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## 0.1 Circulation List

| COPY NO. | COPY HOLDER |
|---|---|
| 1 | Research & Development Manager |
| 2 | Procurement Manager |
| 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 1 Rev 1 | 2013-11-14 | -Changed Document Number prefix from KPLC1 to KP1 and inserted new logo<br>-Included Low Voltage Stay Insulators | S. Kimitei | G. Owuor |
| | | | | |
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## FOREWORD

This specification has been prepared by the Research and Development Department of The Kenya Power & Lighting Company Limited (abbreviated as KPLC) and it lays down requirements for Porcelain Stay Insulators (upto 33kV). The specification is intended for use by KPLC in purchasing the insulators.

The supplier shall submit information which demonstrates satisfactory service experience with products which fall within the scope of this specification.

## 1. SCOPE

This specification is for porcelain stay insulators for use on overhead power distribution lines operating at a nominal voltage of up to 33kV 50Hz.

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 porcelain stay insulators acceptable for use in the company and it shall be the responsibility of the Supplier to ensure adequacy of the design, adherence to applicable standards and the specification, good workmanship and good engineering practice in the manufacture of the insulators for The Kenya Power & Lighting Company Limited.

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

## 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.

IEC 60383: Tests on insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000V.

IEC 60060-1: High-voltage test techniques. Part 1: General definitions and test requirements.

BS 137: Insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000V.

BS 183: Specification for general purpose galvanized steel wire strand.

## 3. TERMS AND DEFINITIONS

The terms and definitions given in the reference standards shall apply.

## 4. REQUIREMENTS

### 4.1 Service Conditions

The insulators shall be suitable for continuous use 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, in direct sunlight, heavy saline conditions along the coast and isokeraunic levels of up to 180 thunderstorm days per year.

### 4.2. DESIGN, MATERIALS AND CONSTRUCTION

4.2.1 The insulator shall be designed for insulation of stays to reduce risk of dangerous potential gradients at ground level and, in the case of stays on earthed structures, to prevent electrolytic corrosion of stay rods.

4.2.2 The insulating material shall be porcelain.

The porcelain shall be sound, thoroughly vitrified and free from defects and blemishes which might adversely affect the life of the insulator. The exposed parts of the porcelain shall be smoothly glazed and shall be brown in colour.

4.2.3 The insulator shall be free from stresses due to expansion and contraction in any part which may lead to deterioration.

4.2.4 The holes in the insulator shall be smoothly radiused with as large a radius as practicable to present an even bearing surface to the stay strand loop.

### 4.3 PARTICULAR REQUIREMENTS

#### 4.3.1 Particular Requirements for 11kV Stay Insulators

The insulator shall be strain type suitable for stay wire size 7/4.00mm Grade 700 (7/8 SWG), stay wire to BS 183.
The minimum failing load of the insulator shall be: 110kN
The minimum power frequency wet flashover voltage shall be: 20kV, r.m.s.
The minimum impulse withstand voltage shall be: 60kV peak, positive.
The insulator shall be to the general arrangement drawing shown in Drg. no. tsp/04/016/01.

### 4.3.2. Particular Requirements for 33kV Stay Insulators

The insulator shall be strain type suitable for stay wire size 19/3.55mm Grade 700 (19/10 SWG), stay wire to BS 183.
The minimum failing load of the insulator shall be: 110kN
The minimum power frequency wet flashover voltage shall be: 48kV, r.m.s.
The minimum impulse withstand voltage shall be: 100kV peak, positive.
The insulator shall be to the general arrangement drawing shown in DRG. NO. TSP/04/016/02.

### 4.3.3. Particular Requirements for Low Voltage Stay Insulators

The insulator shall be strain type suitable for stay wire size 4/4.00mm Grade 700 (4/8 SWG), stay wire to BS 183.
The minimum failing load shall be: 80kN
The power frequency flashover voltage, wet shall be: 18kV, r.m.s.
The power frequency flashover voltage, dry shall be: 35kV, r.m.s
The insulator shall be to the general arrangement drawing shown in DRG. NO. TSP/04/016/03

## 5. TESTS AND INSPECTION

5.1 Type tests, routine tests and sample tests shall be done following procedures specified in IEC 60383, IEC 60060-1, BS 137 and the requirements of this specification. It shall be the responsibility of the manufacturer to perform or to have performed the tests specified.

5.2 Copies of previous Type Test Certificates and Type Test Reports by a third party testing laboratory accredited to ISO/IEC 17025 shall be submitted with the offer for evaluation. A copy of the accreditation certificate for the testing laboratory shall also be submitted with the tender (all in English Language).

Type test reports to be submitted shall include the following:

- dry lightning impulse withstand voltage test,
- power-frequency flashover voltage test (wet),
- verification of dimensions,

- porosity test and
- test for mechanical strength (failing load test).

Type Test Reports for stay insulator of similar or higher voltage rating and similar or higher mechanical failing load shall be accepted as representative for any of the stay insulators on tender.

5.3 A sample of each type of stay insulator offered shall be submitted with the bid documents for evaluation.

5.4 The insulators shall be subject to acceptance tests at the manufactures' works before dispatch. Acceptance tests shall be witnessed by two Engineers appointed by The Kenya Power and Lighting Company Limited (KPLC).

Factory Acceptance Tests shall include impulse withstand voltage test, wet power-frequency withstand voltage test, verification of dimensions, porosity test and test for mechanical strength

5.5 On receipt of the insulators 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, insulators which upon examination, test or use fail to meet any or all of the requirements in the specification.

## 6. MARKING, LABELLING AND PACKING

6.1 The following information shall be clearly and indelibly marked on each insulator:

a) Name or trade mark of the manufacturer
b) Mechanical failing load
c) The letters KPLC followed by the purchase order number

The marking may be printed or impressed provided such impressions do not impair the performance of the insulator.

6.2 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.

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.

## 7. TECHNICAL DOCUMENTATION

7.1 The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) for tender evaluation.

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

a) Guaranteed Technical Particulars of the stay insulator to be manufactured,
b) Design drawings and construction details of the stay insulator,
c) Quality assurance plan (QAP) that will be used to ensure that the insulator 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 9001:2008
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, good workmanship, good engineering practice and adherence to applicable standards in the manufacture of the stay insulators for KPLC,
g) Packaging details (including packaging materials).

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**ANNEX A: Guaranteed Technical Particulars** *(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, details of manufacturing capacity, the manufacturer's experience and copies of type test certificates, type test reports and accreditation certificate to ISO/IEC 17025 for the testing laboratory for tender evaluation, all in English Language)*

**TENDER NO**..... .....
**BIDDER'S NAME & ADDRESS** .....

| No. | Requirements | BIDDER'S OFFER |
|---|---|---|
| 1. | Name of the manufacturer and country of manufacture | |
| 2. | Applicable standards | |
| 3. | Service conditions | |
| 4. | Voltage Rating | |
| 5. | Type of insulator (strain type required) | |
| 6. | Size of stay wire to be used | |
| 7. | Minimum mechanical failing load of the insulator | |
| 8. | Minimum power frequency flashover voltage, wet | |
| 9. | Minimum impulse withstand voltage, positive | |
| 10. | Drawing submitted (indicate drawing number) | |
| 11. | Materials, colour and finish | |
| 12. | Manufacturer's Guarantee and Warranty | |
| 13. | List catalogues, brochures, technical data and drawings submitted to support the offer. | |
| 14. | List customer sales records submitted to support the offer. | |
| 15. | List Type Test Certificates and their Test Reports submitted with tender (indicate test report numbers, date, Testing Institution and contact addresses)<br>• Dielectric tests (Lightning Impulse and | |

| | | | |
|---|---|---|---|
| | Power Frequency Withstand Tests).<br>• Mechanical Failing Load.<br>• Verification of Dimensions.<br>• Porosity Test. | | |
| 16. | List Acceptance Tests to be witnessed by KPLC Engineers at the factory. | | |
| 17. | Copy of ISO 9001:2008 Certificate submitted (indicate validity) | | |
| 18. | Quality Assurance Program/Plan | | |
| 19. | Statement of compliance to tender specifications | | |
| 20. | Comments on tender specifications | | |
| 21. | Deviations from tender specifications and supporting data, test reports, technical documents etc. | | |
| 22. | Inspection of the insulators at KPLC stores/site. | | |
| 23. | Marking | Name or trade mark of the manufacturer | |
| | | Mechanical failing load & Unit | |
| | | The letters KPLC | |
| | | Purchase order number | |
| | Packaging | | |

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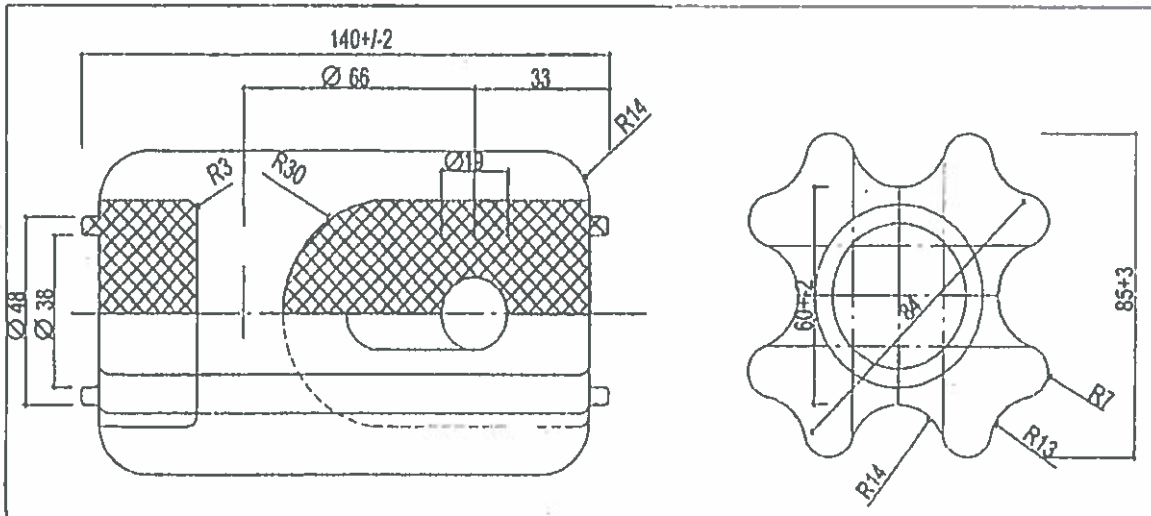
**Manufacturer's Name, Signature, Stamp and Date**




Technical specification

1.part shows without glaze,the other parts are all in brown glage.

2.Mechanical failing load:110KN

3.power frequency wet flashover voltage:20KV

4.Impulse withstand voltage:60Kv

5.standard:BS137

6.Transition:All transition between surface must be smooth to provide even bearing for stay wire.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
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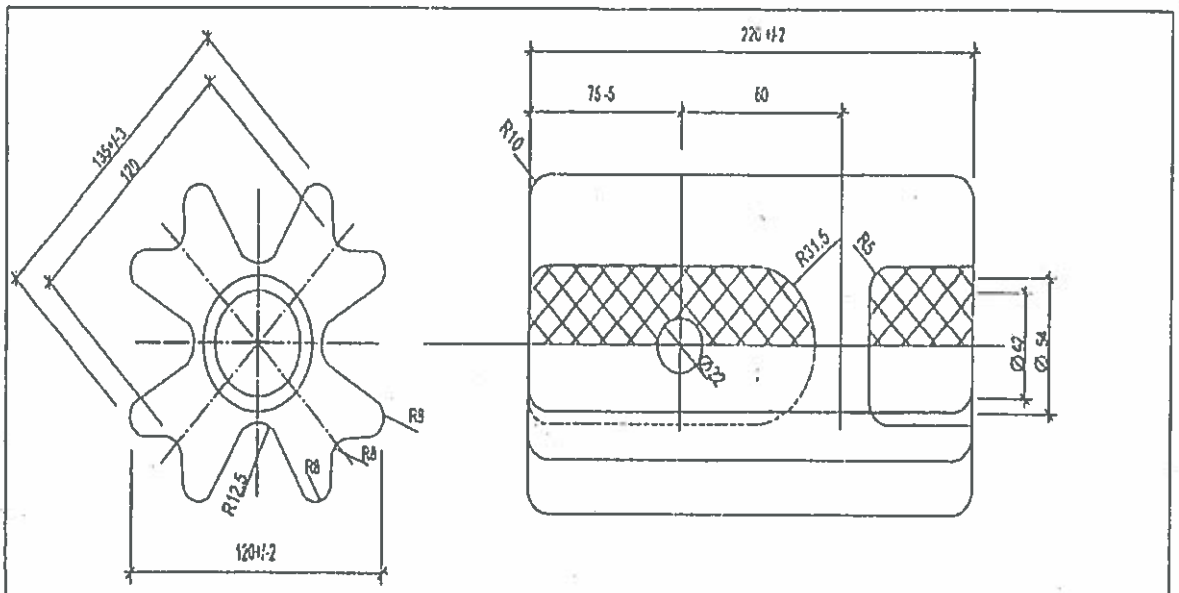
11KV porcelain insulator stay

K. P. & L. Co. Ltd

Drg. no.tsp/04/016/01




TECHNICAL SPECIFICATION

1.part shows without glaze,the other parts are all in brown glaze.

2.Mechanical failing load:110KN

3.Power frequency wet flashover voltage:42KV

4.Impulse withstand voltage:100KV

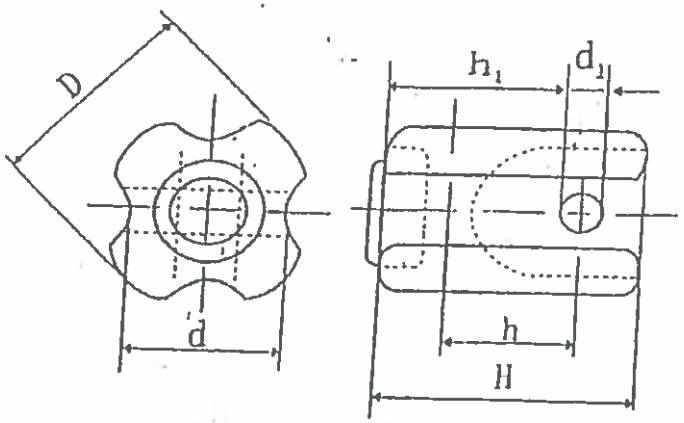
5.Standard:BS137

6.Transitions:All transition between surface must be smooth to provide even bearing for stay wire.

33kv porcelain insulator stay

K. P. & L. Co. Ltd

DRG NO:TSP/04.016/02




| DIMENSIONS (mm) | REQUIREMENT, nominal |
|---|---|
| H | 103 |
| h | 49 |
| $h_1$ | 62 |
| D | 82 |
| d | 49 |
| $d_1$ | 22 |

**DRG. NO. TSP/04/016/03: Low Voltage Stay Insulator**

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| Issued by: Head of Section, Technical Stds & Specs | Authorized by: Research and Development Manager |
|---|---|
| Signed: | Signed: |
| Date: 2008-12-30 | Date: 2008-12-30 |

## 0.1 Circulation List

| COPY NO. | COPY HOLDER |
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| 1 | Research & Development Manager |
| 2 | Supplies Manager |
| 3 | Stores & Stock Control Manager |
| 4 | Transmission Manager |
| 5 | Distribution Manager |
| 6 | Assistant Manager, Technical Audit |

## 0.2 Amendment Record

| Rev No. | Date (YYYY-MM-DD) | Description of Change | Prepared by (Name & Signature) | Approved by (Name & Signature) |
|---|---|---|---|---|
| | | | | |
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## FOREWORD

This specification has been prepared by the Research and Development Department of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for Wooden Stay Insulators (Permali Stay Insulators). It is intended for use by KPLC in purchasing the insulators.

It shall be the responsibility of the manufacturer to ensure adequacy of the design and good engineering practice in the manufacture of the insulators for KPLC. The manufacturer shall submit information which confirms satisfactory service experience with products which fall within the scope of this specification.

## 1. SCOPE

1.1 This specification covers Wooden Stay Insulators also referred to as Permali Stay Insulators for use on overhead power lines operating at voltages of up to 66kV, 50Hz.

1.2 The specification covers Double Beam Wooden Stay Insulators for use with 19/10 SWG stay wire on overhead power lines operating at voltages of up to 66kV, 50Hz.

## 2. REFERENCES

The following documents were referred to during the preparation of this specification; in case of conflict, the requirements of this specification shall take precedence.

ISO 1461: Metallic Coatings – Hot dip galvanized coatings on fabricated ferrous products – Requirements.

IEC 383: Tests on insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000V.

BS4360: Specification for weldable structural steels.

BS183: Specification for general purpose galvanized steel wire strand.

## 3. TERMS AND DEFINITIONS

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

## 4. REQUIREMENTS

### 4.1 SERVICE CONDITIONS

The insulators shall be suitable for continuous use 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 level of galvanizing for all ferrous parts and all materials used shall be suitable for these conditions.

### 4.2. MATERIALS AND CONSTRUCTION

4.2.1. The Wooden Stay Insulators shall be manufactured from impregnated laminated wood not subject to natural timber defects such as variability, splitting, weathering and moisture absorption.

4.2.2. The wood shall have high impulse flashover values and be free from defects that can lead to damage from lightning strikes and power arcs. Neither thorough wetting nor surface deposits shall affect the performance.

4.2.3. All the steelwork shall meet the requirements of BS 4360 and galvanized to ISO 1461. Nuts and bolts shall meet the requirements of relevant ISO Standards.

Note: The stay wire to be used is manufactured to BS 183.

4.2.4. The insulators shall offer good mechanical and electrical properties (as required in clause 4.2.6) and shall give satisfactory service for long periods under the specified conditions.

4.2.5. The stay wire insulators shall be supplied complete with hot – dip galvanized metal fittings and accessories including splice thimbles. Both ends shall be identical and the horn tangs and bolts shall be keyed into the end plates for positive positioning and single spanner assembly.

### 4.2.6. MECHANICAL AND ELECTRICAL PROPERTIES

4.2.6.1 The stay insulators shall be of the following minimum mechanical properties:

| Assembly | Wooden Section | Stay wire to BS 183 | U.B.S. of stay wire | Required Breaking Strength of complete assembly |
|---|---|---|---|---|
| Double Beam | 23mm x 44mm | 19/10 SWG | 110kN | 122kN |

4.2.6.2 The stay insulators shall withstand the following impulse flashover voltages (peak):

| Assembly | Dimensions: Horn Gap (m) | Insulator condition | Impulse withstand, peak (kV) |
|---|---|---|---|
| Double Beam | 1.04 | New & Dry | 645 |

## 5. TESTS AND INSPECTION

5.1 Tests shall be done in accordance with the requirement of this specification and relevant IEC standard. It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified.

5.2 Certified true copies of previous test reports by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited 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 to be submitted shall include the following:

5.2.1 Impulse withstand test, peak (kV);
5.2.2 Breaking Strength of complete assembly (kN);
5.2.3 Verification of Dimensions;

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

Acceptance tests shall include the following tests as per applicable latest IEC Standards:

5.3.1 Verification of dimensions;
5.3.2 Verification of tightness of the interface between end fittings and insulator;
5.3.3 Verification of the Breaking Strength of complete assembly;
5.3.4 Galvanizing test (by Gravimetric method).

## 6. MARKING AND LABELLING

6.1 The following information shall be marked indelibly and legibly on the insulator.

a) Name or trade mark of the manufacturer
b) Year of manufacture
c) Ultimate Breaking Strength (U.B.S.) of complete assembly in kN
d) Impulse withstand voltage (peak), kVp

The marking shall not impair the performance of the insulator.

6.2 A set of Three (3) installation and technical manuals for the insulators shall be submitted during delivery (all in English Language).

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ANNEX A: **Technical Particulars** *(to be filled and signed by the Manufacturer for all clauses and submitted together with catalogues, brochures, drawings, technical data and test reports for tender evaluation)*

| Description | Bidder's offer |
|---|---|
| 1. Service Conditions | |
| 2. Applicable Standards | |
| 3. Maximum System Voltage (kV) | |
| 4. One-minute power frequency withstand voltage, 50Hz, wet. (kV) | |
| 5. Lighting impulse withstand voltage, 1.2/50 pos. (kV) | |
| 6. Minimum horn gap distance (mm) | |
| 7. Ultimate Breaking Strength (kN) | |
| 8. Length of insulator set with fittings (mm) | |
| 9. Material of fittings and level of corrosion protection | |
| 10. Material of insulating part | |
| 11. List of copies of Test Reports submitted (indicate Test Report Numbers, Testing Authority & Contact Addresses) | |
| 12. List Acceptance Tests to be witnessed by KPLC Engineers at the factory | |
| 13. List of catalogues, brochures, technical data, drawings and customer sales records submitted to support the offer. | |
| 14. Statement of Compliance to Specifications | |

.....

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

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## 0.1 Circulation List

| COPY NO. | COPY HOLDER |
|---|---|
| 1 | Research & Development Manager |
| 2 | Procurement Manager |
| 3 | Stores & Stock Control Manager |
| 4 | Chief Manager Distribution |
| 5 | Deputy Manager, Technical Audit |

## 0.2 Amendment Record

| Rev No. | Date (YYYY-MM-DD) | Description of Change | Prepared by (Name & Signature) | Approved by (Name & Signature) |
|---|---|---|---|---|
| | | | | |
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## FOREWORD

This specification has been prepared by the Research and Development Department of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for 66KV Post Insulators. The Specification is to be used by KPLC for procurement of the insulators.

## 1. SCOPE

1.1 This specification is for line post insulators for use on overhead power distribution lines operating at 66kV 50Hz on either wood or pre-stressed round hollow concrete poles.

1.2 This specification covers the following insulators:

(i) Type 1A: 66kV Line Post Insulators of Porcelain Material for use on wooden poles.

(ii) Type 1B: 66kV Line Post Insulators of Porcelain Material for use on concrete poles.

(iii) Type 2A: 66kV Line Post Composite Insulators (Silicon Rubber) for use on wooden poles.

(iv) Type 2B: 66kV Line Post Composite Insulators (Silicon Rubber) for use on concrete poles

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 66kV line post 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. 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.

IEC 720: Characteristics of line post insulators.

IEC 168: Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1000V.

IEC 815: Guide for the selection of insulators in respect of polluted conditions.

IEC 1109: Composite insulators for a.c. overhead lines with a nominal voltage greater than 1000V – Definitions, test methods and acceptance criteria.

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

## 3. TERMS AND DEFINITIONS

For the purpose of this specification, definitions given in the reference standards shall apply.

## 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 isokeraunic levels of up to 180 thunderstorm days per year.

The minimum nominal specific creepage distance shall be 25mm/kV suitable for Pollution level III (Heavy) as per IEC 815.

### 4.2. MATERIALS AND CONSTRUCTION

4.2.1 The insulating material shall be porcelain or silicon rubber.

4.2.1.1 Where porcelain is used, it shall be sound, free from defects, thoroughly vitrified, smoothly glazed and of uniform brown colour.

4.2.1.2 Composite insulator shall be made of composite materials of high resistance to moisture, ultraviolet radiation, high temperatures and tropical sunshine conditions. The core shall be made of resin-impregnated glass fibres free from defects. The housing of the insulator shall be manufactured from high quality silicone rubber. The final colour of the insulator housing shall be BROWN.

4.2.2 The post insulator shall be free from stresses due to expansion and contraction in any part which may lead to deterioration.

No chemical reaction between materials due to contact shall be allowed (e.g. between cement and metal fittings).

4.2.3 The under surface and grooves of sheds or skirts shall be easy cleaning. Sheds shall be substantially symmetrical in shape without appreciable warping.

4.2.4 The line post insulator shall be of clamp-top type suitable for both vertical and horizontal mounting as per IEC 720, and as follows:

(a) Horizontal mounting

i) Wooden poles: the insulator shall be complete with an integral curved base suitable for direct bolting (by two bolts) onto a wooden pole. The bolt size shall be M20.

ii) Concrete poles: The insulator shall be complete with galvanized metal brackets/fittings for attachment to prestressed round concrete pole at an angle of 5° from the horizontal. The brackets and fittings shall withstand the failing load of the insulator.

iii) Galvanizing shall be in accordance with ISO1461.

(b) Vertical mounting

i) Wooden poles: the insulator shall be complete with a longitudinal bracket and accessories suitable for direct bolting (by two bolts) onto a wooden pole. The bolt size shall be M16.

ii) Concrete poles: The insulator shall be complete with galvanized metal brackets/fittings for attachment to prestressed round concrete pole. The brackets and fittings shall withstand the failing load of the insulator.

iii) Galvanizing shall be in accordance with ISO1461.

(c) Each line post insulator shall be complete with conductor connector (clamp-top type) suitable for aluminium conductors of sizes 150-300mm².

*Detailed drawings showing required mounting arrangements and accessories shall be submitted with the Tender for evaluation.*

## 4.3. RATINGS

4.3.1 The mechanical and electrical ratings of the insulators shall be as follows:

| | |
|---|---|
| Minimum failing load | 12.5kN |
| Minimum creepage distance | 1800 mm (25 mm/kV) |
| Minimum Dry Arcing distance | 686 mm |
| Minimum wet power frequency withstand voltage | 170kV |
| Minimum lightning impulse withstand voltage | 350kV |

## 4.4 QUALITY MANAGEMENT SYSTEM

4.4.1 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 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 9001:2008.

4.4.2 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.

4.4.3 Details and supporting documents for the manufacturer's experience and manufacturing capacity of similar insulators shall be submitted with the tender.

## 5. TESTS AND INSPECTION

5.1 Type tests, routine tests, and sample tests shall be done in accordance with the requirement of IEC 168, IEC 1109 and the requirements of this specification. It shall be the responsibility of the manufacturer to perform or to have performed the tests specified and other tests normally performed at works.

5.2 Copies of previous Test Reports from the National or International Testing Authority or an ISO/IEC 17025 accredited independent Laboratory shall be submitted with the tender for the purpose of technical evaluation, all in the English Language. Copies of Test Reports to be submitted shall include Design and Type Tests in accordance with IEC 168 and IEC 1109.

5.3 Routine and Sample Test Reports for the insulators to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. The Test Reports shall be from an ISO/IEC 17025 accredited Laboratory.

5.4 On receipt of the insulators, KPLC may perform routine and sample tests in order to verify compliance with specification. The supplier shall replace without charge to KPLC, any insulators which upon examination, test or use fail to meet any of the requirements in this specification.

## 6. PACKING, MARKING AND INSTRUCTIONS

6.1 The following information shall be marked indelibly and legibly on the insulator:

i) Manufacturers Name or Trademark
ii) Type Designation and Batch Number
iii) Year of manufacture
iv) Failing Load (cantilever)
v) The letters 'KPLC'

6.2 Instructions for storage, handling and installation shall be included in each package, all in the English Language.

6.3 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.

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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**ANNEX A: 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 and copies of certificates/test reports for tender evaluation)*

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

| Clause number | **Bidder's offer** (indicate full details of the offered insulator for each requirement of the specification) |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4.1 | |
| 4.2.1 | |
| 4.2.2 | |
| 4.2.3 | |
| 4.2.4 (a) (i) | |
| (a) (ii) | |
| (b) (i) | |
| (b) (ii) | |
| (c) | |
| 4.3.1 | |
| 4.4.1 | |
| 4.4.2 | |
| 4.4.3 | |
| 5.1 | |
| 5.2 | |
| 5.3 | |
| 5.4 | |
| 5.4 | |
| 6.1 | |
| 6.2 | |
| 6.3 | |

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

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## 0.1 Circulation List

| COPY NO. | COPY HOLDER |
|---|---|
| 1 | Research & Development Manager |
| 2 | Supplies Manager |
| 3 | Stores & Stock Control Manager |
| 4 | Operations & Maintenance Manager |
| 5 | Deputy Manager, Technical Audit |

## 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 | 2010-04-06 | Cancels and replaces Issue 1 Rev 2 dated April 10, 2008 | S Kimitei | G Owour |
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## FOREWORD

This specification has been prepared by the Research and Development Department of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for 11 & 33kV Pin Type Composite Insulators. It is intended for use by KPLC in purchasing the insulators.

The manufacturer shall submit information which confirms 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 power lines.

1.2 This specification covers the following composite insulators:

(i) 11kV Pin Type Composite Insulators;

(ii) 33kV Pin Type Composite Insulators.

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 Pin Type Composite Insulators acceptable for use in the company (KPLC) 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. 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.

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.

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 60383: Tests on insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000V

## 3. TERMS AND DEFINITIONS

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

## 4. REQUIREMENTS

### 4.1 SERVICE CONDITIONS

The insulators shall be suitable for continuous operation outdoors in tropical areas at altitudes of up to 2000m 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 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 be pin type moulded in one single piece and supplied complete with metal end fittings. Metal fittings shall be galvanized to ISO 1461 to suit service conditions specified in clause 4.1.

4.2.3. The insulator shall be made of composite materials of high resistance to moisture, ultraviolet radiation, high temperatures and tropical sunshine conditions. The core shall be made of resin-impregnated glass fibres free from defects. The housing of the insulator shall be manufactured from high quality silicone rubber.

4.2.4. The under surface and grooves of sheds or skirts shall be easy cleaning. Sheds shall be substantially symmetrical in shape without appreciable warping.

4.2.5. The insulator shall be suitable for both vertical and horizontal applications. It shall be suitable for both bare and protected conductors.

4.2.6. The insulator bottom metal end fitting shall be suitable for mounting on steel cross arm.

4.2.7. The top and side grooves shall be designed to accept conductor sizes in the range 7 – 18.2mm overall diameter.

4.2.8. The final colour of the insulator housing shall be BROWN.

## 4.3. CHARACTERISTICS

The mechanical and electrical characteristics of the insulators shall be as follows:-

| CHARACTERISTICS | 11kV INSULATOR | 33kVINSULATOR |
|---|---|---|
| Minimum Creapage Distance | 300 mm | 900 mm |
| Minimum Power Frequency Withstand Voltage (Wet), 50Hz 60s | 38 kV | 90 kV |
| Minimum Lighting Impulse Withstand Voltage (Dry), +ve, 1.2/50µs | 95 kVp | 200 kVp |
| Minimum Failing Load | 10 kN | 10 kN |

## 4.4. QUALITY MANAGEMENT SYSTEM

4.4.1 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 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 9001:2008.

4.4.2 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.

## 5. TESTS AND INSPECTION

5.1 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.

5.2 Copies of previous design and type test reports by the relevant 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 shall be submitted for tender evaluation:

5.2.1 Tests on interfaces and connections of metal fittings;
5.2.2 Assembled core load-time test;
5.2.3 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);
5.2.4 Tests for the core material;
5.2.5 Flammability test;
5.2.6 Dry lightning impulse withstand voltage test;
5.2.7 Wet power frequency test;
5.2.8 Mechanical load-time test and test of the tightness of the interface between end fittings and insulator housing.

5.3 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 the following tests as per IEC 1109 and applicable latest IEC standards:

5.3.1 Verification of dimensions;
5.3.2 Verification of the locking system;
5.3.3 Verification of tightness of the interface between end fittings and insulator housing;
5.3.4 Verification of the specified mechanical load;
5.3.5 Galvanizing test (by Gravimetric method).

## 6. MARKING AND LABELLING

6.1 The following information shall be marked indelibly and legibly and in a permanent manner on each insulator.

i) Manufacturer's Name or Trademark – embossed on largest silicon rubber shed;
ii) Manufacturer's Type Reference Number – embossed on silicon rubber portion over the metal fitting;
iii) Rated Voltage – embossed on the silicon rubber shed;
iv) Specified Mechanical Load – embossed on the metal fitting;
v) The letters 'KPLC' - embossed on silicon rubber portion over the metal fitting.

6.2 All marking shall be by embossing and marking on metal fittings shall be before galvanizing. The marking shall not affect the performance of the insulator.

6.3 Interpretation of the Type Reference Number (in terms of specified electrical characteristics) shall be given in the manufacturer's brochure/catalogue delivered together with the insulators (all in English language).

6.4 A set of Three (3) installation and technical manuals for the insulators shall be submitted during delivery.

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**ANNEX A: Guaranteed Technical Particulars** *(to be filled and signed by the Manufacturer and submitted together with copies of relevant Manufacturer's catalogues, brochures, drawings, technical data, sales records and copies of type test certificates and type test reports for tender evaluation)*

**TENDER NO .....**

| Description | Bidder's offer |
|---|---|
| 1. Manufacturer's name & address | |
| 2. Type Reference Number of insulator offered | |
| 3. Service Conditions | |
| 4. Applicable Standards | |
| 5. Maximum System Voltage (kV) | |
| 6. One-minute power frequency withstand voltage, 50Hz, 60s, wet (kV rms) | |
| 7. Lighting impulse withstand voltage, 1.2/50µs positive, dry, (kVp) | |
| 8. Minimum creepage distance (mm) | |
| 9. Specified mechanical load (kN) | |
| 10. Length of insulator with fittings (mm) | |
| 11. Material of fittings and level of corrosion protection | |
| 12. Material of rod | |
| 13. Material of housing and sheds | |
| 14. Conductor groove, size | |
| 15. Suitability for both vertical & horizontal application | |
| 16. List of copies of Design and Type Test Reports submitted (indicate Test Report Numbers, Testing Authority and contact addresses) | |
| 17. List Acceptance Tests to be witnessed by KPLC Engineers at the factory | |
| 18. List of catalogues, brochures, technical data, drawings and customer sales records submitted to support the offer. | |
| 19. Marking (indicate parameters and method of marking to be used during manufacture) | |
| 20. Copy of ISO 9001:2008 Certificate submitted (indicate validity) | |
| 21. Quality Assurance Plan | |
| 22. Deviations from tender specifications and supporting data, test reports, technical documents etc. | |

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

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## 0.1 Circulation List

| COPY NO. | COPY HOLDER |
|---|---|
| 1 | Research & Development Manager |
| 2 | Procurement Manager |
| 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 | Cancels and replaces Issue 1 Rev 2 dated 2008-04-10 | S Kimitei | G. K. Gathuge |
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## FOREWORD

This specification has been prepared by the Research and Development 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.

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.

## 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.

## 3. TERMS AND DEFINITIONS

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

## 4. REQUIREMENTS

### 4.1 SERVICE CONDITIONS

The insulators shall be suitable for continuous operation outdoors in tropical areas at altitudes of up to 2000m 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 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 insulator shall be of high resistance to moisture and ultraviolet radiation and withstand high tropical sunshine conditions.

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

4.2.5. 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 shall be as follows:-

| CHARACTERISTICS | 11kV INSULATOR | 33kV INSULATOR |
|---|---|---|
| System Highest Voltage | 12kV, 50Hz | 36kV, 50Hz |
| Minimum Creepage Distance | 300 mm | 900 mm |
| Minimum Power Frequency Withstand Voltage (wet), 50Hz, 1min. | 38 kV | 90 kV |
| Minimum Lighting Impulse Withstand Voltage, 1.2/50 µs, dry, positive | 95 kV | 200 kV |
| Minimum Failing Load | 70 kN | 70 kN |

## 4.4. QUALITY MANAGEMENT SYSTEM

4.4.1 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 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 9001:2008.

4.4.2 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.

## 5. TESTS AND INSPECTION

5.1 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.

5.2 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:

5.2.1 Tests on interfaces and connections of metal fittings;
5.2.2 Assembled core load-time test;
5.2.3 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);
5.2.4 Tests for the core material;
5.2.5 Flammability test;
5.2.6 Dry lightning impulse withstand voltage test;
5.2.7 Wet power frequency test;
5.2.8 Mechanical load-time test and test of the tightness of the interface between end fittings and insulator housing.

5.3 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:

5.3.1 Verification of dimensions;
5.3.2 Verification of the locking system;
5.3.3 Verification of tightness of the interface between end fittings and insulator housing;
5.3.4 Verification of the specified mechanical load;
5.3.5 Galvanizing test (by Gravimetric method).

## 6. MARKING, PACKING AND LABELLING

6.1 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 'KPLC'

6.2 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.

6.3 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.

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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**ANNEX A: 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)*

| Description | Bidder's offer |
|---|---|
| Name of Manufacturer & Country of Origin of insulators being offered | |
| Type Reference/Model Number of insulators offered | |
| 1. Service Conditions | |
| 2. Applicable Standards | |
| 3. Maximum System Voltage (kV) | |
| 4. One-minute power frequency withstand voltage, 50Hz, wet. (kV rms) | |
| 5. Lightning impulse withstand voltage, 1.2/50 µs, dry, positive ($kV_p$) | |
| 6. Minimum creepage distance (mm) | |
| 7. Specified mechanical load, tension (kN) | |
| 8. Length of insulator set with fittings (mm) | |
| 9. Material of fittings and level of corrosion protection | |
| 10. Material of rod | |
| 11. Material of housing and sheds | |
| 12. Socket, size & standard | |
| 13. Ball, size & standard | |
| 14. List of copies of Design and Type Test Reports submitted (indicate Test Report Numbers, Testing Authority and contact addresses) | |
| 15. List Acceptance Tests to be witnessed by KPLC Engineers at the factory | |
| 16. 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. | |
| 17. Marking (indicate parameters and method of marking to be used during manufacture) | |
| 18. Copy of ISO 9001:2008 Certificate submitted (indicate validity) | |
| 19. Statement of compliance to specifications | |

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

TSP04-017

# THE KENYA POWER AND LIGHTING CO. LTD.

✓ 98

## SPECIFICATION

*For*

## COMPOSITE INSULATORS

### Part 1: Suspension/Tension Line Insulators (11 & 33kV)

REVISION RECORD

| REVISION | ISSUE | COMPILED BY | DATE | APPROVAL |
|---|---|---|---|---|
| 0 | 1ST ISSUE | | 1999 – 04 - 02 | |
| 1 | 1ST ISSUE, REV 1 | | 2003 – 08 - 12 | |
| 2 | 2ND ISSUE | Asst. Engineer R&D | July 20, 2004 | Aug 04 |
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# SPECIFICATION FOR COMPOSITE INSULATORS
Part 1: Suspension/Tension Line Insulators (11 & 33kV)

## FOREWORD

This standard specification has been prepared by the Research and Development Department of KPLC and it lays down requirements for composite insulators for tension and suspension applications. It is intended for procurement of the materials from manufacturers.

This specification is based on IEC 61109 and is subject to revision as and when required.

This specification supersedes all specifications for composite insulators for tension and suspension applications issued before the revision date. It was prepared to establish and promote uniform requirements for composite insulators. The specification stipulates the minimum requirements for equipment acceptable for evaluation.

## 1. SCOPE

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

1.2. This specification covers the following composite insulators:

(i) 11kV Suspension/Tension Line Insulator

(ii) 33kV Suspension/Tension Line Insulator

## 2. REFERENCES

The following documents were referred to during the preparation of this specification; in case of conflict the provision of this specification shall take precedence.

IEC 120: Dimensions of ball and socket couplings of string insulator units.

IEC 815 Guide for the selection of insulators in respect of polluted conditions.

IEC 1109: Composite insulators for a.c. overhead lines with a nominal voltage greater than 1000V – Definitions, test methods and acceptance criteria.

# 3. TERMS AND DEFINITIONS

For the purpose of this specification, the definitions given in the reference standards shall apply.

# 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 and heavy saline conditions along the coast.

## 4.2. MATERIAL AND CONSTRUCTION

4.2.1. The insulators shall be manufactured in accordance with IEC 1109.

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

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

4.2.4. The insulator shall be fitted with ball and socket coupling in accordance to IEC 120.

The ball pin shall be of medium carbon steel.

The ball pin diameter shall be 16mm and shall be supplied with a corresponding "R" form retaining clip.

The security clip shall be of stainless steel or an approved copper alloy.

## 4.3. CHARACTERISTICS

The mechanical and electrical characteristics of the insulators shall be as follows:-

| CHARACTERISTICS | 11kV INSULATOR | 33kVINSULATOR |
|---|---|---|
| Minimum Creepage Distance | 390 mm | 1180 mm |
| Minimum Vertical Arcing Distance (between metal fittings) | 180 mm | 410 mm |
| Minimum Power Frequency Withstand Voltage (wet) | 38 kV | 90 kV |
| Minimum Lighting Impulse Withstand Voltage (dry) | 95 kV | 200 kV |
| Minimum Failing Load | 70 kN | 70 kN |

## 4.4. MARKING AND INSTRUCTIONS

4.4.1 The following information shall be marked permanently, indelibly and legibly on the insulator:

i) Manufacturers name or trademark
ii) Manufacturers type designation
iii) Year of manufacture
iv) Specified Electrical characteristics
v) Specified Mechanical Load

4.4.2 Instructions for storage, handling and installation shall be included in each package, all in English.

## 5. TESTS AND FACTORY INSPECTION

5.1 Design tests, type tests, sampling tests and routine tests shall be done in accordance with the requirement of IEC 1109. It shall be the responsibility of the manufacture to perform or to have performed all the tests specified.

5.2 Copies of previous Design and Type Test Reports certified by the National Testing/ Standards Authority of the country of manufacture or its accredited testing laboratory shall be submitted with the tender for the purpose of technical evaluation, all in English. A copy of the accreditation certificate for the testing laboratory shall be submitted in English.

5.3 The reports to be submitted shall cover tests on interfaces and connections of metal fittings, assembled core load-time test, test of housing: tracking and erosion test, tests for the core material, dry lightning impulse withstand voltage test, wet power-frequency test and mechanical load-time test all in accordance with IEC 1109.

5.4 Prior to the manufacture of insulators on order, the purchaser (KPLC) reserves the right to inspect the manufacturing facility and the quality management system at no extra cost save for the air travel (of two Engineers) to the nearest international airport in the country of manufacture.

5.5 Upon completion of manufacturing process, the insulators shall be subject to inspection by two KPLC Engineers at place of manufacture and sample tests carried out on samples picked at random in their presence. The sample tests shall be done in accordance with IEC 1109 and shall include verification of dimensions, verification of the locking system, verification of the specified mechanical load and galvanizing test among others.

Routine and Sampling Test Reports shall be completed and made available for approval before shipment/delivery of the insulators. **All Test reports shall be certified by an ISO/IEC 17025 accredited Laboratory recognized by the International Laboratory Accreditation Co-operation (ILAC). This is a requirement by the Kenya Government. . .**

## 6. TECHNICAL DOCUMENTATION

6.1. The Bidder shall submit a clause by clause statement of compliance with these specifications together with copies of the manufacturer's catalogues, brochures, technical data, drawings and test certificates clearly marked to support each clause, all in English for evaluation. The manufacturer's type reference /designation of the item offered shall be indicated.

6.2. In the case of tender award, technical details and drawings for the insulators to be supplied shall be submitted to the purchaser for approval before manufacture commences.

6.3. A detailed list & contact addresses of previous customers shall be submitted with the tender.

APPENDIX A: Statement of Compliance *(to be filled by the Supplier for all clauses and submitted for tender evaluation)*

| Clause Number | Bidder's offer | Manufacturer's catalogue, drawing, technical data or tests certificate Reference Page to support the offer. |
|---|---|---|
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NB: - This schedule does not in any way substitute for detailed information required elsewhere in the specification.

**Manufacturer's Declaration:** I .....on behalf of.....

**Declare that the above specifications matrix conforms to a typical tender item type..... as clearly marked in the attached technical brochures & drawings, and being offered for this tender.**

**Signature..... Date.....Stamp/Seal.....**

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## 0.1 Circulation List

| COPY NO. | COPY HOLDER |
|---|---|
| 1 | Head of Department Standards |
| 2 | Head of Department Procurement |
| Electronic copy (pdf) on KPLC server currently: http://172.16.1.40/dms/browse.php?fFolderId=23 | |

## 0.2 Amendment Record

| Rev No. | Date (YYYY-MM-DD) | Description of Change | Prepared by (Name & Signature) | Approved by (Name & Signature) |
|---|---|---|---|---|
| 2 | 2010-02-20 | 1. Changed title scope, reference & content to PIN type insulator<br>2. Included letters KPLC in marking | Eng. Simon Kimitei | Godfrey Gathige |
| Issue 1 Rev 0 | 2015-01-21 | Replaces Issue 2 Rev. 1; KPLC1/3CB/TSP/04/012 | Michael Apudo | Dr. Eng. Peter Kimemia |
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## FOREWORD

This specification has been prepared by the Standards Department in collaboration with Network Management Division both of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for 11kV porcelain insulators for industrial/inland installations. It is intended for use by KPLC in purchasing the insulators.

The supplier 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 porcelain insulators for use on overhead power distribution lines operating at a nominal voltage of 11kV, with the maximum operating voltage of 12kV and frequency of 50Hz.

1.2. The specification covers 11kV porcelain insulators (complete with spindle/pilot pin) to be used in industrial/inland installations.

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.

1.4. The specification stipulates the minimum requirements for 11kV porcelain insulators (c/w spindle/pilot pin) acceptable for use in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good workmanship, good engineering practice and adherence to standards, specifications and applicable regulations in the manufacture of the insulators for The Kenya Power & Lighting Company Ltd.

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

## 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.

IEC 60383: Insulators for overhead lines with a nominal voltage above 1000 V -- Part 1: Ceramic or glass insulator units for a.c. systems. Definitions, test methods and acceptance criteria.

| | |
|---|---|
| IEC 60815: | Selection and dimensioning of high-voltage insulators intended for use in polluted conditions -- Part 1: Definitions, information and general principles – Part 2: Ceramic and glass insulators for a.c. systems |
| ISO 1461: | Metallic Coatings – Hot dip galvanized coatings on fabricated ferrous products – Requirements. |
| ISO 898-2: | Mechanical properties of fasteners made of carbon steel and alloy steel -- Part 2: Nuts with specified property classes -- Coarse thread and fine pitch thread |
| BS 137: | Insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000V a.c. – Part 2: Requirements |
| BS 3288: | Insulators and conductor fittings for overhead power lines - Part 2: Specification for selected limits of size. |
| BS 3643: | ISO metric screw threads. - Part 2: Specification for selected limits of size. |
| BS 4464: | Specification for spring washers for general engineering and automobile purposes. Metric series |
| PD 970: | Wrought steels for mechanical and allied engineering purposes — Requirements for carbon, carbon manganese and alloy hot worked or cold finished steels |
| ANSI C29.6: | Wet process porcelain insulator- High voltage pin type |

## 3. TERMS AND DEFINITIONS

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

**Effective thread** - the thread, after galvanizing or after being given any other suitable anti-corrosion protection, and shall take a nut for the distance stated.

## REQUIREMENTS

### 4.1. SERVICE CONDITIONS

The insulators shall be suitable for continuous operation outdoors in tropical areas and installations in areas located in:

(i) Close proximity to an industrial pollution source - site pollution severity (SPS) of class E6 (heavy) as per IEC 60815-1 clause 8.
(ii) Humidity of up to 95%,

(iii) Average ambient temperature of +35 ° C.
(iv) Altitude of not more than 2200m above sea level.

## 4.2. DESIGN AND CONSTRUCTION

4.2.1. The insulator shall consist of a wet processed porcelain part and a galvanized steel spindle complete with nuts, ring and spring washer.

4.2.2. The insulator shall have a standard or open profile with shed inclinations between 14° - 24° for the shed top angle and 8° – 16° for the shed bottom angle conforming to IEC 60815-2 requirements and Fig. 2.

4.2.3. The insulator shall be tie-top type with spindle / pilot pin base and shall be suitable for both vertical and horizontal mounting; classified as a class B insulator in accordance with IEC 60383.

4.2.4. The insulator shall have a cemented zinc thimble pin-hole thread suitable for M22 large steel head spindle as per BS 3288-2. The insulator shall be supplied complete with the steel spindle or pilot pin suitable for mounting on steel crossarm . The spindle shall have components and dimensions as per Fig. 1b.

4.2.5. Both the spindle and pilot pin shall be a single piece obtained by the process of forging with no joints. They shall not be made by joining, welding, shrink-fitting or any other process from more than one piece of material.

4.2.6. They shall be of good finish, free from flaws and other defects. The finish of the collar shall be such that a sharp angle between the collar and the shank is avoided and that the collar or the seating surface of the metal base shall bed down correctly on to the cross-arm when fixed to that through a hole and diameter of which is 2 mm greater than the diameter of the shank.

4.2.7. The threads of nuts and tapped holes shall be cut after galvanizing and shall be well oiled or greased. All other threads shall be formed before galvanizing.

4.2.8. Threads shall be compatible for use with pin insulators as per BS 137 with a coarse pitch series with thread tolerance class 6g for external threading and 6H for internal threading in accordance with BS 3643-2 prior to galvanizing.

## 4.3. MATERIALS

### 4.3.1. Insulating material

4.3.1.1. The insulating material shall be good commercial-grade wet-processed porcelain conforming to ANSI C29-6, 1996.The porcelain shall be sound, free from flaws and blemishes, thoroughly vitrified, smoothly glazed and of uniform brown colour when finished.

4.3.1.2. The insulator shall be free from stresses due to expansion and contraction in any part which may lead to deterioration. No chemical reaction between materials due to contact (e.g. between cement and metal fittings) shall be allowed.

4.3.1.3. The under surface and grooves of sheds or skirts shall be easy cleaning. Sheds shall be substantially symmetrical in shape without appreciable warping.

### 4.3.2. Spindle

4.3.2.1. The spindle shall be of galvanized steel complying with any grade of steel with reference symbol P, minimum tensile strength of 550 MPa and surface hardness of more than 160 HV in accordance with PD 970.

4.3.2.2. The nuts used in the spindle shall be two (2) in number and shall conform to property 4.8 of ISO 898-2 and one spring washer conforming to BS 4464.

4.3.2.3. All ferrous parts shall be hot dip galvanized in accordance with ISO 1461 with minimum mean coating mass of 395 g/m$^2$ (minimum mean coating thickness of 55µm).

4.3.2.4. The threads on head of the spindle shall be steel large type reference 16 as per BS 3288-2 and Fig. 1a. They shall screw into a thimble or equivalent component fixed in the pin hole of the insulator.

4.3.2.5. The spindle shall be large type reference number 29, with dimensions as per Table 1 and Fig. 1b and shall be in accordance with BS 3288-2

**Table 1: Dimensions of insulator pin with large steel heads as per BS 3288-2 and Fig. 1b**

| Dimensions in mm | | | | | | | |
|---|---|---|---|---|---|---|---|
| A | ØB | ØC | ØD | ØE | F | (RG) | X* |
| 230 | 50 | 25 | 37 | 22 | 6 | 13 | 50 |
| **Dimension X to be 50mm screwed 45mm* | | | | | | | |

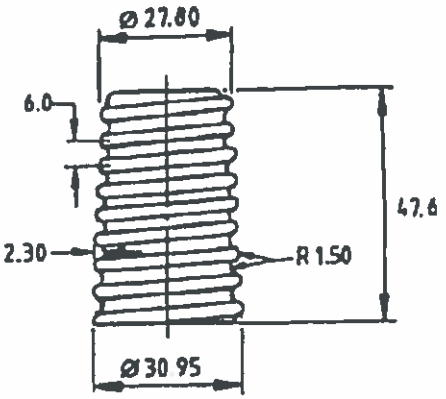



Fig 1a: Head of spindle

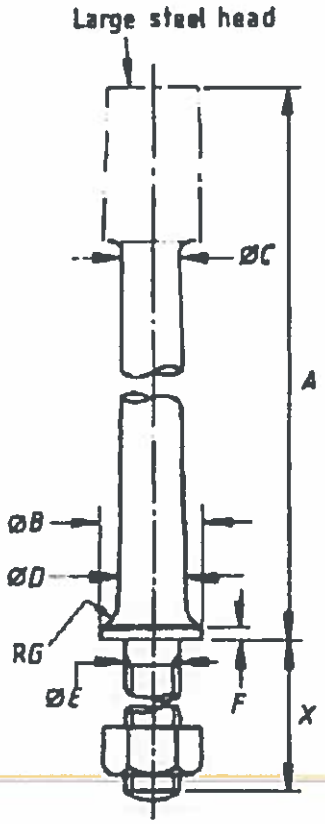



Fig 1b: Spindle with large steel head

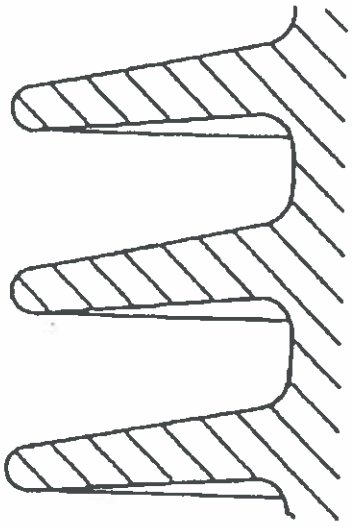
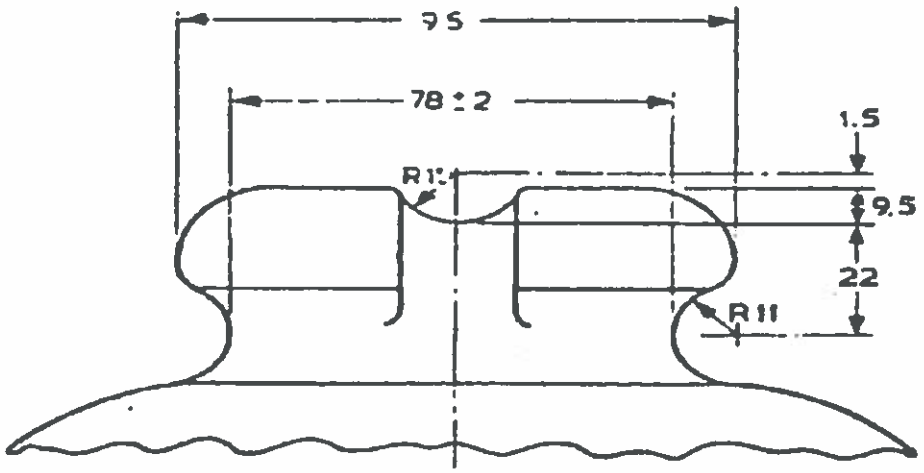


**Fig 2: Typical "open" profiles for Pin Insulators**




All dimensions are in millimetres

**NOTE:** *Tolerance in accordance with BS 137 i.e. (0.04d + 1.5) mm, where d is the dimension shown on the drawing.*

**Fig. 3: Typical head of an 11kV porcelain insulator**

4.3.2.6. The stalk length of spindle (Fig. 1b) shall be measured above the seating face of the collar and the shank length of the line pins (Fig. 1b) shall be measured below the seating face of the collar. The effective thread of 50 mm shank shall be not less than 45 mm.

4.3.2.7. The dimensions of a typical head of an 11kV porcelain insulator shall be as per Fig.3 and the various ratings shall be as shown in Table 2.

**Table 2: The mechanical and electrical characteristics of the insulators as per IEC 60383**

| S/No | Particulars | Required values |
|---|---|---|
| 1. | Minimum failing load (bending) | 12.5 kN |
| 2. | Tie top radius | 11mm |
| 3. | Total height | 250mm |
| 4. | Specific creepage distance | 25mm/kV |
| 5. | Minimum total creepage distance | 300mm |
| 6. | Minimum dry arcing distance | 311mm |
| 7. | Visible discharge test | 9kV |
| 8. | Minimum power frequency withstand voltage, Wet | 50kV (r.m.s.) 50Hz 60s |
| 9. | Minimum lightning impulse withstand voltage, Dry | 95kV (peak)1.2/50µs |
| 10. | Radio Interference noise level at standard test voltage – 7.5 kV (IEC60437-1997) | 30 dB |
| 11. | Maximum RIV value at standard test voltage – 7.5 kV | 100 µV |
| 12. | Minimum average coating mass (thickness) for bolts, nuts and washers | 395 g/m$^2$ (55µm) |
| 13. | Spindle size | M22 suitable for steel cross-arm 10mm thick |
| 14. | Maximum weight | 12kg |

### 4.4. Quality Management System

4.4.1. The supplier shall submit a 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 9001:2008.

4.4.2. 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.

## 5. TESTS AND INSPECTION

5.1. Type tests, sampling tests and routine tests shall be done in accordance with the requirements of IEC 60383, IEC 60815-1 & 2, BS 3288, BS 137, ISO 1461, BS 3643, BS 4464, ANSI C29.6, PD 970, ISO 898-2 and this specification. It shall be the responsibility of the supplier to perform or to have performed all the tests specified.

5.2. Copies of Type Test Certificates & 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 to ISO/IEC 17025 for the testing laboratory shall also be submitted (all in English language).

Copies of type test reports to be submitted with the tender (by bidder) for evaluation shall be as stated:

a) Verification of dimensions
b) Dry lightning impulse withstand tests
c) Wet power-frequency withstand voltage tests
d) Mechanical failing load tests
e) Thermal-mechanical performance tests

**NOTE:** *Any translations of certificates and test reports into English language shall be signed and stamped by the third party Testing Laboratory that carried out the tests.*

5.3. The insulators shall be subject to acceptance tests at the manufactures' works before dispatch. Acceptance tests (routine & sample tests) will be witnessed by two Engineers appointed by The Kenya Power and Lighting Company Limited (KPLC). Routine and sample test reports for the insulators to be supplied shall be submitted to KPLC for approval before shipment of the goods.

5.4. Tests to be witnessed by KPLC Engineers at the factory before shipment shall be in accordance with IEC 60383, IEC 60815-1 & 2, BS 3288, BS 137, ISO 1461, BS 3643, BS 4464, ANSI C29.6, PD 970, ISO 898-2 and this specification and shall include the following:

a) Verification of dimensions
b) Temperature cycle test
c) Mechanical failing load test
d) Porosity test
e) Galvanizing test
f) Visual inspection
f) Electrical tests - Wet power-frequency withstand voltage tests, Dry lightning impulse withstand tests and Radio interference tests.

5.5. On receipt of the insulators 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, insulators which upon examination, test or use fail to meet any of the requirements in the specification.

## 6. MARKING ANDPACKING

### 6.1 MARKING

The following information shall be marked indelibly and legibly and in a permanent manner on the porcelain portion of each insulator in English Language:

(a) Name or trade mark of the manufacturer;
(b) Type Reference Number and Specified Mechanical Failing Load;
(c) Year of manufacture;
(d) Batch or serial number;
(e) The letters '**KPLC PROPERTY**'

### 6.2 PACKING

6.2.1 The insulators shall be packed in wooden crates which are reinforced and held closely by external steel strip bindings. Each crate shall be internally braced to permit stacking and the steel strip 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 wooden 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.

6.2.2 Instructions for storage, handling and installation shall be included in each package, all in English Language.

## 7. DOCUMENTATION

7.1. The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) for tender evaluation. The documents to be submitted (all in English language) for tender evaluation shall include the following:

a) Guaranteed Technical Particulars fully filled and signed by the manufacturer;
b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
c) Sales records for previous five years and reference letters from at least four of the customers;
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 warranty and guarantee;

h) Manufacturer's letter of authorization, copy of the manufacturer's ISO 9001:2008 certificate and other technical documents required in the tender.

7.2. The successful bidder (supplier) shall submit the following documents/details (from the manufacturer as per tender) to The Kenya Power & Lighting Company for approval before manufacture:

a) Guaranteed Technical Particulars fully filled and signed by the manufacturer;
b) Design drawings & construction details of the insulators including 3-D views;
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 9001:2008;
d) Test Program to be used after manufacture;
e) Marking details and method to be used in marking each insulator;
f) Manufacturer's undertaking to ensure adequacy of the design, adherence to applicable regulations, standards and specification, ensure good workmanship and good engineering practice in the manufacture of the insulators for The Kenya Power and Lighting Company Limited;
g) Packaging details (including packaging materials and marking and identification of component packages).

**NOTE:** *The drawings to be submitted by the supplier to KPLC for approval before manufacture shall be in standard format clearly indication drawing number, parts list with material details & quantities, standard of manufacture, ratings, approval details and identity of the manufacturer (as per manufacturer's authorization submitted during tendering).*

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**ANNEX A: SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR OFFERED INSULATORS** *(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 past five years, four customer reference letters, details of manufacturing capacity, the manufacturer's experience, 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 | Description | Guaranteed Technical Particulars for insulators offered |
|---|---|---|
| | Name of Manufacturer & Country of manufacture of the insulators being offered | specify |
| | Type/Model Reference Number | specify |
| 1 | Scope: Supplier to ensure adequacy of the design, good workmanship, good engineering practice and adherence to standards, specifications and applicable regulations in the manufacture of the insulators for KPLC | specify |
| 2 | Design standards complied with | specify |
| 3 | Terms and Definitions | specify |
| 4 | Requirements | |
| 4.1 | Service conditions | specify |
| 4.2 | Design & Construction | |
| | Insulator components | specify |
| | Insulator shed profile | specify |
| | Insulator mounting | specify |
| | Threads profile of insulator. | specify |
| 4.3 | Materials | |
| 4.3.1 | Insulating material | specify |
| 4.3.2 | Spindle dimensions | Attach drawings |
| 4.3.2.7 | **RATINGS:** Nominal System Voltage & Frequency | specify |
| | Maximum System Voltage | specify |
| | Minimum Failing Load (bending) | Prove compliance through tests reports |
| | Tie top radius | specify |
| | Total height | specify |
| | Specific creepage distance | specify |
| | Minimum total creepage distance | specify |
| | Minimum dry arcing distance | specify |
| | Power Frequency Withstand Voltage, rms (50Hz 60s, wet) | specify |
| | Impulse Withstand Voltage, peak (1.2/50µs, dry) | specify |

| | | |
|---|---|---|
| | Radio Interference noise level at standard test voltage – 7.5 kV (IEC60437-1997) | specify |
| | Maximum R.I. value at test voltage of 7.5 kV | specify |
| | Minimum average coating mass (thickness) for bolts, nuts and washers | specify |
| | Stud Size | specify |
| | Stud suitable for? | specify |
| | Weight. | specify |
| 4.5 | Quality Management System | |
| | Quality Assurance Plan | provide |
| | Copy of ISO 9001:2008 Certificate | provide |
| | Manufacturer's experience | provide |
| | Manufacturing Capacity (units per month) | provide |
| | List of previous customers | provide |
| | Customer reference letters | provide |
| 5.1 | Test standards and responsibility of carrying out tests | provide |
| 5.2 | Copies of Type Test Reports submitted with tender | provide |
| 5.3 | Acceptance tests to be witnessed by KPLC at factory before shipment | provide |
| 5.4 | Test reports to be submitted by supplier to KPLC for approval before shipment | provide |
| 5.5 | Replacement of rejected insulators | specify |
| 6.1 | Marking | specify |
| 6.2 | Packing | specify |
| 7.1 | Documents submitted with tender | provide |
| 7.2 | Documents to be submitted by supplier to KPLC for approval before manufacture | provide |
| | Statement of compliance to specification | provide |

.....

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

# THE KENYA POWER AND LIGHTING COMPANY LTD.

## SPECIFICATION

*for*

## 132kV STATION POST INSULATORS

REVISION RECORD

| REVISION | ISSUE | COMPILED BY | DATE | APPROVAL & DATE |
|---|---|---|---|---|
| *0* | *1st Issue* | *R&D* | *July 2005* | 22/7/2005 |
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# SPECIFICATION FOR 132kV STATION POST INSULATORS

## CONTENTS

# SPECIFICATION FOR 132kV STATION POST INSULATORS

## FOREWORD

This specification has been prepared by the Research & Development Department on behalf of the Technical Committee of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for 132 kV Station Post Insulators. It has been approved by the Technical Committee for use by KPLC in purchasing the insulators from manufacturers.

It shall be the responsibility of the manufacturer to ensure adequacy of the design and good engineering practice in the manufacture of the insulators for KPLC.

## 1. SCOPE

1.1 This specification covers Station Post Insulators of ceramic material intended for outdoor service in electrical installations or equipment operating on alternating current system with a nominal voltage of 132, 000 volts and a frequency of 50Hz.

1.2 The insulators covered by this specification are intended for use in isolators (disconnectors) or as bus-bar supports.

## 2. REFERENCES

The following documents were referred to during the preparation of this specification. In case of conflict, the provisions of this specification shall take precedence.

Unless otherwise specified, the latest revision, edition and amendments shall apply.

IEC 273: – Dimensions of Indoor and Outdoor Post Insulators and Post Insulator Units for systems with nominal voltages greater than 1 000V.

IEC 168: Tests on indoor and outdoor post insulators of ceramic material or glass for systems with nominal voltages greater than 1000V.

IEC 815: Guide for the selection of insulators in respect of polluted conditions.

## 3. TERMS AND DEFINITIONS

For the purpose of this specification, definitions given in the reference standards shall apply.

## 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, humidities of up to 90%, average ambient temperature of

+30°C with a minimum of -1°C and a maximum of +40°C and saline conditions along the coast.

The minimum nominal specific creepage distance shall be 25mm/kV suitable for Pollution level III (Heavy) as per IEC 815.

## 4.2. DESIGN AND CONSTRUCTION

4.2.1 The insulators shall be designed and constructed in accordance with IEC 273 and the requirements of this specification.

4.2.2 The insulators shall be outdoor cylindrical post insulators complete with metal fittings as per IEC 273.

4.2.3 The insulating material shall be porcelain; sound. free from defects, thoroughly vitrified, smoothly glazed and of uniform brown colour.

4.2.4 The insulator shall be free from stresses due to expansion and contraction in any part which may lead to deterioration. No chemical reaction between materials due to contact shall be allowed (e.g. between cement and metal fittings).

4.2.5 The under surface and grooves of sheds or skirts shall be easy cleaning. Sheds shall be substantially symmetrical in shape without appreciable warping.

4.2.6 The electrical characteristics, mechanical characteristics, dimensional characteristics and fixing arrangements shall all be in accordance with 4.3.

4.2.7 Fixing holes shall be equally spaced on the appropriate pitch circle which shall be concentric with the axis of the insulator. Holes in top and bottom fittings shall be in line and they shall be so arranged as to permit the use of normal hexagonal bolt heads and nuts.

## 4.3. CHARATERISTICS

The Electrical, Mechanical and Dimensional Characteristics of the insulators shall be as follows:

| | |
|---|---|
| Lightning impulse withstand voltage: | 750kV |
| Power frequency withstand voltage, wet: | 325kV |
| Height of post insulator: | 1700mm ±2.5mm |
| Minimum creepage distance: | 3900mm |
| Maximum nominal diameter of insulating part: | 350mm |
| Failing load, Bending: | 8000N |
| Failing load, Torsion: | 4000N |
| Top metal fitting pitch circle diameter: | 127mm |
| Bottom metal fitting pitch circle diameter | 127mm |

*Note: The withstand voltages are based on service conditions given in 4.1*

## 4.4. MARKING AND INSTRUCTIONS

4.4.1 The following information shall be marked indelibly and legibly on the insulator:

i) Manufacturer's name or trademark
ii) Type designation (indicating type, mechanical, creepage and electrical characteristics in accordance with IEC 273)
iii) Year of manufacture

4.4.2 Instructions for storage, handling and installation shall be included in each package, all in the English Language.

## 5. TESTS AND INSPECTION

5.1 Type tests, routine tests, sample tests and inspection shall be done in accordance with the requirement of IEC 273, IEC 168 and this specification. It shall be the responsibility of the manufacturer to perform or to have performed the tests specified.

5.2 Certified true copies of previous Test Reports from an ISO/IEC 17025 accredited Laboratory recognized by the International Laboratory Accreditation Co-operation (ILAC) shall be submitted with the tender for the purpose of technical evaluation, all in the English Language. Copies of proof of accreditation shall be attached.

5.3 Type Test Reports to be submitted shall include dry lightning impulse withstand voltage test, wet power-frequency withstand voltage test, test for mechanical strength and radio interference test all in accordance with IEC 168.

5.4 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 intends to witness acceptance tests at the factory. The Supplier shall invite KPLC in adequate time to facilitate good preparation for the exercise.

5.5 On receipt of the insulators, KPLC may perform routine and sample tests in order to verify compliance with specification.

The supplier shall replace without charge to KPLC, any insulators which upon examination, test or use fail to meet any of the requirements in this specification.

## 6. TECHNICAL DOCUMENTATION

6.1. The Bidder shall submit a clause by clause statement of compliance with these specifications together with copies of the manufacturer's catalogues, brochures, technical data, drawings and test reports clearly marked to support each clause, all in the English Language for evaluation. The manufacturer's type reference/designation of the item offered shall be indicated.

6.2. Technical details and drawings for the insulators to be supplied shall be submitted to KPLC for approval before manufacture commences.

**6.3. Experience of Manufacturer**

6.3.1 A detailed list and contact addresses of previous major customers (utilities) in the past five years shall be submitted with the tender for evaluation.

6.3.2 The manufacturer shall have at least five years experience in the manufacture of the offered insulators. Documentary evidence shall be submitted to support this.

APPENDIX A: Statement of Compliance *(to be filled and signed by the Manufacturer for all clauses and submitted for tender evaluation)*

| Clause Number | Bidder's offer | Manufacturer's catalogue, drawing, technical data or test report Reference Page to support the offer. |
|---|---|---|
| | | |

*NB: - This schedule does not in any way substitute for detailed information required elsewhere in the specification.*

**Manufacturer's Declaration: I .....on behalf of..... Declare that the above specifications matrix conforms to a typical tender item type ..... as clearly marked in the attached technical brochures & drawings, and being offered for this tender.**

**Signature..... Date.....Stamp/Seal.....**

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## 0.1 Circulation List

| COPY NO. | COPY HOLDER |
|---|---|
| 1 | Research & Development Manager |
| 2 | Supplies Manager |
| 3 | Stores & Stock Control Manager |
| 4 | Operations & Maintenance Manager |
| 5 | Deputy Manager, Technical Audit |

## 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 | 2010-04-06 | Cancels and replaces Issue 1 Rev 2 dated April 10, 2008 | S Kimitei | G Owour |
| | | | | |
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| | | | | |

## FOREWORD

This specification has been prepared by the Research and Development Department of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for 11 & 33kV Pin Type Composite Insulators. It is intended for use by KPLC in purchasing the insulators.

The manufacturer shall submit information which confirms 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 power lines.

1.2 This specification covers the following composite insulators:

(i) 11kV Pin Type Composite Insulators;

(ii) 33kV Pin Type Composite Insulators.

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 Pin Type Composite Insulators acceptable for use in the company (KPLC) 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. 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.

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.

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 60383: Tests on insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000V

## 3. TERMS AND DEFINITIONS

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

## 4. REQUIREMENTS

### 4.1 SERVICE CONDITIONS

The insulators shall be suitable for continuous operation outdoors in tropical areas at altitudes of up to 2000m 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 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 be pin type moulded in one single piece and supplied complete with metal end fittings. Metal fittings shall be galvanized to ISO 1461 to suit service conditions specified in clause 4.1.

4.2.3. The insulator shall be made of composite materials of high resistance to moisture, ultraviolet radiation, high temperatures and tropical sunshine conditions. The core shall be made of resin-impregnated glass fibres free from defects. The housing of the insulator shall be manufactured from high quality silicone rubber.

4.2.4. The under surface and grooves of sheds or skirts shall be easy cleaning. Sheds shall be substantially symmetrical in shape without appreciable warping.

4.2.5. The insulator shall be suitable for both vertical and horizontal applications. It shall be suitable for both bare and protected conductors.

4.2.6. The insulator bottom metal end fitting shall be suitable for mounting on steel cross arm.

4.2.7. The top and side grooves shall be designed to accept conductor sizes in the range 7 – 18.2mm overall diameter.

4.2.8. The final colour of the insulator housing shall be BROWN.

## 4.3. CHARACTERISTICS

The mechanical and electrical characteristics of the insulators shall be as follows:-

| CHARACTERISTICS | 11kV INSULATOR | 33kVINSULATOR |
|---|---|---|
| Minimum Creapage Distance | 300 mm | 900 mm |
| Minimum Power Frequency Withstand Voltage (Wet), 50Hz 60s | 38 kV | 90 kV |
| Minimum Lighting Impulse Withstand Voltage (Dry), +ve, 1.2/50µs | 95 kVp | 200 kVp |
| Minimum Failing Load | 10 kN | 10 kN |

## 4.4. QUALITY MANAGEMENT SYSTEM

4.4.1 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 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 9001:2008.

4.4.2 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.

## 5. TESTS AND INSPECTION

5.1 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.

5.2 Copies of previous design and type test reports by the relevant 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 shall be submitted for tender evaluation:

5.2.1 Tests on interfaces and connections of metal fittings;
5.2.2 Assembled core load-time test;
5.2.3 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);
5.2.4 Tests for the core material;
5.2.5 Flammability test;
5.2.6 Dry lightning impulse withstand voltage test;
5.2.7 Wet power frequency test;
5.2.8 Mechanical load-time test and test of the tightness of the interface between end fittings and insulator housing.

5.3 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 the following tests as per IEC 1109 and applicable latest IEC standards:

5.3.1 Verification of dimensions;
5.3.2 Verification of the locking system;
5.3.3 Verification of tightness of the interface between end fittings and insulator housing;
5.3.4 Verification of the specified mechanical load;
5.3.5 Galvanizing test (by Gravimetric method).

## 6. MARKING AND LABELLING

6.1 The following information shall be marked indelibly and legibly and in a permanent manner on each insulator.

i) Manufacturer's Name or Trademark – embossed on largest silicon rubber shed;
ii) Manufacturer's Type Reference Number – embossed on silicon rubber portion over the metal fitting;
iii) Rated Voltage – embossed on the silicon rubber shed;
iv) Specified Mechanical Load – embossed on the metal fitting;
v) The letters 'KPLC' - embossed on silicon rubber portion over the metal fitting.

6.2 All marking shall be by embossing and marking on metal fittings shall be before galvanizing. The marking shall not affect the performance of the insulator.

6.3 Interpretation of the Type Reference Number (in terms of specified electrical characteristics) shall be given in the manufacturer's brochure/catalogue delivered together with the insulators (all in English language).

6.4 A set of Three (3) installation and technical manuals for the insulators shall be submitted during delivery.

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**ANNEX A: Guaranteed Technical Particulars** *(to be filled and signed by the Manufacturer and submitted together with copies of relevant Manufacturer's catalogues, brochures, drawings, technical data, sales records and copies of type test certificates and type test reports for tender evaluation)*

**TENDER NO .....**

| Description | Bidder's offer |
|---|---|
| 1. Manufacturer's name & address | |
| 2. Type Reference Number of insulator offered | |
| 3. Service Conditions | |
| 4. Applicable Standards | |
| 5. Maximum System Voltage (kV) | |
| 6. One-minute power frequency withstand voltage, 50Hz, 60s, wet (kV rms) | |
| 7. Lighting impulse withstand voltage, 1.2/50µs positive, dry, (kVp) | |
| 8. Minimum creepage distance (mm) | |
| 9. Specified mechanical load (kN) | |
| 10. Length of insulator with fittings (mm) | |
| 11. Material of fittings and level of corrosion protection | |
| 12. Material of rod | |
| 13. Material of housing and sheds | |
| 14. Conductor groove, size | |
| 15. Suitability for both vertical & horizontal application | |
| 16. List of copies of Design and Type Test Reports submitted (indicate Test Report Numbers, Testing Authority and contact addresses) | |
| 17. List Acceptance Tests to be witnessed by KPLC Engineers at the factory | |
| 18. List of catalogues, brochures, technical data, drawings and customer sales records submitted to support the offer. | |
| 19. Marking (indicate parameters and method of marking to be used during manufacture) | |
| 20. Copy of ISO 9001:2008 Certificate submitted (indicate validity) | |
| 21. Quality Assurance Plan | |
| 22. Deviations from tender specifications and supporting data, test reports, technical documents etc. | |

.....

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

## TABLE OF CONTENTS

## 0.1 Circulation List

| COPY NO. | COPY HOLDER |
|---|---|
| 1 | Head of Department Standards |
| 2 | Head of Department Procurement |
| 3 | Regional Manager Coast |
| Electronic copy (pdf) on KPLC server currently: http://172.16.1.40/dms/browse.php?fFolderId=23 | |

## 0.2 Amendment Record

| Rev No. | Date (YYYY-MM-DD) | Description of Change | Prepared by (Name & Signature) | Approved by (Name & Signature) |
|---|---|---|---|---|
| Issue 2 | 2014-09-01 | Special creepage distance for coastal installations | Michael Apudo | Eng. Simon Kimitei |
| | | | | |
| | | | | |
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## FOREWORD

This specification has been prepared by the Standards Department in collaboration with Network Division and Coast Region Management all of The Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for 33kV composite pin insulators for coastal installations. It is intended for use by KPLC in purchasing the insulators.

The supplier shall submit information which confirms 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 power distribution lines operating at a nominal voltage of 33kV; frequency of 50Hz and in areas which are in the direct vicinity of the coast and are exposed to sea spray or very strong and polluting winds from the sea, but in some cases, depending on topography, they can be as far as 50 km inland.

1.2. 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.

1.3. The specification stipulates the minimum requirements for 33kV composite pin insulators acceptable for use in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good workmanship, good engineering practice and adherence to standards, specifications and applicable regulations in the manufacture of the insulators for The Kenya Power & Lighting Company Ltd.

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

## 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.

ISO 1461: Metallic Coatings – Hot dip galvanized coatings on fabricated ferrous products – Requirements.

ISO 48: Rubber, vulcanized or thermoplastic -- Determination of hardness (hardness between 10 IRHD and 100 IRHD),

IEC 60507: Artificial pollution tests on high-voltage insulators to be used on a.c. systems

IEC 60437: Radio interference test on high-voltage insulators

IEC 60587: Electrical insulating materials used under severe ambient conditions – Test methods for evaluating resistance to tracking and erosion

IEC 61109: Composite insulators for a.c. overhead lines with a nominal voltage greater than 1000V – Definitions, test methods and acceptance criteria.

IEC 60815: Selection and dimensioning of high-voltage insulators intended for use in polluted conditions -- Part 1: Definitions, information and general principles -- Part 3: Polymer insulators for a.c. systems

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

## 3. TERMS AND DEFINITIONS

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

## 4. REQUIREMENTS

### 4.1. SERVICE CONDITIONS

#### 4.1.1. Environmental conditions

The insulators shall be suitable for continuous operation outdoors in tropical areas at:
a) Altitudes of up to 2000m above sea level,

b) Humidity of up to 90%,
c) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C,
d) Heavy saline conditions along the coast and tropical sunshine conditions.
e) Site pollution severity (SPS) of class E7 (very heavy) as per IEC 60815-1 clause 8.

NOTE: *The level of galvanizing for all ferrous parts and materials used shall be suitable for these conditions.*

### 4.1.2. System requirements

The following system requirements shall be taken into account for the selection and dimensioning of outdoor insulation.

a) Type of system — Alternating Current (a.c)
b) Maximum operating voltage across insulation
   i) Phase-to-earth, $U_{ph-e}$ (Um/√3) : 20.8 kV
   ii) Phase-to-phase voltage $U_{ph-ph}$ (Um): 36 kV
c) Imposed performance voltage requirements (2.5Um/√3): 52 kV

## 4.2. DESIGN AND CONSTRUCTION

### 4.2.1. Design

4.2.1.1. The composite pin insulator shall be of Type A in accordance with IEC 60383 and shall be designed, manufactured and tested to IEC 61109, IEC 60815-3 and other applicable /latest IEC standards and the requirements of this specification.

4.2.1.2. The composite pin insulator shall have a core and insulating housing and weather-shed housing both manufactured by the same manufacturer. It shall also have forged steel hardware components for attaching it to the support and conductor.

4.2.1.3. The insulator shall be an open shed profile type with excellent self-cleaning properties and a provision for easy cleaning when maintenance is required.

4.2.2. **Materials**

4.2.2.1. **Core**

4.2.2.1.1. The insulator core shall be made of fracture-resistant electrical grade epoxy / vinyl ester / isopolyester based fiberglass rod to achieve maximum failing load. The core shall be mechanically and electrically sound, free from voids, foreign substances and manufacturing flaws.

4.2.2.1.2. The insulator design shall ensure that the core is totally encapsulated and fully sealed, from the live to the earthed ends, by the insulating material from the environment, in order to avoid ingress of moisture. If any tacky substances are used as sealers, they shall not be exposed to environmental influence.

4.2.2.2. **Housing and Weathersheds**

4.2.2.2.1. The material used for the housings shall be manufactured from base polymer - 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.

**NOTE:**

i) *The silicon rubber shall be treated with additive packages to modify their behavior for satisfactory performance in an outdoor polluted environment. The additives (fillers) shall include but not limited to anti-tracking agents, ultra-violet screens and stabilizers, antioxidants, ionic scavengers, etc.*

ii) *Proof of the type of base polymer used and the additives shall be submitted with the tender.*

4.2.2.2.2. 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.

4.2.2.2.3. A minimum sheath thickness of 3.0 mm of silicone rubber shall be extruded or injection moulded on the reinforced fiberglass rod. The polymer sleeve and

weather-shed insulating material shall have a chemical structure of 100 percent silicone rubber before fillers are added.

4.2.2.2.4. The silicone rubber shall be firmly bonded to the rod, be seamless, smooth and free from imperfections. The strength of the silicone rubber to rod interface shall be greater than the tearing strength of the silicone rubber.

4.2.2.2.5. The weather-sheds shall be firmly bonded to the sheath, vulcanized to the sheath or moulded as part of the sheath and be seamless smooth and free from imperfections. The strength of the silicone rubber weather-shed to sheath interface shall be greater than the tearing strength of the silicone rubber.

4.2.2.2.6. Weather-sheds shall be at intervals to provide optimum electrical performance and the weather-shed designs shall provide a protected bottom surface that tends to keep dry in wet conditions.

4.2.2.2.7. The insulator shall be capable of withstanding high pressure power washing. A power wash test shall be performed on polymer insulators to demonstrate that the units can be power washed. The spray shall be a solid stream through a 6mm diameter nozzle at 3.79Mpa for a period of ten minutes. There shall be no signs of water entering through or under the outside weather-shed into the core or at the polymer hardware interface into the core.

4.2.2.2.8. The gap between hardware base and housing shall be sealed by an elastomer with permanent elasticity. The sealing shall stick permanently to the surface of the material as well as to the housing.

### 4.2.3. Finish

4.2.3.1. The pin insulators shall be supplied complete with necessary hardware including hot dip galvanized steel pin with nut spring washer and a lock nut for mounting the insulator to the channel iron cross arms as shown in Fig. 1.

4.2.3.2. The finished product shall be of high resistance to moisture, high salinity, ultraviolet radiation, high temperatures and tropical sunshine conditions.

4.2.3.3. The final colour of the insulator housing shall be BROWN.

4.2.3.4. The under surface and grooves of sheds or skirts shall be easy cleaning. Sheds shall be substantially symmetrical in shape without appreciable warping.

4.2.3.5. The top and side grooves shall be hot dip galvanized steel and be designed to accept conductor sizes in the range 7 – 18.2mm overall diameter.

### 4.2.4. Galvanizing

4.2.4.1. All steel hardware components shall be hot dip galvanized after their machined bent or worked operations of any manner. The zinc coating shall adhere tightly to the surface of the base metal. The zinc coated parts shall not have any un-coated spots.

4.2.4.2. The coating shall be uniform and free from blisters, flux, black spots, dross, tear drop edges, flaking zinc, rough appearance and in general shall be smooth, clean and unscarred when received. The minimum thickness of the coating of the steel or iron base shall conform to ISO 1461 and Table 1.

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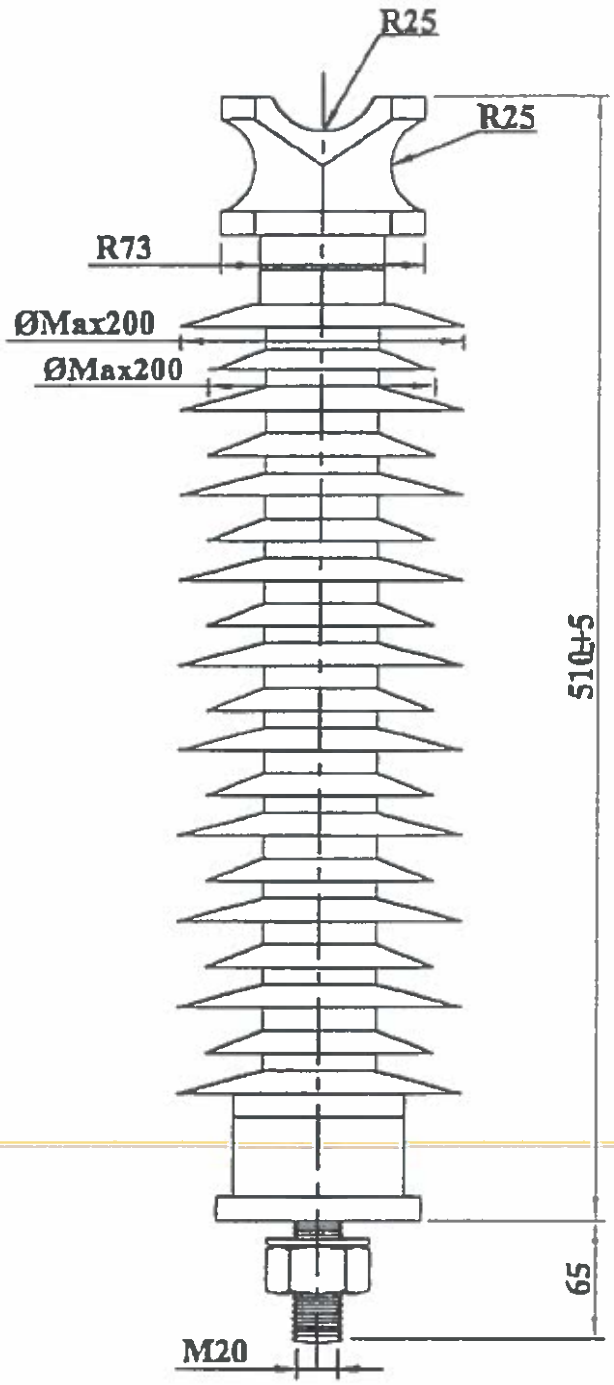


Dimensions in millimeters

Figure 1: General arrangement for 33 kV Composite Pin Insulator

| Issued by: Assistant Engineer, Tech Stds & Specs | Authorized by: Chief Engineer, Tech Stds & Specs |
|---|---|
| Signed: | Signed: |
| Date: 2014-09-01 | Date: 2014-09-01 |

## 4.3. CHARACTERISTICS

The mechanical and electrical characteristics of the insulators shall be as per Table 1:-

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

| Characteristics | | Units | Ratings |
|---|---|---|---|
| Shed diameter, min | | mm | 142 |
| Total shed height, min | | mm | 510 |
| Specific creepage distance | | mm/kV | 40 |
| Creepage distance, min | | mm | 1320 |
| Arcing distance, min | | mm | 360 |
| Electro-mechanical failing load(cantilever), min | | kN | 12.5 |
| Rod diameter | | mm | 20 |
| Power frequency withstand voltage - 50Hz 60s, wet | | kV | 135 |
| Power frequency withstand voltage - 50Hz 60s, dry | | kV | 150 |
| Lighting impulse withstand voltage - 1.2/50μs, dry | | kV | 250 kV |
| Visible discharge test voltage, min | | kV | 27 |
| Radio Interference noise level at standard test voltage – 22kV | | dB | 30 (IEC60437-1997) |
| Maximum RIV value at standard test voltage – 22kV | | μV | 100 |
| Mean coating thickness | For iron and steel castings and forgings | $g/m^2$ (μm) | 600 (85) |
| | For bolts, nuts and washers | $g/m^2$ (μm) | 375 (54) |
| Approximate weight | | Kg | 4.5 |

## 4.4. QUALITY MANAGEMENT SYSTEM

4.4.1. The supplier shall submit a 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 9001:2008.

4.4.2. 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.

4.4.3. The bidder shall indicate the delivery time of the insulators, manufacturer's monthly and annual production capacity and experience in the production of the type and size of insulators being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers outside the country of manufacture for the insulators sold in the last five years together with reference letters from four of the customers shall be submitted with the tender for evaluation.

## 5. TESTS AND INSPECTION

5.1. Type tests, sampling tests and routine tests shall be done in accordance with the requirements of IEC 61109, IEC 60815, IEC 60383, IEC 60437, IEC 60507, ISO 1461, and this specification. It shall be the responsibility of the supplier to perform or to have performed all the tests specified.

5.2. Copies of Type Test Certificates & 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 to ISO/IEC 17025 for the testing laboratory shall also be submitted (all in English language).

5.3. Copies of type test reports to be submitted with the tender (by bidder) for evaluation shall be as stated:

a) Tests on interfaces and connections of metal fittings;
b) Assembled core load-time test;
c) Test of housing: tracking and erosion test. The test reports MUST include resistance to ageing tests (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);
d) Tests for the core material;
e) Visible discharge test;
f) Dry lightning impulse withstand voltage test;
g) Wet power frequency test;
h) One minute rain test/wet flashover test
i) Mechanical load-time test and tightness test of the interface between end fittings and insulator housing.
j) Chemical composition test for silicon content
k) Recovery of hydrophobicity test
l) Brittle fracture resistance test

**NOTE**: *Any translations of certificates and test reports into English language shall be signed and stamped by the third party ISO/IEC 17025 accredited Testing Laboratory that carried out the tests.*

5.4. The insulators shall be subject to acceptance tests at the manufactures' works before dispatch. Acceptance tests (routine & sample tests) will be witnessed by two Engineers appointed by The Kenya Power and Lighting Company Limited (KPLC). Routine and sample test reports for the insulators to be supplied shall be submitted to KPLC for approval before shipment of the goods.

5.5. Tests to be witnessed by KPLC Engineers at the factory before shipment shall be in accordance with IEC 61109, IEC 60815, IEC 60383, IEC 60437, IEC 60507, ISO 1461, and this specification and shall include the following:

a) Identification, visual inspection of the insulators and verification of dimensions;
b) Verification of the locking system;
c) Verification of tightness of the interface between end fittings and insulator housing;
d) Verification of the specified mechanical load (SML);
e) Electrical tests - Wet power frequency test;
f) Galvanizing test (by Gravimetric method).
g) Temperature cycle test
h) Porosity test

5.6. On receipt of the insulators 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, insulators which upon examination, test or use fail to meet any of the requirements in the specification.

## 6. MARKING AND PACKING

### 6.1. Marking

6.1.1. The following information shall be marked indelibly and legibly and in a permanent manner on each insulator in English Language.

(i) Manufacturer's name or trademark;
(ii) Manufacturer's type designation;

(iii) Specified electrical characteristics;
(iv) Specified mechanical load.
(v) The letters '**KPLC**'.

6.1.2. All marking shall be by embossing on the insulator housing and marking on metal fittings shall be before galvanizing. The marking shall not affect the performance of the insulator.

**NOTE**: *Markings on loose tags/ties shall not be accepted.*

6.1.3. A set of Three (3) installation and technical manuals for the insulators shall be submitted during delivery.

### 6.2. Packing

6.2.1. The insulators shall be packaged in individual weatherproof packages of wooden crates to protect them against damage during shipping, inland transportation and storage. The packages shall be weatherproof and the external covering shall be designed to be removable by hand without cutting.

6.2.2. Each package shall have a packing list and in addition, shall be marked with the following information in English Language.
a) Descriptive name
b) Rated voltage
c) Quantity packed in package
d) Contract and lot number
e) Gross weight of packager
f) Volume of package
g) Applicable standards
h) Label "**Property of KPLC**".

## 7. DOCUMENTATION

7.1. The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) for tender evaluation. The documents to be submitted (all in English language) for tender evaluation shall include the following:

a) Guaranteed Technical Particulars fully filled and signed by the manufacturer;
b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
c) Sales records for previous five years and reference letters from at least four of the customers;
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 warranty and guarantee;
h) Manufacturer's letter of authorization, copy of the manufacturer's ISO 9001:2008 certificate and other technical documents required in the tender.

7.2. The successful bidder (supplier) shall submit the following documents/details (from the manufacturer as per tender) to The Kenya Power & Lighting Company for approval before manufacture:
a) Guaranteed Technical Particulars fully filled and signed by the manufacturer;
b) Design drawings & construction details of the insulators including 3-D views;
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 9001:2008;
d) Test Program to be used after manufacture;
e) Marking details and method to be used in marking each insulator;
f) Manufacturer's undertaking to ensure adequacy of the design, adherence to applicable regulations, standards and specification, ensure good workmanship and good engineering practice in the manufacture of the insulators for The Kenya Power and Lighting Company Limited;
g) Packaging details (including packaging materials and marking and identification of component packages).

**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, parts list with material details and quantities, standard of manufacture, ratings, approval details and identity of the manufacturer (as per manufacturer's authorization submitted during tendering).*

**ANNEX A: SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR OFFERED INSULATORS** *(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 past five years, four customer reference letters, details of manufacturing capacity, the manufacturer's experience, 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 | Description | Guaranteed Technical Particulars for insulators offered |
|---|---|---|
| | Name of Manufacturer & Country of manufacture of the insulators being offered | |
| | Type/Model Reference Number | |
| 1 | Scope: Supplier to ensure adequacy of the design, good workmanship, good engineering practice and adherence to standards, specifications and applicable regulations in the manufacture of the insulators for KPLC | |
| 2 | Design standards complied with | |
| 3 | Terms and Definitions | |
| 4 | Requirements | |
| 4.1 | System conditions | |
| 4.2 | Design and construction | |
| | 4.2.1 Design | |
| | 4.2.1.1 - 4.2.1.3 | |
| | 4.2.2 Materials | |
| | 4.2.2.1 Core | |
| | 4.2.2.1.1 - 4.2.2.1.2 | |
| | 4.2.2.2 Housing and weather-sheds | |
| | 4.2.2.2.1 - 4.2.2.2.9 | |
| | 4.2.3 Finish | |
| | 4.2.3.1 - 4.2.3.5 | |
| | 4.2.4 Galvanizing | |
| | 4.2.4.1 - 4.2.4.2 | |

| CLAUSE | Description | Guaranteed Technical Particulars for insulators offered |
|---|---|---|
| 4.3 | Characteristics | |
| | Nominal system voltage & frequency | |
| | System highest voltage | |
| | Shed diameter, min | |
| | Unit spacing, min | |
| | Specific creepage distance | |
| | Creepage distance, min | |
| | Arcing distance, min | |
| | Electro-mechanical failing load(cantilever), min | |
| | Coupling designation | |
| | Power frequency withstand voltage - 50Hz 60s, wet | |
| | Power frequency withstand voltage - 50Hz 60s, dry | |
| | Lighting impulse withstand voltage - 1.2/50μs, dry | |
| | Visible discharge test voltage | |
| | Radio interference level at standard test voltage | |
| | Maximum RIV value at standard test voltage | |
| | Minimum average coating mass (thickness) | |
| | 1. For iron and steel castings and forgings | |
| | 2. For bolts, nuts and washers | |
| 4.5 | Quality Management System | |
| | Quality Assurance Plan | |
| | Copy of ISO 9001:2008 Certificate | |
| | Manufacturer's experience | |
| | Manufacturing Capacity (units per month) | |
| | List of previous customers | |
| | Customer reference letters | |
| 5.1 | Test standards and responsibility of carrying out tests | |
| 5.2 | Copies of Type Test Reports submitted with tender | |
| 5.3 | Acceptance tests to be witnessed by KPLC at factory before shipment (give list) | |
| 5.4 | Test reports to be submitted by supplier to KPLC for approval before shipment | |

| CLAUSE | Description | Guaranteed Technical Particulars for insulators offered |
|---|---|---|
| 5.5 | Replacement of rejected insulators | |
| 6.1 | Marking | |
| 6.2 | Packing | |
| 7.1 | Documents submitted with tender | |
| 7.2 | Documents to be submitted by supplier to KPLC for approval before manufacture | |
| | Statement of compliance to specification | |

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