KS 516:2008.

4.2.6. **Dimensions**

4.2.6.1. The length of the pole shall conform to the values specified in the tables in clause 4.4, with a tolerance of ± 75mm. The length shall be measured from the butt end to the lowest cut slant of the top.

4.2.6.2. Holes drilled in the pole to support the fittings shall have a diameter of 18.0mm for pole size 10.0m, and 24.0mm for all other sizes, with a tolerance of ±1mm. Holes shall be on a straight line parallel to the axis drilled at 90°.

4.2.6.3. The set of MV and the LV holes shall be 90° spaced on the surface of the pole. The table below shows the required drilling positions, measured from the top of the pole for each pole category.

***Table 2: Hole Drilling Positions***

| **STANDARD POLE LENGTH (M)** | **POSITION OF EACH HOLE FROM THE TOP OF THE POLE (mm)** | | | | | |
|---|---|---|---|---|---|---|
| | MV | | LV | | | |
| Hole No. ⇒ | 1 | 2 | 3 | 4 | 5 | 6 |
| 10 | - | - | 150 | 455 | 760 | 1065 |
| 11 | 150 | 530 | 1400 | 1705 | 2010 | 2315 |
| 12 | 150 | 759 | 1674 | 1979 | 2284 | 2589 |

4.2.6.4. The butt end of the pole shall be cut square to within 5°.The top end shall be cut to a slant angle of 60° (- 0 + 5°) to the longitudinal axis (longer side).

4.2.6.5. Shaping and cutting of poles as well as drilling of holes shall be carried out before impregnation. Poles shall be shaved free of the bark, and branches shall be cut off neatly in the direction of growth and be dressed down flush with the trunk before impregnation.

4.3. **IMPREGNATION**

4.3.1. The poles shall have a minimum sap wood thickness of 15mm as observed at each end of pole.

4.3.2. The average moisture content of the pole at the time of impregnation shall be as indicated in clause 4.1.3, being expressed as a percentage on dry weight before treatment.

4.3.3. Impregnation shall be carried out using the full cell (vacuum-pressure) process according to Kenya standard specification KS 02-94.

4.3.4. The preservative used shall be specified in the Tender document but shall be either creosote in mineral oil base, or formulations of water-soluble compounds of copper, chromium and arsenic (CCA), or water-based formulations of Alkaline Copper Quaternary Compounds (ACQ).

4.3.5. The penetration shall be complete in the sapwood and the retention shall be at levels not less than the following:

a) 100 Kg/M³ for Creosote

b) 20 Kg/M³ Specific Sapwood retention for CCA

c) 22 Kg/M³ Specific Sapwood retention for ACQ

***Note:***

*These are weights of the Creosote, CCA and ACQ retained per meter (M3) cubed of treated wood respectively.*

4.3.6. Care shall be taken to ensure that the poles have undergone complete preservative fixation and are safe to handle before delivery. Fixation period shall not be less than 72 hours after preservative impregnation.

## 4.4. BANDING AND COLOUR CODING

### 4.4.1. Banding

4.4.1.1. Each end of each pole shall be banded by one band of galvanized mild steel strapping of width not less than 19mm and thickness not less than 1.2mm. The strapping is to be firmly tensioned into position by the use of a suitable strapping machine capable of applying a tensile force of not less than one-half of the ultimate tensile strength of the strapping being used.

4.4.1.2. Each band is to be nailed to the pole at four different positions evenly located on the pole using galvanized clout nails of not less than 3mm diameter and length not less than 38mm.

4.4.1.3. Two traps of hot dip galvanized steel wire of diameter of at least 3.15mm with a tensile strength of at least 450Mpa shall similarly be used (at each end of the pole) in place of the flat steel strap.

4.4.1.4. The bands are shall be applied at 100mm ± 10mm away from each end of the pole.

4.4.1.5. The banding shall be done before seasoning and dressing of the poles and prior to treatment.

### 4.4.2. Nail Plates

4.4.2.1. Both ends of each pole shall be covered by anti-split plate (gang nails plate). The nail plate shall be made of galvanized steel with a zinc coating of at least 610 g/m².

4.4.2.2. The plate shall have a minimum thickness of 1.2mm and have a minimum nail length of 14mm. The size of the plate shall be such that the area covered by the plate is at least 60% of the area of applicable pole end.

4.4.2.3. Each nail shall be fully embedded in the pole end and no nail shall be bent. The nail plate shall be so positioned in the middle of a cut end that its edges do not protrude over the round face of the timber.

### 4.4.3. Colour Coding

The nail plate used on the poles shall be coded to facilitate size identification during handling and storage. The paint used for colour coding shall be indelible and in accordance with the table below:

*Table 3: Colour Codes*

| STANDARD POLE LENGTH (M) | | COLOUR OF PAINT |
|---|---|---|
| 10.0 | 182.5 TGL (140mm top diameter) | BLACK |
| | 202.5mm TGL (160mm top diameter) | PINK |
| | 222.5mm TGL(180mm top diameter) | GREEN |
| 11.0 | | NAVY BLUE |
| 12.0 | | YELLOW |
| 14.0 | | RED |
| 15.0 | | SKY BLUE |
| 17.0 | | WHITE |
| 18.0 | | ORANGE |

## 4.5. DIMENSIONS AND STRENGTH VALUES FOR POLES

*Table 4: Dimension and Strength Values*

| LENGTH m | MINIMUM TOP DIAMETER (mm) | MINIMUM DIAMETER AT THEORETICAL GROUNDLINE (mm) | THEORETICAL GROUNDLINE (TGL) FROM BUTT (m) | FORCE REQUIRED TO CAUSE A FIBRE STRESS OF 55MPa (CANTILEVER LOADING) kN |
|---|---|---|---|---|
| 10.0 | 140 | 182.5 | 1.8 | 4.15 |
| | 160 | 202.5 | | 5.67 |
| | 180 | 222.5 | | 7.52 |
| 11.0 | 180 | 227.5 | 1.8 | 7.13 |
| 12.0 | 180 | 232.5 | 1.8 | 6.85 |
| 14.0 | 200 | 262.5 | 2.0 | 8.20 |
| 15.0 | 220 | 287.5 | 2.0 | 9.93 |
| 16.0 | 220 | 292.5 | 2.0 | 9.71 |
| 18.0 | 200 | 282.5 | 2.0 | 7.65 |

***Note:***

1) *The manufacturer/treatment plant MUST have Strength Test Facility and necessary equipment to achieve this objective.*
2) *Test samples shall be selected as detailed in table 5.*
3) *Stage inspection is Mandatory in manufacturing process (Templates for this shall be as provided by Quality Control Section and shall be as developed in conjunction with Standards Department).*

## 5. TESTS AND INSPECTION

5.1 The treated wooden poles shall be inspected and tested in accordance with the requirements of this specification, KS 02-94 and KS 516 2008. It shall be the responsibility of the supplier to perform or to have performed the tests specified.

5.2 The poles shall be tested against the relevant minimum dimensions and strength values as per clause 4.4 among other parameters as per this specification and applicable standards.

### 5.3 Sampling

5.3.1 Lot: In a consignment, 500 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.

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

5.3.3 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 below.

5.3.4 All the poles selected shall be tested for defects, physical dimensions and straightness. 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 Table 5.

5.3.5 The lot having been found satisfactory according to 5.4.4 shall be further tested for ultimate load of the poles. For this purpose, the number of poles given in table 5 shall be tested. These poles may be selected from those already tested according to 5.4.4 and found satisfactory.

5.3.6 All these poles tested for ultimate load shall satisfy the corresponding specification requirements. If one or more poles fail, twice the number of poles required for 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.

*Table 5: Test Sample Size*

| No. of poles in the lot | Sample size | Defects and Dimensional Requirements acceptance number | Ultimate load test |
|---|---|---|---|
| Up to 100 | 10 | 1 | 1 |
| 101 to 200 | 15 | 1 | 1 |
| 201 to 300 | 20 | 2 | 1 |
| 301 to 500 | 30 | 3 | 2 |

## 6. MARKING

6.1 Each pole shall be marked with the following information:

a) The words **'PROPERTY OF KPLC'**;
b) Manufacturer's name or trade mark;
c) Date of treatment, comprising the first two digits of the month followed by the last two digits of the year separated by a slash;
d) The number of the Kenya Standard to which the pole is manufactured, in this case, KS 516 & KS 02-94;
e) Length of the pole (in metres);
f) Top diameter (in mm);
g) Hazard class (In this case H4);
h) Species of timber;
i) Preservative used and applicable standard;
j) Ground line
k) Marking for serialization and traceability.

All the markings shall be legible and permanent.

6.2 The marking in 6.1 above shall be on a plate made of aluminium and of at least 60mm x 60mm x 1.2mm in dimensions.

6.3 The aluminum plate shall be secured to the pole by at least four galvanized steel wire nails of at least 50mm length.

6.4 The aluminum plate shall be placed at a depth of 3mm from the surface of the pole and positioned 3.5m from the butt end of the pole.

## APPENDICES

### APPENDIX A: TESTS AND INSPECTION (Normative)

A.1. Copies of Type Test Certificates and 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 for the testing laboratory shall be submitted with the tender (all in English Language). Any translations of certificates and test reports into English language shall be signed and stamped by the Testing Authority.

A.2 Copies of Test Reports to be submitted shall include the following tests as per KS 02-94 and KS 516:

(i) Ultimate Strength Test
(ii) Preservative Penetration Test;
(iii) Dimensions Test
(iv) Preservative Retention Test
(v) Knots' Test
(vi) Splits and Checks Tests
(vii) Marking for Serialization and Traceability
(viii) Banding
(ix) Straightness Test
(x) General Defects Tests

A.3. The poles shall be subjected to acceptance tests at the manufacturer's premises before dispatch. KPLC shall appoint a cross-functional team of officers/engineers that shall include the User and a representative from Standards Department. Consignments presented for inspection shall not be less than 2,000 poles unless the order quantity is less. The sampling and testing shall be as per clause 5. The acceptance tests to be witnessed shall include, but not limited to, the following tests:

(i) Dimensional and physical Checks
(ii) Straightness and defects checks,
(iii) Preservative retention
(iv) Strength Tests
(v) Moisture Content
(vi) Details of standard and reference equipment& preservative used in treatment
(vii) All other tests as detailed in this specification

A.4. On receipt of the treated wooden 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 charge to KPLC, wooden poles that upon examination, test or use fail to meet any of the requirements in this specification.

## APPENDIX B: QUALITY MANAGEMENT SYSTEM (Normative)

B.1. Supplier shall submit quality assurance plan (QAP) that shall be used to ensure that the poles material, manufacture, workmanship, tests, service capability, maintenance and documentation, will fulfil the requirements stated in the contract documents, standards, specifications and regulations.

B.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 treated poles, the Diamond Mark of Quality from Kenya Bureau of Standards) shall be submitted with the tender for evaluation.

B.3. Details on the manufacturing experience, production capacity and testing capacity of the manufacturer shall be submitted with the tender.

B.4. Details on manufacturing capacity shall be submitted with the tender shall include detailed list of manufacturing facilities, number and capacity of each cylinder, drying kiln and total monthly production of the whole plant.

B.5. Details on testing capacity shall be submitted with the tender shall include quantities and calibration status of all necessary test and measuring equipment and shall include spectrometric analyzer, moisture meter, and strength testing facility, hydrometer, increment borer, calipers and band strapping machine.

B.6. Details on manufacturer's experience to be submitted with the tender shall include list of previous customers and reference letters from at least four of the previous customers.

## APPENDIX C: DOCUMENTATION AND DEMONSTRATION (Normative)

C.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 (GTP) signed by the manufacturer;
b) Copies of the Manufacturer's catalogues, brochures, drawings giving all relevant dimensions, Schematic Diagram and technical data;
c) Sales records for the last five years and at least four customer reference letters;
d) Details of manufacturing capacity and the manufacturer's experience;
e) Copies of required test/calibration reports of testing/calibrating laboratory accredited to ISO/IEC 17025;

f) Copy of accreditation certificate to ISO/IEC 17025 for the testing/calibrating laboratory;

g) Manufacturers letter of authorization, ISO 9001 certificate, and other technical documents required in the tender.

h) Manufacturer's warranty and guarantee; subject to 60 months from date of delivery to KPLC stores

C.2. The successful bidder (supplier) may submit the following documents/details to KPLC for approval before manufacture:

a) Fully-filled clause by clause Guaranteed Technical Particulars (GTP) signed by the manufacturer, specific values shall be filled in. Terms like "Yes", "Agree", "Complied" **shall not be acceptable;**

b) 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.

c) Test Program to be used after manufacture,

d) Marking details and method to be used in marking the poles,

e) Manufacturer's undertaking to ensure adequacy of the design, good workmanship, good engineering practice and adherence to applicable standards, regulations and specifications in the manufacture of the poles for KPLC,

f) Quality Control documents to ensure poles are Mature, correct seasoning and proper Testing

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## APPENDIX D: GUARANTEED TECHNICAL PARTICULARS (Normative)

*(to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, 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. ..... BIDDER'S NAME & ADDRESS .....**

| CLAUSE NUMBER | DESCRIPTION | | KPLC requirement | BIDDER'S OFFER |
|---|---|---|---|---|
| | Name & address of Manufacturer | | state | |
| | Country and forest where the trees were grown | | state | |
| | Country of manufacture | | state | |
| | Manufacturer's Letter of Authorization | | attach | |
| | Manufacturer's warranty and guarantee for the offered treated wooden poles | | attach | |
| | Capacity of manufacturer (number of poles produced in a day) | | specify | |
| | List & contact addresses of previous customers of manufacturer for similar poles (last five years) | | list | |
| | Reference letters from at least four of the previous customers | | attach | |
| 1 | Scope | | state | |
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| | | Documented evidence of the same | state | |
| | | Date of planting | state | |
| | | Date of felling | state | |
| 4.2.3 | (a) Moisture content | | specify | |

| | | | |
|---|---|---|---|
| | (b) Documented evidence of seasoning | provide | |
| | (c) Seasoning period (≥ 6 months) | state | |
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| | | | |
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.....

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

***Note*

*All guaranteed values **MUST** be clearly stated. Words like 'agreed', Yes; 'confirmed', 'As per KPLC specifications', etc. shall not be accepted and shall be considered non-responsive.*