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Kenya Power

11kV & 33kV COMPOSITE INSULATORS Part 1: Suspension/ Tension Insulators for Inland and Coastal Applications– SPECIFICATION

A Document of the Kenya Power & Lighting Co. Plc
June 2024

TABLE OF CONTENTS

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

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.

0.2 AMENDMENT RECORD

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 2 Rev 0	2011-03-14	Cancels and replaces Issue 1 Rev 2 dated 2008-04-10	S. Kimitei	
Issue 2 Rev 1	2016-08-30	1. Included IEC 60363, ISO 9001:2008 and ISO/IEC 17025 at Clause 2, References. 2. Changed altitude from 2000m to 2200m and included weather isokeraunic level of 180 thunderstorm days at clause 4.1, Service Conditions. 3. Included word PROPERTY after KPLC at Clause 6.1(v), Marking Packaging and Labelling 4. Change of title	S. Nguli	P. Kimemia
Issue 2 Rev 1	2023-06-23	1. Included requirements for coastal applications. 2. Updated the specification to the new format and GTPs to clause by clause format. 3. Miscellaneous changes	Jean Otsyula Eng. J. Ndirangu	Dr. Eng. Peter Kimemia

FOREWORD

This Specification has been prepared by the Standards Department of the Kenya Power and Lighting Company Plc (KPLC) and it lays down requirements for 11 kV & 33kV Suspension/Tension Type Composite Insulators. It is intended for use by KPLC in purchasing the insulators.

The bidder shall submit information which confirms the manufacturer's satisfactory service experience with products which fall within the scope of this specification.

This specification stipulates the minimum requirements for the insulators acceptable for use in the company and it shall be the responsibility of the supplier and manufacturer to ensure that the offered design is of the highest quality and guarantees excellent service to KPLC. Good workmanship and good engineering practice shall be exhibited in the manufacture of the insulators for KPLC.

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

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

Name	Department
Jean Otsyula	Standards
Julius Ndirangu	Standards

1. SCOPE

1.1. This specification is for composite insulators for use on overhead lines for tension and suspension purposes for inland and coastal applications.

1.2. This specification covers the following composite insulators:

(i) 11kV Suspension/Tension Line Insulators;

(ii) 33kV Suspension/Tension Line Insulators.

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

This specification stipulates the minimum requirements for 11kV & 33kV Suspension/Tension Type Composite Insulators acceptable for use in the company and it shall be the responsibility of the Manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the insulators for KPLC.

The specification does not purport to include all the necessary provisions of a contract.

2. NORMATIVE REFERENCES

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

ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles – Specifications and test methods.

ISO 1460: Metallic coatings – Hot dip galvanized coatings on ferrous materials – Gravimetric determination of the mass per unit area.

IEC 61109: Insulators for overhead lines - Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V - Definitions, test methods and acceptance criteria.

IEC 60120: Ball and socket couplings of string insulator units - Dimensions.

IEC 60815: Selection and dimensioning of high-voltage insulators intended for use in polluted conditions

IEC 60383: Insulators for overhead lines with a nominal voltage above 1000 V.

ISO 9001: Quality Management Principles.

ISO/IEC 17025: General requirements for the competence of testing and calibration laboratories.

3. DEFINITIONS AND ABBREVIATIONS

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

Creepage Distance – The shortest distance or the sum of the shortest distances along the insulating parts of the insulator between those parts which normally have the operating voltage between them (IEC 60383-1). It is calculated by multiplying the Specific Creepage Distance by the r.m.s. value of the highest operating line-to-line voltage across the insulator.

4. REQUIREMENTS

4.1. SERVICE CONDITIONS

4.1.1 The insulators 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.

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

f) The level of galvanizing for all ferrous parts and materials shall be suitable for these conditions.

4.2. MATERIALS AND CONSTRUCTION

4.2.1. The insulators shall be manufactured to IEC 61109, other applicable/ latest standards and the requirements of this specification.

4.2.2. The insulators shall have a core made of resin-impregnated glass fibres free from defects. The housing of the insulator shall be manufactured from high quality silicone rubber.

4.2.3. The housing of the insulator shall be made of high quality reinforced high temperature vulcanized (HTV) silicone rubber based on dimethyl siloxane, which exhibit hydrophobicity with the capability to transfer hydrophobicity to the layer of pollution.

4.2.4. The reinforced HTV silicone rubber shall have a shore 'A' hardness of not less than 60 as per ISO 48 and the track resistance of the sheath and shed materials shall meet the requirements of IEC 60587 Method 1 Class 1A4.5 or 1B4.5 or Method 2 1 Class 2A4.5.

4.2.5. The insulator sheds shall be open type. Designed to minimize trapping of contamination. It shall be made of polymer having glazed brown or grey colour. The silicon rubber housing shall be made by direct moulding method.

4.2.6. The insulator shall be of high resistance to moisture and ultraviolet radiation and withstand high tropical sunshine conditions.

4.2.7. The final colour of the insulator housing shall be GREY.

4.2.8. The insulator shall be fitted with ball and socket coupling in accordance with IEC 60120. The ball pin and socket shall be of medium carbon steel. The ball pin diameter shall be 16mm and shall be supplied complete with a corresponding "R" form retaining clip. The security clip shall be of stainless steel.

4.3. CHARACTERISTICS

The mechanical and electrical characteristics of the insulators as well as the withstand capabilities of the insulator housing shall be as follows:

Table 1: Mechanical and electrical characteristics of the insulators

	Item		12kV	36kV
1	System Highest Voltage and Frequency		12kV, 50 Hz	36kV, 50 Hz
2	Creepage distance, minimum	Inland	300 mm	900mm
		Coastal	372 mm	1116mm
3	Minimum Power Frequency Withstand Voltage (wet), 50 Hz, 1 min.	Inland	38kVrms	90kVrms
		Coastal	38kVrms	95kVrms
4	Minimum Lightning Impulse Withstand Voltage, 1.2/50 µs, dry, positive		95kVp	200kVp
5	Minimum failing load		70kN	70kN

Table 2: Withstand capabilities of insulator housing

	Item		Units	12kV	36kV
1	Minimum Lightning Impulse Withstand Voltage		kVp	95	200
2	Power Frequency Withstand Voltage for 1 min, (wet)		kVrms	46	116
3	Creepage distance, minimum	Inland, 25mm/kV	mm	300	900
		Coastal, 31mm/kV		372	1116
4	Permissible head load static (SLL)		N	175	
5	Permissible head load dynamic (SLL)		N	250	
6	Short circuit withstand capability (rated short circuit withstand current, Is		kA	20	
7	Permissible length of the active part, minimum		mm	135	145
8	Housing shield resistance		Ω	<5000	
9	Number of units		No.	1	

5. TESTS REQUIREMENTS

The insulator shall be inspected and tested in accordance with the requirements of relevant standards and provisions of this specification.

6. MARKING AND PACKING

6.1. MARKING

6.1.1. The following information shall be marked legibly and indelibly and in a permanent manner by embossing on each insulator during manufacture:

a) The manufacturer's name or trade mark;
b) The manufacturer's type designation
c) The voltage rating
d) Specified Mechanical Load
e) The letters "**Property of KPLC**"
f) The year of manufacture

6.1.2. All markings shall permanent and shall be by embossing on the insulator part and any on metal fittings shall be before galvanizing. The marking shall not affect the performance of the insulator. Tags and stickers shall not be accepted.

6.2. PACKING

6.2.1. The insulators shall be packed in wood crates which are reinforced and held closed by external steel wire bindings. Each crate shall be internally braced to permit stacking and the steel wire bindings shall be designed to keep the crate firmly closed and permit easy and rapid opening at time of installation.

6.2.2. The crates shall then be stacked on sturdy wood pallet. The assembly shall be held tightly in place with steel bands and protected against moisture by a complete covering of heat-shrinkable polyethylene film.

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APPENDICES

A: TESTS AND INSPECTION (Normative)

A.1 The insulators shall be inspected and tested in accordance with IEC 61109, IEC 60383, ISO 1460 and the requirements of this specification. It shall be the responsibility of the manufacturer to perform or to have performed the tests specified.

A.2 Copies of previous Design and Type Test Certificates and Type Test Reports issued by the relevant Independent International or National Testing/ Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation (all in English Language). A copy of accreditation certificate for the laboratory shall also be submitted. Any translations of certificates and test reports into English language shall be signed and stamped by the Testing Authority.

Copies of type test reports for the following Design and Type Tests to IEC 61109 shall be submitted with the tender for evaluation:

- Tests on interfaces and connections of metal fittings
- Assembled core load-time test
- Test of housing: tracking and erosion test. The test reports MUST include resistance to ageing tests by KEMA or equivalent Testing Authority (under climate chambers to mimic the conditions – sunshine, salinity, temperature, humidity, spray and so on – typical of tropical climate and those stated in clause 4.1 in addition to the highest system voltage)
- Tests for the core material
- Flammability test
- Dry Lightning Impulse Withstand Voltage Test
- Wet power frequency test
- Mechanical load-time tests and test of the tightness of the interface between end fittings and insulator housing.

A.3 KPLC engineers (2) will witness acceptance tests at the factory before shipment. Acceptance tests shall include Routine and Sample tests as per IEC 61109 and applicable latest IEC standards on the following:

- Verification of dimensions
- Verification of the locking system
- Verification of tightness of the interface between end fittings and insulator housing
- Verification of the specified mechanical load
- Galvanizing test (by Gravimetric method).

A.4 Routine and sample test reports for the insulators to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods.

A.5 On receipt of the insulators, Kenya Power 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 Kenya Power, any insulator 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 insulator 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.

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.

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 and stamped by the manufacturer;
b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
c) Sales records and at least four 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 third party testing laboratory;
g) Manufacturer's ISO 9001:2015 certificate, and other technical documents required in the tender.

C.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 (GTP) signed and stamped by the manufacturer;
a) Design Drawings and construction details of the insulator.
b) Product manuals and brochures.
c) Quality assurance plan (QAP) based on ISO 9001.

d) Test program to be used after manufacture.
e) Marking details and method to be used in marking the insulators.
f) Manufacturer's undertaking to ensure adequacy of the design.
g) Packaging details (including packaging materials).

Note: The drawings to be submitted by the supplier to KPLC for approval before manufacture shall be in standard format clearly indicating the drawing number, components with material details, standard of manufacture, ratings, approval details and identity of the manufacturer (as per tender) et cetera.

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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, customer reference letters (4), details of manufacturer's capacity and experience; and copies of complete type test certificates and test reports for tender evaluation, all in English Language)

Tender No. .....

Bidder's name and Address.....

Clause number	Requirement	Bidder's offer
	Manufacturer's Name and address	Specify
	Country of Manufacture	Specify
	Type Reference/Model number of insulators offered	Specify
1.	Scope	State
2.	Normative References	State
3.	Definitions and Abbreviations	State
4.	**Requirements**	
4.1	Service Conditions	State
4.2	**Materials and Construction**	
4.2.1	Insulator manufacture standards	State
4.2.2	Material of manufacture for insulator core	Specify
4.2.3	Material of manufacture for insulator housing	Specify
4.2.4	Properties and standards of manufacture for the insulator housing material (hardness, track resistance etc.)	Specify
4.2.5	Open type insulator designed to minimize trapping of contamination	State
	Colour of polymer for insulator sheds	State
	Method of moulding for insulator housing	State
4.2.6	Insulator shall be of high resistance to moisture and ultraviolet radiation and withstand high tropical sunshine conditions	State
4.2.7	Final colour of the insulator housing	Specify
4.2.8	Insulator fitted with ball and socket coupling as per IEC 60120	Specify
	Material of manufacture for ball pin and socket	State
	Ball pin diameter of 16mm and supplied complete with a corresponding "R" form retaining clip	State
	Security clip material of manufacture	State
4.3	**Characteristics**	

Clause number	Requirement	Bidder's offer
Table 1	**Mechanical and electrical characteristics of the insulators**	
	System Highest Voltage and Frequency (kV, Hz)	State
	Creepage distance, minimum (mm) – Inland/ Coastal	State
	Minimum Power Frequency Withstand Voltage (wet), 50 Hz, 1 min. (kVrms)	State
	Minimum Lightning Impulse Withstand Voltage, 1.2/50 µs, dry, positive (kVp)	State
	Minimum failing load (kN)	State
Table 2	**Withstand capabilities of insulator housing**	
	Minimum Lightning Impulse Withstand Voltage (kVp)	State
	Power Frequency Withstand Voltage for 1 min, (wet) (kVrms)	State
	Creepage distance minimum, (mm)	State
	Permissible head load static (SLL), (N)	State
	Permissible head load dynamic (SLL), (N)	State
	Short circuit withstand capability (rated short circuit withstand current, Is (kA)	State
	Permissible length of the active part, minimum (mm)	State
	Housing shield resistance (Ω)	State
	Number of units, (No.)	State
5	Test Requirements	Specify
6	**Marking and Packing**	
6.1	Marking	Specify
6.2	Packing	Specify
A	**Test and Inspection**	
A.1	Test standards and responsibility of carrying out tests	State
A.2	Copies of: design and type test certificates & reports, accreditation certificate, and scope of accreditation to ISO/IEC 17025 submitted with the tender	Provide
A.3	Acceptance tests to be witnessed by KPLC at the factory before shipment	State
A.4	Test reports for the insulators (including its individual components) to be submitted to KPLC for approval before shipment/ delivery	State compliance
A.5	Inspection at the stores and replacement of rejected items	State compliance
B	**Quality Management System**	

Clause number	Requirement	Bidder's offer
B.1	Quality Assurance Plan	Provide
B.2	Copy of ISO 9001:2015 Certificate	Provide
C	**Documentation and demonstration**	
C.1	Documents submitted with tender	Provide
C.2	Documents to be submitted by supplier to KPLC for approval before manufacture	List
	Statement of compliance to specification (indicate deviations if any & supporting documents)	State compliance

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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.*