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Kenya Power

# POWER LINE AERIAL MARKERS – SPECIFICATION

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


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| Issued by: Head of Section, Standards Development | Authorized by: Head of Department, Standards |
|---|---|
| Signed: | Signed: |
| Date: 2020-11-18 | Date: 2020-11-18 |

## 0.2 AMENDMENT RECORD

| Rev No. | Date (YYYY-MM-DD) | Description of Change | Prepared by (Name & Signature) | Approved by (Name & Signature) |
|---|---|---|---|---|
| 0 | 2020-11-18 | New Issue | Nancy Wairimu | Dr. Eng. Peter Kimemia |
| | | | | |
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| | | | | |

## FOREWORD

This Specification has been prepared by the Standards Department in collaboration with Transmission department both of The Kenya Power and of Lighting Company Plc. (KPLC) and it lays down requirements for Power Line Aerial Markers.

Power Line Aerial Markers are installed on distribution and transmission Lines to enhance awareness of their presence as well as warn aircraft pilots during day and night.

There are no other specifications in this series.

This specification stipulates the minimum requirements for Power Line Aerial Markers acceptable for use in the company and it shall be the responsibility of the suppliers and manufacturer to ensure that the offered design is of the highest quality, guarantees excellent service to KPLC and exhibits good workmanship and good engineering practice in the manufacture.

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

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

| Name | Division |
|---|---|
| Dedan Njoroge Kuria | Network Management |
| Nancy Wairimu Mungai | Institute of Energy Studies & Research |

## 1. SCOPE

This specification specifies the materials, design, size, test methods, marking and packaging of Power Line Aerial Markers.

## 2. NORMATIVE REFERENCE

The following standard and guidelines 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 document shall apply.

ICAO Annex 14: Aerodromes. Volume 1, Aerodrome Design and Operations.

FAA AC 70/7460-1L: Obstruction marking and Lighting

ISO 9001: 2015: Quality Management System

## 3. DEFINITIONS AND ABBREVIATIONS

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

### 3.1. ABBREVIATIONS

**KPLC:** Kenya Power and Lighting Company Plc

**ICAO: –** International Civil Aviation Organization

**FAA:** Federal Aviation Administration

## 4. REQUIREMENTS

### 4.1. SERVICE CONDITIONS

The Power Line Aerial Markers shall be suitable for installations 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 +30$^0$C with a minimum of -1$^0$C and a maximum of +55$^0$C;
d) Heavy Saline conditions along the coast.
e) Wind load of 80m/sec.

## 4.2. DESIGN AND CONSTRUCTION

4.2.1. The Power Line Aerial Markers shall be free of gouges, cracks, and sharp corners or points.

4.2.2. The Power Line Aerial Markers shall be furnished with suitable spiral-formed lineguards as shown in figure 1.

4.2.3. The Power Line Aerial Markers mechanical structure and dimensions shall be as per figure 1.

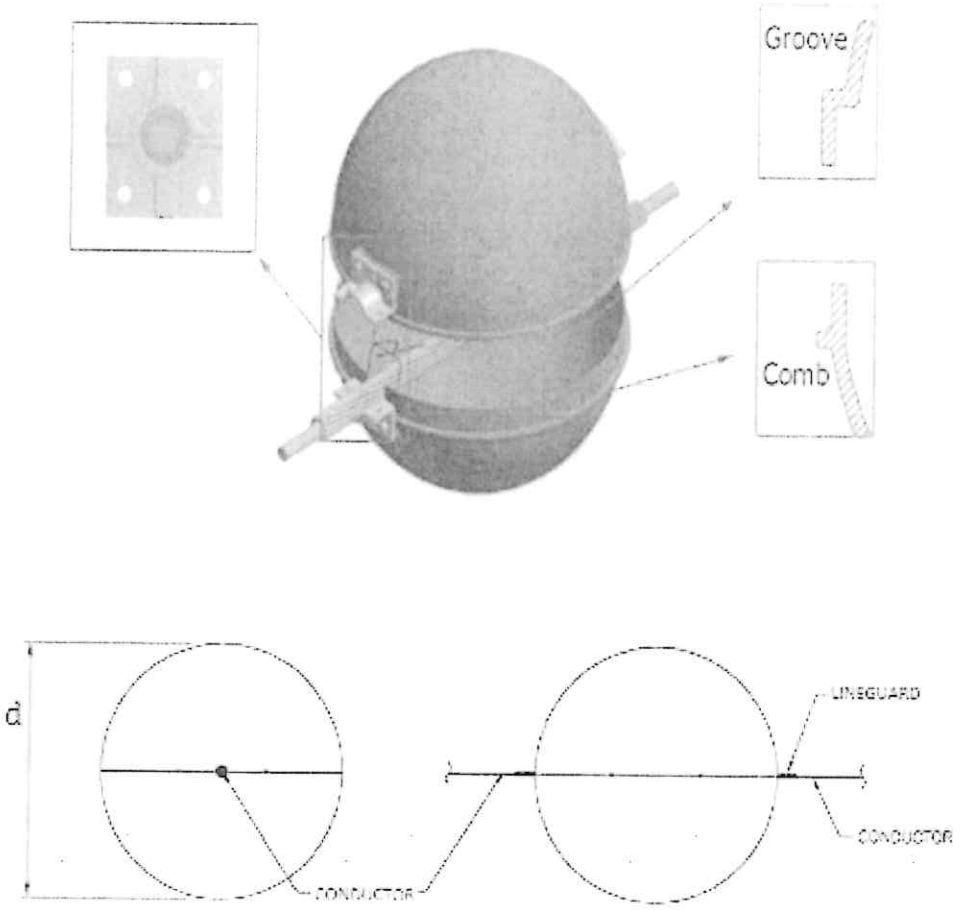



**Figure 1: Typical Mechanical Structure - Power Line Aerial Markers**

4.2.4. The Power Line Aerial Markers shall be light and durable. They shall be made from material that is UV-stabilized, and with UV-resistant coating to ensure exceptional color stability over their life. Its properties shall not change when exposed to environment specified in clause 4.1.

4.2.5. The Power Line Aerial Markers shall have drain holes to prevent rain accumulating in the sphere.

4.2.6. The Power Line Aerial Markers shall be supplied with preformed armour rods can decrease vibration and abrasion for the conductors as shown in figure 2.



**Figure 2: Preformed Armour rods**

4.2.7. The Power Line Aerial Markers shall have a reflective tape to ensure night visibility.

4.2.8. The clamps, bolts and nuts used in Power Line Aerial Markers shall be resistant to corrosion.

4.2.9. The Power Line Aerial Markers particular requirement shall be specified in Table 1 below.

**Table 1: Power Line Aerial Markers Particular requirement**

| PARAMETERS | REQUIREMENTS |
|---|---|
| **Operation** | |
| Visible Distance | 1250m |
| Voltage Range | Up to 1000kV |
| Conductor Diameter | 6.5 – 35mm |
| **Mechanical Structure** | |
| Colour | Orange, Red, Yellow and White |
| Sphere Body Material | Fiberglass Reinforced Polymer (FRP) [*Tensile Strength > 128MPa, Flexural Strength > 230MPa, Barcol Hardness > 44*] |
| Cable Clamp | Aluminium Alloy |
| Bolts/Nuts/Washers | Stainless Steel 304 |
| Diameter | 9", 12", 24", 36" |
| Thickness | 2.5 – 3.0 mm |
| Drain Holes | 10mm |
| Preformed Armor Rods | Yes |
| Reflective Tape | Yes |
| Weight | 7 – 9 kg |
| Reflective Coefficient | 0.3 – 0.7 |
| **Environment** | |
| Operating Temperature | -1°C to +55°C |
| Wind Load | 80 m/sec |

**Note:** *The colour and the diameter will be specified in the tender*

4.2.10. The design of the Power Line Aerial Markers shall be stacking compatible to save on storage space and transportation cost.

## 5. TESTS REQUIREMENTS

The Power Line Aerial Markers shall be inspected and tested in accordance with relevant International Standards and the requirements of this specification.

## 6. MARKING AND PACKING

### 6.1. MARKING

The Power Line Aerial Markers shall be legibly and indelibly marked with the following information:

a) Model or reference type;
b) Name or Trade name of the manufacturer;
c) Year of Manufacture;
d) Batch or serial number;
e) The words "PROPERTY OF KENYA POWER AND LIGHTING COMPANY';

### 6.2. PACKING

6.2.1. The Power Line Aerial Markers shall be packed in a manner to protect it from damage during transportation and storage.

6.2.2. Instruction of storage, handling and installation shall be included in each package, all in English language.

This space is left blank intentionally

## APPENDICIES

### A: TESTS AND INSPECTION (Normative)

A.1 It shall be the responsibility of the supplier to test or to have all the relevant tests performed.

A.2 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 also 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.3 The bidder shall provide current e-mail address, fax and telephone numbers and contact person at the Testing Laboratory where Type Tests were carried out.

A.4 The Power Line Aerial Markers shall be subjected to acceptance tests at the manufacturer's works before dispatch. Two Engineers appointed by KPLC shall witness acceptance tests.

A.5 Test certificates for the Power Line Aerial Markers to be supplied shall be submitted to KPLC for approval before shipment/delivery of the equipment.

A.6 On receipt of the Power Line Aerial Markers, 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 the Power Line Aerial Markers, which upon examination, test or use fail to meet any or all of the requirements in the specification.

### B: QUALITY MANAGEMENT SYSTEM (Normative)

B.1 The supplier shall submit a Quality Assurance Plan (QAP) that will be used to ensure that the Power Line Aerial Markers physical properties, tests 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.

B.2 The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications including copy of valid and relevant ISO 9001: 2015 certificate shall be submitted with the tender for evaluation.

B.3 The bidder shall indicate the delivery time of the Power Line Aerial Markers, manufacturer's monthly and annual production capacity and experience in the production of the type and size of items being offered. A detailed list and contact addresses (including e-mail) of the manufacturer's previous customers for similar type of the Power Line Aerial Markers 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.

**C: DOCUMENTATION (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, specific values shall be filled in, terms like "yes", "Agree" , "complied" shall not be acceptable;
b) Copies of the Manufacturer's catalogues, brochures, drawings 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 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 Third Party Testing Laboratory;
g) Manufacturers Letter of Authorization, ISO 9001:2015 Certificate and other technical documents required in the tender.
h) Manufacturer's warranty and guarantee; subject to at least 12 months from date of delivery to KPLC stores

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

a) Fully filled clause by clause Guaranteed Technical Particulars (GTP) stamped and signed by the manufacturer, specific values shall be filled in, terms like "yes", "Agree" , "complied" shall not be acceptable;
b) Design Drawings with details of the Power Line Aerial Markers to be manufactured for KPLC.
c) Quality Assurance Plan (QAP) that will be used to ensure that the 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 9001:2015.
d) Detailed test program to be used during factory testing;
e) Marking details and method to be used in marking the Power Line Aerial Markers;
f) Packaging details (including packaging materials).

C.3 Statement of compliance to specification (indicate deviations if any provide supporting documents)

## 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, sales records for previous five years, four customer reference letters, details of suppliers' capacity and experience; and copies of complete type test certificates and test reports for tender evaluation, all in English Language)*

**Tender No. .....**

| Clause number | KPLC requirement | | Bidder's offer (indicate full details ) |
|---|---|---|---|
| Manufacturer's Name and address | | | Specify |
| Country of Manufacture | | | Specify |
| Bidder's Name and address | | | Specify |
| 1. | Scope | | Specify |
| | Item on offer - Description | | Specify |
| 2. | References | | Specify |
| 3. | Definitions and Abbreviations | | |
| 3.1 | Abbreviations | | Specify |
| 4. | Requirements | | |
| 4.1 | Service Conditions | | Specify |
| | Operating conditions | Altitude | State |
| | | Humidity | State |
| | | Average Ambient temperature | State |
| | | Saline Condition | |
| | | Wind load | State |
| 4.2 | **Design and Construction** | | |
| 4.2.1 | Free of gouges, cracks, and sharp corners or points | | Specify |
| 4.2.2 | Spiral-formed lineguards | | Specify |
| 4.2.3 | Mechanical Structure and Dimensions | | Provide drawing |
| 4.2.4 | Features | Light and durable | Specify |
| | | UV-stabilized material | Specify |
| | | UV-resistant coating | Specify |
| | | Properties shall not change when exposed to environment specified in 4.1 | Specify |
| 4.2.5 | Shall have drain holes | | Provide |

| Clause number | KPLC requirement | | Bidder's offer (indicate full details ) |
|---|---|---|---|
| 4.2.6 | Shall be supplied preformed armour rods | | Provide |
| 4.2.7 | Shall have a reflective tape | | Provide |
| 4.2.8 | Clamps, bolts and nuts used in Power Line Aerial Markers shall be resistant to corrosion | | Specify |
| **4.2.9** | **Particular requirements specify** | | |
| | **Parameters** | **Requirements** | |
| | Visible Distance | 1250m | Specify |
| | Voltage Range | Up to 1000kV | Specify |
| | Conductor Diameter | 6.5 – 35mm | Specify |
| | Colour | Orange, Red, Yellow and White | Specify |
| | Sphere Body Material | Fiberglass Reinforced Polymer (FRP) [Tensile Strength > 128MPa, Flexural Strength > 230MPa, Barcol Hardness > 44] | Specify |
| | Cable Clamp | Aluminium Alloy | Specify |
| | Bolts/Nuts/Washers | Stainless Steel 304 | Specify |
| | Diameter | 9", 12", 24", 36" | Specify |
| | Thickness | 2.5 – 3.0 mm | Specify |
| | Drain Holes | 10mm | Specify |
| | Preformed Armor Rods | Yes | Specify |
| | Reflective Tape | Yes | Specify |
| | Weight | ≤ 9kg | Specify |
| | Reflective Coefficient | 0.3 – 0.7 | Specify |
| | Operating Temperature | -55°C to +55°C | Specify |
| | Wind Load | 80m/sec | Specify |
| 4.2.10 | Shall be stacking compatible | | Specify |
| 5. | Test Requirements | | Specify |
| 6 | Marking and Packing | | |
| 6.1 | Marking | | Specify |
| 6.2 | Packing | | Specify |
| A | Test and inspection | | |
| A.1 | Responsibility of carrying out tests | | State |
| A.2 | Copies of Type Test Reports submitted with tender | | Provide |

| Clause number | KPLC requirement | Bidder's offer (indicate full details ) |
|---|---|---|
| A.3 | Contacts of testing laboratory | Provide |
| A.4 | Acceptance tests at the manufacturers works | State compliance |
| A.5 | Test certificates to be submitted by supplier to KPLC for approval before supply/delivery | State compliance |
| A.6 | Inspection at the stores and replacement of rejected items | State compliance |
| B | Quality Management System | |
| B.1 | Quality Assurance Plan | Provide |
| B.2 | Manufacturer's Declaration of Conformity to applicable standards and copy of ISO 9001:2015 Certificate | Provide |
| B.3 | Delivery time | State |
| | Manufacturer's experience | State |
| | Manufacturing Capacity (units per month, per year) | State |
| | List of previous customers | Provide |
| | Customer reference letters | Provide |
| C | Documentation | |
| C.1 | Documents submitted with tender | State compliance |
| C.2 | Documents to be submitted by supplier to KPLC for approval before manufacture | State compliance |
| C.3 | Statement of compliance to specification (indicate deviations if any & provide supporting documents) | State compliance |

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