



The Kenya Power & Lighting  
Co. Ltd.

TITLE:

**11kV & 33kV COMPOSITE  
INSULATORS  
Part 1: Suspension/Tension  
Insulators for inland  
applications- SPECIFICATION**

Doc. No.

KPLC1/3CB/TSP/04/017/3

Issue No.

2

Revision  
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Page 1 of 11

## TABLE OF CONTENTS

### 0.1 Circulation List

### 0.2 Amendment Record

## FOREWORD

1. SCOPE
2. REFERENCES
3. TERMS AND DEFINITIONS
4. REQUIREMENTS
- ANNEXES
5. TESTS AND INSPECTION
6. MARKING, PACKING AND LABELLING
7. GUARANTEED TECHNICAL PARTICULARS

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Issue No.	2
Revision No.	1
Date of Issue	2016-09-02
Page 2 of 11	

### 0.1 Circulation List

COPY NO.	COPY HOLDER
1	Manager, Standards
2	Electronic copy (pdf) on KPLC Server (currently: Network→stima-fprnt-001→techstd&specs)

### 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	Cancel and replaces Issue 1 Rev 2 dated 2008-04-10	S Kimitei	
Issue 2 Rev 1	2016-08-30	1.) Included IEC60363,ISO 9001:2008, and ISO/IEC 17025 at Clause 2, References	S. Nguli	P. Kimemia
		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 LABELING		
		Change of title		

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Doc. No.	KPLC1/3CB/TSP/04/017/13
Issue No.	2
Revision No.	1
Date of Issue	2016-09-02
Page 3 of 11	

## 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 11 & 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.

### 1. SCOPE

- 1.1 This specification is for composite insulators for use on overhead lines for tension and suspension purposes for inland application.
- 1.2 This specification covers the following composite insulators:
  - (i) 11kV Suspension/Tension Line Insulators;
  - (ii) 33kV Suspension/Tension Line Insulators.
- 1.3 The 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.

The specification stipulates the minimum requirements for 11 & 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.

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Issue No.	2
Revision No.	1
Date of Issue	2016-09-02
Page 4 of 11	

## 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) shall apply.

- ISO 1461: Metallic Coatings – Hot dip galvanized coatings on fabricated ferrous products – Requirements.
- ISO 1460: Metallic Coatings – Hot dip galvanized coatings on fabricated ferrous metals – Determination of mass per unit area – Gravimetric method.
- IEC 61109: Composite insulators for a.c. overhead lines with a nominal voltage greater than 1000V – Definitions, test methods and acceptance criteria.
- IEC 60120: Dimensions of ball and socket couplings of string insulator units.
- IEC 60815: Guide for the selection of insulators in respect of polluted conditions.
- IEC60363: Insulators for overhead lines with nominal voltages above 100v
- ISO 9001:2008: Quality management systems
- 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.

**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.

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Issue No. 2

Revision No. 1

Date of Issue 2016-09-02

Page 5 of 11

#### 4. REQUIREMENTS

##### 4.1 SERVICE CONDITIONS

The insulators shall be suitable for continuous operation outdoors in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C, heavy saline conditions along the coast and tropical sunshine conditions. The weather isokeraunic levels reach up to 180 thunderstorm days per year. The level of galvanizing for all ferrous parts and materials used 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 IEC standards and the requirements of this specification.

4.2.2. The insulator 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 Class 2A4.5.

4.2.5. Insulator sheds shall be open type, designed to minimize trapping of contamination. It shall be made of polymer having glazed brown or gray color. The silicon rubber housing shall be made by direct molding 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 color 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.

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Issue No.	2
Revision No.	1
Date of Issue	2016-09-02
Page 6 of 11	

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 shall be as follows:-

**Table 1: Mechanical and electrical characteristics of the insulators**

CHARACTERISTICS	12KV	36KV
System Highest Voltage	12kV, 50Hz	36kV, 50Hz
Creepage Distance - minimum	300 mm	900 mm
Minimum Power Frequency Withstand Voltage (wet), 50Hz, 1min.	38 kV	90 kV
Minimum Lighting Impulse Withstand Voltage, 1.2/50 $\mu$ s, dry, positive	95 kV	200 kV
Minimum Failing Load	70 kN	70 kN

**Table 2: Withstand capabilities of insulator housing**

Description	Units	Requirement	
Lightning impulse withstand voltage,	kVpk	95	200
Power frequency withstand voltage for 1 min, wet	kVrms	46	116
Creepage distance, 25mm/kV, minimum	mm	300	900
Permissible head load static (SLL),	N	175	
Permissible head load dynamic (SLL),	N	250	
Short circuit withstand capability (rated short circuit (withstand) current $I_s$ )	kA	20	
Permissible length of the active part, minimum	mm	135	145
Housing shield resistance	$\Omega$	<5,000	
Number of units		1	

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Issue No.	2
Revision No.	1
Date of Issue	2016-09-02
Page 7 of 11	

## ANNEXES

### 5. QUALITY MANAGEMENT SYSTEM



- 5.1 The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the insulator design, material, 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 fulfil the requirements of ISO 9001:2008.
- 5.2 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.

### 6. TESTS AND INSPECTION

- 6.2. Design tests, type tests, sampling tests and routine tests shall be done in accordance with the requirement of 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 all the tests specified.
- 6.3. Copies of previous design and type test reports 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.

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

- 6.3.1. Tests on interfaces and connections of metal fittings;
- 6.3.2. Assembled core load-time test;
- 6.3.3. 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);
- 6.3.4. Tests for the core material;

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Issue No.	2
Revision No.	1
Date of Issue	2016-09-02
Page 8 of 11	

- 6.3.5. Flammability test;
  - 6.3.6. Dry lightning impulse withstand voltage test;
  - 6.3.7. Wet power frequency test;
  - 6.3.8. Mechanical load-time test and test of the tightness of the interface between end fittings and insulator housing.
- 6.4. Routine and sample test reports for the insulators to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. 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 and the following:

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

## 7. MARKING, PACKING AND LABELLING

- 7.2. The following information shall be marked indelibly and legibly in a permanent manner by embossing on each insulator during manufacture:
- i) Manufacturer's Name or Trademark
  - ii) Manufacturer's Type Designation
  - iii) Voltage Rating
  - iv) Specified Mechanical Load
  - v) The letters "**Property of KPLC**"
- 7.3. All marking shall be 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.
- 7.4. 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

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Issue No.	2
Revision No.	1
Date of Issue	2016-09-02
Page 9 of 11	

bindings shall be designed to keep the crate firmly closed and permit easy and rapid opening at time of installation.

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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Issue No.	2
Revision No.	1
Date of Issue	2016-09-02
Page 10 of 11	

**8. 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 design & type test certificates and design & type Test reports for tender evaluation

Clause	KPLC Requirement	Bidder's offer
1	Name of Manufacturer & Country of Origin of insulators being offered	
2	Type Reference/Model Number of insulators offered	
3	Applicable Standards	
4.1	Service Conditions	
4.2	Maximum System Voltage (kV)	
4.3	One-minute power frequency withstand voltage, 50Hz, wet. (kV rms)	
4.4	Lightning impulse withstand voltage, 1.2/50 $\mu$ s, dry, positive (kV <sub>p</sub> )	
4.5	Minimum creepage distance (mm)	
4.6	Specified mechanical load, tension (kN)	
4.7	Length of insulator set with fittings (mm)	
4.8	Material of fittings and level of corrosion protection	
4.9	Material of rod	
	Material of housing and sheds	
	Socket, size & standard	
	Ball, size & standard	
5.1	List of copies of Design and Type Test Reports submitted (indicate Test Report Numbers, Testing Authority and contact addresses)	

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Issue No.	2
Revision No.	1
Date of Issue	2016-09-02
Page 11 of 11	

5.2	List Acceptance Tests to be witnessed by KPLC Engineers at the factory	
5.3	List of catalogues, brochures, technical data, drawings, customer sales records, reference letters and details of manufacturer's production capacity and manufacturing experience submitted to support the offer.	
6.1	Marking (indicate parameters and method of marking to be used during manufacture)	
8.0	Copy of ISO 9001:2008 Certificate submitted (indicate validity)	
9.0	Statement of compliance to specifications	

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

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