



**TITLE:**  
**SPECIFICATION FOR 66kV & 132kV COMPOSITE LINE POST INSULATORS – VERTICAL & HORIZONTAL MOUNTING**

|               |                        |
|---------------|------------------------|
| Doc. No.      | KP1/6C.1/36/TSP/04/001 |
| Issue No.     | 1                      |
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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 & calculations, 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)*

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**0.1 Circulation List**

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| Rev No. | Date (YYYY-MM-DD) | Description of Change | Prepared by (Name & Signature) | Approved by (Name & Signature)  |
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| Issue 1 | 2015-10-01        | New Issue             | M. Apudo                       | Dr. Eng. Peter  |
| Rev. 0  |                   |                       | J. Ng'ang'a                    | Kimemia  |
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## FOREWORD

This specification has been prepared by the Standards Department of Kenya Power and Lighting Company Limited (KPLC) and it lays down requirements for 66 kV & 132 kV composite line post insulators complete with metallic end fittings and mounting brackets. 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 66kV & 132kV composite line post insulators complete with metallic end fittings and mounting brackets for use on overhead power transmission lines operating at a nominal voltage of 66kV & 132kV and frequency of 50Hz.
- 1.2. The specification also covers inspection and test of the 66kV & 132 kV composite line post insulators complete with metallic end fittings and mounting brackets as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation. The insulator category and their mounting brackets in this scope shall be of two types namely:

### A. Wood pole mounting

- a) Composite Vertical Line Post Insulator– Rated 72.5kV;
- b) Composite Vertical Line Post Insulator– Rated 145kV;
- c) Composite Horizontal Line Post Insulator– Rated 72.5kV;
- d) Composite Horizontal Line Post Insulator– Rated 145kV.

### B. Concrete or Steel pole mounting

- a) Composite Vertical Line Post Insulator– Rated 72.5kV;
- b) Composite Vertical Line Post Insulator– Rated 145kV;
- c) Composite Horizontal Line Post Insulator – Rated 72.5kV;
- d) Composite Horizontal Line Post Insulator– Rated 145kV.

**NOTE: The Line Post Insulator type and rating on order shall be specified in the tender**

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1.3. The specification stipulates the minimum requirements for 66 kV & 132 kV composite line post 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 documents were referred to during the preparation of this specification; in case of conflict, the requirements of this specification shall take precedence.

- IEC 61952: Insulators for Overhead Lines – Composite Line Post Insulators for A.C. Systems with a Nominal Voltage Greater Than 1 000 V – Definitions, Test Methods and Acceptance Criteria
- IEC 62217: Polymeric HV insulators for indoor and outdoor use. General definitions, test methods and acceptance criteria
- IEC 60273: Characteristics of Indoor and Outdoor Post Insulators and Post Insulator Units for systems with nominal voltages greater than 1 000V.
- IEC 61442: Test methods for accessories for power cables with rated voltages from 6kV (Um = 7,2kV) up to 30kV (Um = 36kV)
- 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 60815-1&3: 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.

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- IEC 60071: Insulation co-ordination – Part 1: Definitions, principles and rules- Part 2: Application guide.
- IEC 60120: Dimensions of ball and socket couplings of string insulator units;
- IEC 60471: Dimensions of clevis and tongue couplings of string insulator units;
- IEC 61466-1: Composite string insulator units for overhead lines with a nominal voltage greater than 1 000 V – Part 1: Standard strength classes and end fittings;
- IEC 60707: Methods of test for the determination of flammability of solid electrical insulating materials when exposed to an igniting source.
- 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).
- ISO 8611: Pallets for material handling- Flat pallets.
- ISO 5922: Malleable cast iron.

### 3. TERMS AND DEFINITIONS

For the purpose of this specification, definitions given in the reference standards shall apply and shall include the following;

#### 3.1. Definitions

| Definition              | Explanation   |
|-------------------------|---|
| Cantilever load         | A load applied perpendicular to the longitudinal axis of the insulator.   |
| Certified test report   | A certificate of tests performed as specified within the specification, and carried out by an accredited authority or by the manufacturer and witnessed by an accredited authority that has been accredited in accordance with ISO/IEC 17011. |
| Chips, pits or blisters | Surface marks of insulator shed material usually caused during the manufacturing process.   |
| Connection zone         | The interface between the core of the insulating part and the metal fixing devices.   |
| Crack                   | A surface fracture > 0.1 mm deep.   |

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| <b>Definition</b>                      | <b>Explanation</b>  |
|--|---|
| Flashover                              | A disruptive external discharge across the surface of the insulating part between the metallic end fittings across which, the operating voltage is normally imposed.  |
| Insulator length or height             | The external dimension measured from bottom flange of earth end fitting to top flange of live end fitting.  |
| Metal fittings of an insulator         | Devices that form part of an insulator and intended to connect it to a supporting structure or to a conductor. The two fittings referred to in this specification are the earth end and a line or live end. |
| Minimum Cantilever Failing Load (MCFL) | Minimum bending load that the insulator has to withstand.   |
| Shed                                   | A projection from the core of the insulating part of an insulator intended to increase the creepage distance. The creepage can further be increased by means of ribs in the lower surface of the shed.      |

**3.2. Abbreviations**

| <b>Abbreviation</b> | <b>Explanation</b>                 |
|---------------------|------------------------------------|
| g                   | Acceleration due to gravity        |
| HV                  | High Voltage                       |
| MCFL                | Minimum Cantilever Failing Load    |
| PCD                 | Pitch Circle Diameter              |
| RIV                 | Radio Influence Voltage            |
| rms                 | root mean square                   |
| SCD                 | Specific Creepage Distance         |
| USCD                | Unified Specific Creepage Distance |

**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 2200m above sea level,
- b) Humidity of up to 95%,
- 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) Annual mean isokeraunic level of up to 180 thunderstorm days.

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**NOTE:** The level of galvanizing for all ferrous parts except those that are stainless steel 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) | Nominal system operating voltage             | 66kV                      | 132kV   |
| c) | Maximum continuous operating voltage         | 72.5kV                    | 145kV   |
| d) | System frequency                             | 50Hz                      | 50Hz    |
| e) | Phase to phase separation                    | 1,800                     | 2,200mm |
| f) | Earth fault current with duration of 0.7 sec | 7.8kA                     | 7.8kA   |

#### 4.2. DESIGN AND CONSTRUCTION

##### 4.2.1. General

- 4.2.1.1. The composite line post insulators shall be of type A in accordance with IEC 60383 and shall be designed, manufactured and tested in accordance with IEC 61952, IEC 60815-3 and other applicable /latest IEC standards and the requirements of this specification.
- 4.2.1.2. Line post insulator in this specification shall be a rigid insulator consisting of one piece of insulating material permanently assembled with a metal base cap intended to be mounted rigidly on a supporting structure by means of a central stud or one or more bolts as per IEC 60815-3.
- 4.2.1.3. The composite line post insulators shall have a core, an insulating housing and weather-shed housing both manufactured by the same manufacturer and a forged steel hardware components for attaching it to the support and conductor.
- 4.2.1.4. The composite line post insulators shall be an open shed profile type with excellent self-cleaning properties and a provision for easy cleaning when maintenance is required.

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4.2.1.5. The insulators are required to maintain satisfactory electrical and mechanical performance throughout their lifetime, which is specified as 40 years. Evidence in support of the reliability and performance for this period including information on Failure Mode and Effect Analysis shall be submitted for purposes of tender evaluation.

**NOTE:** Suppliers/Manufacturers shall be required to comment on the environmental soundness of the design and the materials used in the manufacture of the composite line post insulators offered. In particular, comments should address such issues as recyclability and disposability at the end of service life.

**4.2.2. Materials**

**4.2.2.1. Core**

4.2.2.1.1. The composite line post insulator core shall be made of brittle fracture-resistant electrical grade solid high density, axially aligned, glass-fibre-reinforced, epoxy resin rod, of uniform cross-section 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 composite line post insulators 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.

4.2.2.1.3. A special care shall be taken in connecting the glass-fiber-reinforced, epoxy resin rod, to the metal end fittings that allows having high bending, traction, torsion and compression loads and eliminating water penetration which happens in the usual execution of compression end fittings.

4.2.2.1.4. The core material shall have four (4) essential requisites:

- a) The capacity to withstand mechanical stresses that come from a specific use.
- b) Sufficient insulating properties to withstand, with an adequate safety-margin, the electrical stresses of usage and those resulting from over voltages of internal and external origin.
- c) Power arc resistance.
- d) Positive results at the tests according to the standard IEC 61952.

4.2.2.1.5. The minimum required diameter of the core shall be 63.5 mm.

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#### 4.2.2.2. Housing and Weathersheds

4.2.2.2.1. The weathersheds shall be made of polymer materials such as ethylene propylene or silicone elastomers such as:

- a) 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
- b) HPS silicone rubber compound 1800-120V.

#### 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 provided to support the tender during evaluation.*

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.

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- 4.2.2.2.7. The composite line post insulators 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. This test shall be a water spray at a shed seam of approximately 3m from the insulators. 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 the 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.
- 4.2.2.2.9. Cracks on the insulator surface shall not be allowed. Superficial defects or cavities are allowed provided the total defective area does not exceed 0.2% of the total insulator surface and the individual defective areas do not exceed 25 mm<sup>2</sup>. The depth of any cavities must not exceed 1 mm or 5% of the layer thickness of the blanket material in the area under consideration. Individual protrusions on the insulator surface are allowed up to 2 mm as long as their total protruded area does not exceed 0.2% of the total surface of the insulator and the individual protruded area does not exceed 25 mm<sup>2</sup>.

**4.2.2.3. Metallic end fittings**

- 4.2.2.3.1. The metallic end fittings placed at the end of the fiberglass rod shall be:
- a) **Clamp- top type** – designation "HC" for Horizontal mounting or designation "VC" for vertical mounting complete with stud base (complete with two (2) trunnion bolts and locknut) as per ANSI C29-7 with:
    - (i) Sufficient mechanical features to take the stresses that insulators are subjected to.
    - (ii) Conventional horizontal and vertical trunnion to accommodate a standard Line Post Insulator, bolted conductor clamp.
    - (iii) A design with an additional eye for the attachment of other devices during installation or maintenance activities.
  - b) **K-Clamp** – designation "C" in drawing in Annex B and made of corrosion resistant aluminum casting with:
    - (i) A long, smooth contoured conductor clamping zone that accommodates a full range of conductor sizes
    - (ii) A single captive live-line operable bolt.

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- (iii) Overall length shall permits standard cover up hoods to effectively cover all insulator sheds.
- (iv) A design can be installed in either a horizontal or vertical configuration

**NOTE:** *All the metallic end fittings shall be supplied with a matching conductor clamp. The drawings of the same shall be provided for tender evaluation and approval.*

- 4.2.2.3.2. These terminals shall be manufactured according to the IEC 60120, IEC 60471, and IEC 61466-1 standards and according to the characteristics requested by KPLC or their use. The terminals shall be manufactured from:
- a) Forged steel C 30 or C 40, worked and then hot dip galvanized
  - b) Casting steel C 30 or C 40, worked and then hot dip galvanized

**4.2.2.4. Mounting Brackets/ Fixing Base**

- 4.2.2.5. The top and bottom flanges of the end fittings shall have PCDs, holes and thread sizes as per the drawings attached in Annex B.
- 4.2.2.6. The liner post insulators shall be supplied complete with a matching mounting bracket with shapes and sizes similar in design to the illustrations in Annex. B.

**NOTE:** *The illustrations in Annex B does not restrict the manufacturer for offering a superior design of the brackets as long as the insulator design remains the same.*

**4.2.3. Dimensional characteristics**

**4.2.3.1. Insulation creepage**

- 4.2.3.1.1. KPLC has rationalized to three (3) site pollution severity classes as defined in IEC /TS 60815 Part 1 i.e. for nominal voltage upto 132 kV, class 'c – Medium' , class 'd – Heavy' and 'e – Very heavy' are specified.
- 4.2.3.1.2. The minimum specific (SCD) and unified specific (USCD) creepage distances at the maximum continuous system voltage ( $U_m$ ) for these site pollution severity classes are as indicated in Table 1.

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**Table 1: Minimum specific creepage requirements as per IEC/TS 60815-1**

| Pollution zone      | Application area   | SCD   | USCD  |
|---------------------|--------------------|-------|-------|
|                     |                    | mm/kV | mm/kV |
| c – Medium (M)      | Inland             | 25    | 43.3  |
| d –Heavy (H)        | Industrial regions | 31    | 53.7  |
| e – Very heavy (VH) | Coastal regions    | 40    | 53.7  |

**4.2.3.2. Insulator shed profile**

4.2.3.2.1. Insulator shed profiles shall be designed in accordance with IEC/TS 60815-3. Alternating sheds with an ‘open’ or ‘aerodynamic’ profile are preferred. Designs utilizing ‘Under-ribs’ in order to increase the creepage distance shall not be accepted.

4.2.3.2.2. The following parameters apply to the shed profile and are the recommended minimum values in IEC/TS 60815-3 for full compliance:


- a) The shed spacing-projection (s/p) ratio shall be at least 0.65.
- b) The minimum distance between sheds shall be 30 mm;
- c) The creepage to clearance ratio (l/d) shall not exceed 5.
- d) The shed angle shall be between 5° and 22.5°.
- e) The creepage factor (CF) shall not exceed:
  - 3.75 for SPS Class ‘c’ (‘Medium’ pollution class);
  - 3.875 for SPS Class ‘d’ (‘Heavy’ pollution class);
  - 4.0 for SPS Class ‘e’ (‘Very heavy’ pollution class).

**NOTE:** Besides the dimensional constraints of the shed profile, the sheds shall be sufficiently robust to withstand reasonable handling and transportation stresses.

**4.2.3.3. Overall dimensions**

4.2.3.3.1. The length of the horizontal post insulator and height of the vertical post insulator is a critical dimension cases for a given voltage, as there are different specifications for some existing installations, from the electrical performance and mechanical design perspectives, and shall not be deviated from.

4.2.3.3.2. The length and/or height of the insulator and the diameter of the insulating parts are specified in Table 3.

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#### 4.2.3.4. Mechanical characteristics

##### 4.2.3.4.1. Cantilever strength

Post insulators shall be standardized in mechanical strength classes based on the values of the specified minimum cantilever failing load in the bending test according to the classification in IEC 60273.

The minimum values of Minimum Cantilever Failing Load (MCFL) are tabulated in Table 3.

##### 4.2.3.4.2. Torsional strength

Torsional failing load is critical for application in disconnecter switches. The minimum values shall be as per IEC 60273 and are tabulated in Table 3.

#### 4.2.4. Finish

4.2.4.1. The composite line post insulators shall be supplied complete with necessary hardware such as galvanized steel pin with nut spring washer and a lock nut for mounting the insulator to the channel iron cross arms as shown in the drawings in Annex B.

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

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

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

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

#### 4.2.5. Galvanizing

4.2.5.1. All steel hardware components shall be 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.

4.2.5.2. 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

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unscarred when received. The minimum thickness of the coating of the steel or iron base shall conform to ISO 1461 and Table 3.

**4.3. CHARACTERISTICS**

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

**Table 3: Mechanical and electrical characteristics of the Composite Line Insulators (Horizontal & Vertical) in accordance with ANSI C19-17 & 18, IEC 61952, IEC/TS 608715-3 and IEC 60071-1**

| Characteristics  |  | Units                 | Ratings  |         |       |
|--|--|-----------------------|----------|---------|-------|
| Line Voltage   |  | kV                    | 66       | 132     |       |
| Maximum Line Voltage   |  | kV                    | 72.5     | 145     |       |
| Power Frequency Withstand  | Dry                                      | kV <sub>rms</sub>     | 230      | 395     |       |
|  | Wet                                      | kV <sub>rms</sub>     | 185      | 360     |       |
| Lightning Impulse withstand 1.2/50   | Positive                                 | kV <sub>peak</sub>    | 380      | 725     |       |
|  | Negative                                 | kV <sub>peak</sub>    | 450      | 750     |       |
| Visible discharge test voltage, min  |  | kV                    | 53       | 107     |       |
| Radio Influence Voltage (RIV) at 100kHz as per IEC 60437:2009                          | Test                                     | kV                    | 44       | 88      |       |
|  | Maximum                                  | µV                    | 200      | 200     |       |
| Specified Cantilever Load – SCL  |  | kN                    | 3.8      | 7.5     |       |
| Maximum Design Cantilever Load - MCDL, 65% of SCL                                      |  | kN                    | 2.47     | 4.875   |       |
| Specified Tensile Load - STL   |  | kN                    | 15       | 40      |       |
| Maximum Design Compression - MDC   |  | kN                    | 15       | 40      |       |
| Maximum Design Torsion - MDT   |  | daNm                  | 15       | 20      |       |
| Number of Sheds, A   |  | No.                   | 23       | 43      |       |
| Dimensions , L   | Vertical                                 | mm                    | 985      | 1,515   |       |
|  | Horizontal                               | mm                    | 975      | 1,500   |       |
| Creepage distance  | Inland                                   | 25mm/kV               | mm       | 1,812.5 | 3,625 |
|  | Industrial                               | 31mm/kV               | mm       | 2,247.5 | 4,495 |
|  | coastal                                  | 40mm/kV               | mm       | 2,900   | 5,800 |
| Dry Arc Distance (Creepage distance/Creepage factor as per clause 9.7 of IEC/TS 60815) |  | mm                    | 765      | 1380    |       |
| Mean coating thickness   | For iron and steel castings and forgings | g/m <sup>2</sup> (µm) | 610 (85) |         |       |
|  | For bolts, nuts and washers              | g/m <sup>2</sup> (µm) | 375 (54) |         |       |
| Approximate weight   |  | Kg                    | 11.5     | 17.5    |       |

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**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 61952, IEC 60815-1&3, IEC 62217, IEC 61442, IEC 60707, IEC 60383, IEC 60437, IEC 60507, ISO 48, 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 well-recognized Conformity Assessment Body accredited according to ISO / IEC 17020, ISO / IEC 17025 as well as ISO / IEC 17065. The conformity certification 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. Electrical Tests**
    - a) Visible discharge test;
    - b) Dry lightning impulse withstand voltage test;
    - c) Wet power frequency test;
    - d) Dry power frequency test;
    - e) One minute rain test/wet flashover test;
    - f) RIV tests.

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**B. Mechanical Tests – IEC 61952**

- a) Mechanical load-time test and tightness test of the interface between end fittings and insulator housing;
- b) Recovery of hydrophobicity test (IEC 61442) ;
- c) Brittle fracture resistance test.
- d) Tests on interfaces and connections of metal fittings;
- e) Assembled core load-time test;
- f) 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) and shall include;
  - (i) Accelerated weathering test (IEC 60099-4)
  - (ii) Tracking and erosion test (IEC 62217).
    - Test specimens “ duration of **1000 hours** ”
    - Test specimens “ duration of **5000 hours annex C** ”
- g) Tests for the core material;

**C. Chemical composition test for silicon content;**

**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. Tests to be witnessed by KPLC Engineers at the factory before shipment shall be in accordance with IEC 61952, IEC 62217, IEC 61442, IEC 60815-1&3, IEC 60383, IEC 60437, IEC 60507, ISO 48, ISO 1461, and this specification and shall include the following:

**A. Tests on interfaces and connections of end fittings**

- a) Pre-stressing
  - (i) Thermal-mechanical pre-stressing
  - (ii) Water immersion test
- b) Verification tests
  - (i) Visual examination
  - (ii) Steep-front impulse voltage test
  - (iii) Dry power frequency voltage test

**B. Assembled core load-time tests**

- a) Test for verification of the Maximum Design Cantilever Load MDCL
- b) Tensile load test

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- C. Test of sheds and housing material
  - a) Hardness test
  - b) Flammability test acc. to IEC 60707
- D. Test for the core material
  - a) Dye penetration test
  - b) Water diffusion test
  - c) Voltage test

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 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 '**PROPERTY OF 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.*

**6.2. Packing**

6.2.1. All insulators shall be packaged in individual Superior Grade Closed Wooden weatherproof crates to protect them against damage during shipping, inland transportation and storage. The crates shall be secured to pallets for handling by forklifts. Pallets shall not exceed 4 feet in height or 1,000 pounds in weight. The packages shall be weatherproof and designed to be removable by hand without cutting.

6.2.2. Each container is marked with the number of insulators it contains, the catalog number, description of the containers, the manufacturer's name, and any other customer requests.

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Also, a "Polymer Insulator Handling Instruction" sheet is included with all containers. This sheet states any necessary cautions during handling, transportation, and installation. If corona rings are to be included, a corona ring installation sheet is also provided.

- 6.2.3. 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.
  - i) Additional documents to be given by the Tenderers shall include;
    - (i) Summary of exceptions to technical specification,
    - (ii) Manufacturer references and qualifications,
    - (iii) List of spare parts,
    - (iv) List of special tools,
    - (v) Summary of test reports,
    - (vi) Packing / transportation / storage / installation and maintenance manuals,

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- 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).
- 7.2.1. In addition to be submitted by the manufacturer at the point of delivery shall include a set of three (3) number:
- (i) Documents, electrical and mechanical drawings of design, test, packing, labels, transportation, storage, installation, local and operation test of insulators listed below, shall be provided.
  - (ii) Design calculation (if necessary);
  - (iii) Details of packing, transportation and housing;
  - (iv) Test reports and certificates of passed tests;
  - (v) Erection, operation and maintenance manuals;
  - (vi) Drawings showing the outline dimensions, transportation, weight, type and other specifications of them
  - (vii) List of drawings and components parts constituting a complete insulator.

**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).*

## 8. TRAINING

- 8.1. Training materials in the form of drawings, instructions and/or audio visuals shall be provided for the items accepted under the offer.

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- 8.2. Tenderers shall state the availability of training materials which shall include but is not limited to the following topics:
- a) Handling
  - b) Storage
  - c) Application (particularly in areas of heavy coastal pollution)
  - d) Installation
  - e) Maintenance
  - f) Environmental performance
  - g) Electrical performance
  - h) Mechanical performance
  - i) Disposal

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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  | Bidders offer                                       |                       |       |
|------------|--|---|-----------------------|-------|
| 1.2<br>a   | <b>Composite Vertical Line Post Insulator - Rated 72.5kV</b>       |   |                       |       |
|            | Bidders Name & Address   |   |                       |       |
|            | Manufacturer's name and Country of manufacture                     |   |                       |       |
|            | Type Designation/ Catalogue Number                                 |   |                       |       |
|            | Standards of Design and Manufacture                                |   |                       |       |
| 4.2        | Design & Construction  | Type  | state                 |       |
|            |  | Rigid   | state                 |       |
|            | Insulating housing and weather shed housing from same manufacturer |   | state                 |       |
|            | Reliability and Performance evidence                               |   | provide               |       |
|            | Recyclability and disposability                                    |   | comment               |       |
|            | Core   | Material of manufacture                             |                       | state |
|            |  | Can withstand mechanical stress                     |                       | state |
|            |  | Withstands electrical stress of use and overvoltage |                       | state |
|            |  | Power arc resistance                                |                       | state |
|            |  | Diameter of core                                    |                       | state |
|            | Housing & wethersheds  | Material of Manufacture                             |                       | state |
|            |  | Hardness  |                       | state |
|            |  | Track resistance                                    |                       | state |
|            |  | Sheath thickness                                    |                       | state |
|            |  | Strength of weather-shed to sheath interface        |                       | state |
|            |  | Can withstand a high pressure washing test          |                       | state |
|            |  | Defects   |                       | state |
|            | Metallic end fittings  | Clamp top type                                      | Mechanical features   | state |
|            |  |   | Conventional trunnion | state |
|            |  |   | Additional eye        | state |
| K- clamp   |  | Clamping zone properties                            |                       | state |
|            |  | Captive live-line bolt                              |                       | state |
|            |  | Allows for standard cover up hoods                  |                       | state |
|            |  | For vertical or horizontal use                      |                       | state |
| Steel used |  | Forged  | C30 galvanization     | state |
|            | C40  |   |                       |       |

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|   |   | Casting                 | C30       | galvanization | state           |
|   |   |                         | C40       |               |                 |
| Mounting Brackets/ Fixing base          | Drawings of top and bottom flanges of end fittings PCDs, holes and thread sizes |                         |           |               | Attach          |
| Insulation creepage                     | <b>Pollution zone</b>   | <b>Application area</b> | SCD mm/kV | USCD mm/KV    | Specify specify |
|   | Medium  | Inland                  | 25        | 43.3          | state           |
|   | Heavy   | Industrial              | 31        | 53.7          |                 |
|   | Very heavy  | Coastal Area            | 40        | 53.7          | state           |
| Insulator shed profile                  | Design of shed profiles   |                         |           |               | state           |
|   | Shed spacing projection ratio   |                         |           |               | state           |
|   | Minimum distance between sheds  |                         |           |               |                 |
|   | Creepage to clearance ratio   |                         |           |               |                 |
|   | Shed angle  |                         |           |               |                 |
|   | Creepage factor   | Medium pollution class  |           |               | state           |
|   | Extra heavy pollution class   |                         |           | state         |                 |
| Mechanical & electrical characteristics | Line voltage in kV  |                         |           |               | state           |
|   | Maximum Line Voltage in kV  |                         |           |               | state           |
|   | Power frequency with stand  | dry (kVrms)             |           |               | state           |
|   |   | wet (kVrms)             |           |               | state           |
|   | Lightning impulse withstand 1.2/50  | positive (kVpeak)       |           |               | state           |
|   |   | negative (kVpeak)       |           |               | state           |
|   | Visible discharge test voltage, min (kV)  |                         |           |               | state           |
|   | Radio influence Voltage (RIV) at 100kHz   | Test (kV)               |           |               | state           |
|   |   | Maximum ( $\mu$ V)      |           |               | state           |
|   | Specified cantilever load (SCL) (kN)  |                         |           |               | state           |
|   | Max Design cantilever load MCDL, 65% of SCL                                     |                         |           |               | state           |
|   | Specified tensile load - STL  |                         |           |               | state           |
|   | Maximum design compression - MDC  |                         |           |               | state           |
|   | Maximum design torsion - MDT  |                         |           |               | state           |
|   | Number of sheds, A  |                         |           |               | state           |
|   | Dimensions  | vertical (mm)           |           |               | state           |
|   |   | horizontal (mm)         |           |               | state           |
|   | Creepage distance (mm)  | Inland                  |           |               | state           |
|   |   | Industrial              |           |               | state           |
|   |   | Coastal regions         |           |               | state           |
| Dry arc distance (mm)                   |   |                         |           | state         |                 |
| Mean coating thickness                  | for iron and steel castings and forgings ( $g/m^2$ ( $\mu$ m))                  |                         |           | state         |                 |
|   | for bolts, nuts and washers ( $g/m^2$ ( $\mu$ m))                               |                         |           | state         |                 |
| Approximate weight (kg)                 |   |                         |           | state         |                 |

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|--|--|--|-----------------------|-------|
|  | Finish   | Complete post insulators and accessories offered | state                 |       |
|  |  | High resistance to                               | moisture              | state |
|  |  |  | high salinity         | state |
|  |  |  | ultraviolet radiation | state |
|  |  |  | high temperature      | state |
|  |  |  | tropical sunshine     | state |
|  |  | color  | state                 |       |
| Conductor sizes accommodated on top and side grooves | state  |  |                       |       |
| Galvanizing  | Smooth finish  | state  |                       |       |
|  | thickness  | state  |                       |       |
| 4.4  | Quality Management System  |  |                       |       |
|  | Quality Assurance Plan   |  | state                 |       |
|  | Copy of ISO 9001:2008 Certificate  |  | state                 |       |
|  | Manufacturer's experience  |  | state                 |       |
|  | Manufacturing Capacity (units per month)   |  | state                 |       |
|  | List of previous customers   |  | state                 |       |
|  | Customer reference letters   |  | state                 |       |
| 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               |       |
| 8.0  | Manufacturer's Guarantee and Warranty  |  | provide               |       |
| 9.0  | List catalogues, brochures, technical data and drawings submitted to support the offer       |  | provide               |       |
| 10.0   | List customer sales records and reference letters submitted to support the offer.            |  | provide               |       |
| 11.0   | List Test Certificates submitted with tender   |  | provide               |       |
| 12.0   | List test reports of the insulators to be submitted to KPLC for approval before shipment     |  | provide               |       |
| 13.0   | Statement of compliance to specification (indicate deviations if any & supporting documents) |  | provide               |       |

| CLAUSE   | Description   | Bidders offer |
|----------|---|---------------|
| 1.2<br>b | <b>Composite Vertical Line Post Insulator Rated - 145kV</b> |               |
|          | Bidders Name & Address                                      |               |
|          | Manufacturer's name and Country of manufacture              |               |

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**TITLE:**  
**SPECIFICATION FOR 66kV & 132kV COMPOSITE LINE POST INSULATORS – VERTICAL & HORIZONTAL MOUNTING**

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|                                |   |  |                                    |               |                    |       |
|--------------------------------|---|--|------------------------------------|---------------|--------------------|-------|
|                                | Type Designation/ Catalogue Number  |  |                                    |               |                    |       |
|                                | Standards of Design and Manufacture   |  |                                    |               |                    |       |
| 4.2                            | Design & Construction   | Type   |                                    |               | state              |       |
|                                |   | Rigid  |                                    |               | state              |       |
|                                |   | Insulating housing and weather shed housing from same manufacturer |                                    |               | state              |       |
|                                |   | Reliability and Performance evidence                               |                                    |               | provide            |       |
|                                |   | Recyclability and disposability                                    |                                    |               | comment            |       |
|                                | Core  | Material of manufacture  |                                    |               | state              |       |
|                                |   | Can withstand mechanical stress                                    |                                    |               | state              |       |
|                                |   | Withstands electrical stress of use and overvoltage                |                                    |               | state              |       |
|                                |   | Power arc resistance   |                                    |               | state              |       |
|                                |   | Diameter of core   |                                    |               | state              |       |
|                                | Housing & wethersheds   | Material of Manufacture  |                                    |               | state              |       |
|                                |   | Hardness   |                                    |               | state              |       |
|                                |   | Track resistance   |                                    |               | state              |       |
|                                |   | Sheath thickness   |                                    |               | state              |       |
|                                |   | Strength of weather-shed to sheath interface                       |                                    |               | state              |       |
|                                |   | Can withstand a high pressure washing test                         |                                    |               | state              |       |
|                                | Metallic end fittings   | Clamp top type   | Mechanical features                |               | state              |       |
|                                |   |  | Conventional trunnion              |               | state              |       |
|                                |   |  | Additional eye                     |               | state              |       |
|                                |   | K- clamp   | Clamping zone properties           |               | state              |       |
|                                |   |  | Captive live-line bolt             |               | state              |       |
|                                |   |  | Allows for standard cover up hoods |               | state              |       |
|                                |   |  | For vertical or horizontal use     |               | state              |       |
|                                |   | Steel used   | Forged                             | C30           | galvanisation      | state |
|                                |   |  |                                    | C40           |                    |       |
|                                |   |  | Casting                            | C30           | galvanisation      | state |
|                                | C40   |  |                                    |               |                    |       |
| Mounting Brackets/ Fixing base | Drawings of top and bottom flanges of end fittings PCDs, holes and thread sizes |  |                                    | Attach        |                    |       |
| Insulation creepage            | <b>Pollution zone</b>   | <b>Application area</b>  | SCD<br>mm/kV                       | USCD<br>mm/KV | specify<br>specify |       |
|                                | Medium  | Inland   | 25                                 | 43.3          | state              |       |
|                                | Heavy   | Industrial   | 31                                 | 53.7          | state              |       |
|                                | Very heavy  | Coastal Area   | 40                                 | 53.7          | state              |       |
| Insulator shed profile         | Design of shed profiles   |  |                                    | state         |                    |       |
|                                | Shed spacing projection ratio   |  |                                    | state         |                    |       |
|                                | Minimum distance between sheds  |  |                                    |               |                    |       |
|                                | Creepage to clearance ratio   |  |                                    |               |                    |       |
|                                | Shed angle  |  |                                    |               |                    |       |

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|  |  |   |  |                       |       |
|--|--|---|--|-----------------------|-------|
|  | Mechanical & electrical characteristics  | Creepage factor                             | Medium pollution class   | state                 |       |
|  |  |   | Extra heavy pollution class                                    | state                 |       |
|  |  | Line voltage in kV                          |  | state                 |       |
|  |  | Maximum Line Voltage in kV                  |  | state                 |       |
|  |  | Power frequency with stand                  | dry (kVrms)  | state                 |       |
|  |  |   | wet (kVrms)  | state                 |       |
|  |  | Lightning impulse withstand 1.2/50          | positive (kVpeak)  | state                 |       |
|  |  |   | negative (kVpeak)  | state                 |       |
|  |  | Visible discharge test voltage, min (kV)    |  | state                 |       |
|  |  | Radio influence Voltage (RIV) at 100kHz     | Test (kV)  | state                 |       |
|  |  |   | Maximum ( $\mu$ V)   | state                 |       |
|  |  | Specified cantilever load (SCL) (kN)        |  | state                 |       |
|  |  | Max Design cantilever load MCDL, 65% of SCL |  | state                 |       |
|  |  | Specified tensile load - STL                |  | state                 |       |
|  |  | Maximum design compression - MDC            |  | state                 |       |
|  |  | Maximum design torsion - MDT                |  | state                 |       |
|  |  | Number of sheds, A                          |  | state                 |       |
|  |  | Dimensions                                  | vertical (mm)  | state                 |       |
|  |  |   | horizontal (mm)  | state                 |       |
|  |  | Creepage distance (mm)                      | Inland   | state                 |       |
|  |  |   | Industrial   | state                 |       |
|  |  |   | Coastal regions  | state                 |       |
|  |  | Dry arc distance (mm)                       |  | state                 |       |
|  |  | Mean coating thickness                      | for iron and steel castings and forgings ( $g/m^2$ ( $\mu$ m)) | state                 |       |
|  |  |   | for bolts, nuts and washers ( $g/m^2$ ( $\mu$ m))              | state                 |       |
|  |  | Approximate weight (kg)                     |  | state                 |       |
|  |  | Finish                                      | Complete post insulators and accessories offered               | state                 |       |
|  |  |   | High resistance to   | moisture              | state |
|  |  |   |  | high salinity         | state |
|  |  |   |  | ultraviolet radiation | state |
|  |  |   |  | high temperature      | state |
|  |  |   |  | tropical sunshine     | state |
| color  | state                                    |   |  |                       |       |
| Conductor sizes accommodated on top and side grooves |  | state                                       |  |                       |       |
| Galvanizing  | Smooth finish                            | state                                       |  |                       |       |
|  | thickness                                | state                                       |  |                       |       |
| 4.4  | Quality Management System                |   |  |                       |       |
|  | Quality Assurance Plan                   | state                                       |  |                       |       |
|  | Copy of ISO 9001:2008 Certificate        | state                                       |  |                       |       |
|  | Manufacturer's experience                | state                                       |  |                       |       |
|  | Manufacturing Capacity (units per month) | state                                       |  |                       |       |

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|      |  |         |
|------|--|---------|
|      | List of previous customers   | state   |
|      | Customer reference letters   | state   |
| 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 |
| 8.0  | Manufacturer's Guarantee and Warranty  | provide |
| 9.0  | List catalogues, brochures, technical data and drawings submitted to support the offer       | provide |
| 10.0 | List customer sales records and reference letters submitted to support the offer.            | provide |
| 11.0 | List Test Certificates submitted with tender   | provide |
| 12.0 | List test reports of the insulators to be submitted to KPLC for approval before shipment     | provide |
| 13.0 | Statement of compliance to specification (indicate deviations if any & supporting documents) | provide |

| CLAUSE           | Description  | Bidders offer                                       |       |
|------------------|--|---|-------|
| 1.2<br>c         | <b>Composite Horizontal Line Post Insulator - Rated 72.5kV</b>     |   |       |
|                  | Bidders Name & Address   |   |       |
|                  | Manufacturer's name and Country of manufacture                     |   |       |
|                  | Type Designation/ Catalogue Number                                 |   |       |
|                  | Standards of Design and Manufacture                                |   |       |
| 4.2              | Design & Construction  | Type  | state |
|                  |  | Rigid   | state |
|                  | Insulating housing and weather shed housing from same manufacturer | state   |       |
|                  | Reliability and Performance evidence                               | provide   |       |
|                  | Recyclability and disposability                                    | comment   |       |
|                  | Core   | Material of manufacture                             | state |
|                  |  | Can withstand mechanical stress                     | state |
|                  |  | Withstands electrical stress of use and overvoltage | state |
|                  |  | Power arc resistance                                | state |
|                  |  | Diameter of core                                    | state |
|                  | Housing & wethersheds  | Material of Manufacture                             | state |
| Hardness         |  | state   |       |
| Track resistance |  | state   |       |
| Sheath thickness |  | state   |       |

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|   |   |  |               |               |                    |
|---|---|--|---------------|---------------|--------------------|
|   |   | Strength of weather-shed to sheath interface |               | state         |                    |
|   |   | Can withstand a high pressure washing test   |               | state         |                    |
|   |   | Defects                                      |               | state         |                    |
| Metallic end fittings                   | Clamp top type  | Mechanical features                          |               | state         |                    |
|   |   | Conventional trunnion                        |               | state         |                    |
|   |   | Additional eye                               |               | state         |                    |
|   | K- clamp  | Clamping zone properties                     |               | state         |                    |
|   |   | Captive live-line bolt                       |               | state         |                    |
|   |   | Allows for standard cover up hoods           |               | state         |                    |
|   |   | For vertical or horizontal use               |               | state         |                    |
| Steel used                              | Forged  | C30  | galvanisation | state         |                    |
|   |   | C40  |               |               |                    |
|   |   | Casting                                      | galvanisation | state         |                    |
|   |   |  |               |               | C30                |
|   |   | C40  |               |               |                    |
| Mounting Brackets/ Fixing base          | Drawings of top and bottom flanges of end fittings PCDs, holes and thread sizes |  |               | Attach        |                    |
| Insulation creepage                     | <b>Pollution zone</b>   | <b>Application area</b>                      | SCD<br>mm/kV  | USCD<br>mm/KV | specify<br>specify |
|   | Medium  | Inland                                       | 25            | 43.3          | state              |
|   | Heavy   | Industrial                                   | 31            | 53.7          |                    |
|   | Very heavy  | Coastal Area                                 | 40            | 53.7          | state              |
| Insulator shed profile                  | Design of shed profiles   |  |               | state         |                    |
|   | Shed spacing projection ratio   |  |               | state         |                    |
|   | Minimum distance between sheds  |  |               |               |                    |
|   | Creepage to clearance ratio   |  |               |               |                    |
|   | Shed angle  |  |               |               |                    |
|   | Creepage factor   | Medium pollution class                       |               | state         |                    |
| Extra heavy pollution class             |   | state  |               |               |                    |
| Mechanical & electrical characteristics | Line voltage in kV  |  |               | state         |                    |
|   | Maximum Line Voltage in kV  |  |               | state         |                    |
|   | Power frequency with stand  | dry (kVrms)                                  |               | state         |                    |
|   |   | wet (kVrms)                                  |               | state         |                    |
|   | Lightning impulse withstand 1.2/50  | positive (kVpeak)                            |               | state         |                    |
|   |   | negative (kVpeak)                            |               | state         |                    |
|   | Visible discharge test voltage, min (kV)  |  |               | state         |                    |
|   | Radio influence Voltage (RIV) at 100kHz   | Test (kV)                                    |               | state         |                    |
|   |   | Maximum (µV)                                 |               | state         |                    |
|   | Specified cantilever load (SCL) (kN)  |  |               | state         |                    |
|   | Max Design cantilever load MCDL, 65% of SCL                                     |  |               | state         |                    |
|   | Specified tensile load - STL  |  |               | state         |                    |
|   | Maximum design compression - MDC  |  |               | state         |                    |
| Maximum design torsion - MDT            |   |  | state         |               |                    |
| Number of sheds, A                      |   |  | state         |               |                    |

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|  |  |  |                         |  |                       |       |       |
|--|--|--|-------------------------|--|-----------------------|-------|-------|
|  |  |  | Dimensions              | vertical (mm)  | state                 |       |       |
|  |  |  |                         | horizontal (mm)  | state                 |       |       |
|  |  |  | Creepage distance (mm)  | Inland   | state                 |       |       |
|  |  |  |                         | Industrial   | state                 |       |       |
|  |  |  |                         | Coastal  | state                 |       |       |
|  |  |  | Dry arc distance (mm)   |  |                       |       | state |
|  |  |  | Mean coating thickness  | for iron and steel castings and forgings (g/m <sup>2</sup> (μm)) |                       | state |       |
|  |  |  |                         | for bolts, nuts and washers (g/m <sup>2</sup> (μm))              |                       | state |       |
|  |  |  | Approximate weight (kg) |  |                       |       | state |
|  |  |  | Finish                  | Complete post insulators and accessories offered                 |                       |       | state |
|  |  |  |                         | High resistance to   | moisture              |       | state |
|  |  |  |                         |  | high salinity         |       | state |
|  |  |  |                         |  | ultraviolet radiation |       | state |
|  |  |  |                         |  | high temperature      |       | state |
|  |  |  |                         | tropical sunshine  |                       | state |       |
| color  |  |  | state                   |  |                       |       |       |
| Conductor sizes accommodated on top and side grooves |  |  | state                   |  |                       |       |       |
| Galvanizing  | Smooth finish  |  |                         | state  |                       |       |       |
|  | thickness  |  |                         | state  |                       |       |       |
| 4.4  | Quality Management System  |  |                         |  |                       |       |       |
|  | Quality Assurance Plan   |  |                         | state  |                       |       |       |
|  | Copy of ISO 9001:2008 Certificate  |  |                         | state  |                       |       |       |
|  | Manufacturer's experience  |  |                         | state  |                       |       |       |
|  | Manufacturing Capacity (units per month)   |  |                         | state  |                       |       |       |
|  | List of previous customers   |  |                         | state  |                       |       |       |
|  | Customer reference letters   |  |                         | state  |                       |       |       |
| 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  |                       |       |       |
| 8.0  | Manufacturer's Guarantee and Warranty  |  |                         | provide  |                       |       |       |
| 9.0  | List catalogues, brochures, technical data and drawings submitted to support the offer |  |                         | provide  |                       |       |       |
| 10.0   | List customer sales records and reference letters submitted to support the offer.      |  |                         | provide  |                       |       |       |
| 11.0   | List Test Certificates submitted with tender   |  |                         | provide  |                       |       |       |
| 12.0   | List test reports of the insulators to be submitted to KPLC for approval before        |  |                         | provide  |                       |       |       |

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|      |  |         |
|------|--|---------|
|      | shipment   |         |
| 13.0 | Statement of compliance to specification (indicate deviations if any & supporting documents) | provide |

| CLAUSE                         | Description   | Bidders offer                                       |                                    |       |
|--------------------------------|---|---|------------------------------------|-------|
| 1.2<br>d                       | <b>Composite Horizontal Line Post Insulator - Rated 145kV</b>                   |   |                                    |       |
|                                | Bidders Name & Address  |   |                                    |       |
|                                | Manufacturer's name and Country of manufacture                                  |   |                                    |       |
|                                | Type Designation/ Catalogue Number  |   |                                    |       |
|                                | Standards of Design and Manufacture   |   |                                    |       |
| 4.2                            | Design & Construction   | Type  | state                              |       |
|                                |   | Rigid   | state                              |       |
|                                | Insulating housing and weather shed housing from same manufacturer              | state   |                                    |       |
|                                | Reliability and Performance evidence  | provide   |                                    |       |
|                                | Recyclability and disposability   | comment   |                                    |       |
|                                | Core  | Material of manufacture                             | state                              |       |
|                                |   | Can withstand mechanical stress                     | state                              |       |
|                                |   | Withstands electrical stress of use and overvoltage | state                              |       |
|                                |   | Power arc resistance                                | state                              |       |
|                                |   | Diameter of core                                    | state                              |       |
|                                | Housing & wethersheds   | Material of Manufacture                             | state                              |       |
|                                |   | Hardness  | state                              |       |
|                                |   | Track resistance                                    | state                              |       |
|                                |   | Sheath thickness                                    | state                              |       |
|                                |   | Strength of weather-shed to sheath interface        | state                              |       |
|                                |   | Can withstand a high pressure washing test          | state                              |       |
|                                | Metallic end fittings   | Clamp top type                                      | Mechanical features                | state |
|                                |   |   | Conventional trunnion              | state |
|                                |   |   | Additional eye                     | state |
|                                |   | K- clamp  | Clamping zone properties           | state |
|                                |   |   | Captive live-line bolt             | state |
|                                |   |   | Allows for standard cover up hoods | state |
|                                |   |   | For vertical or horizontal use     | state |
| Steel used                     |   | Forged  | C30 galvanisation                  | state |
|                                |   |   | C40                                |       |
|                                |   | Casting   | C30 galvanisation                  | state |
|                                | C40   |   |                                    |       |
| Mounting Brackets/ Fixing base | Drawings of top and bottom flanges of end fittings PCDs, holes and thread sizes | Attach  |                                    |       |

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| Insulation creepage                                 | Pollution zone                                   | Application area   | SCD   | USCD  | Specify |
|---|--|--|-------|-------|---------|
|   |  |  | Mm/kV | mm/KV | Specify |
|   | Medium   | Inland   | 25    | 43.3  | state   |
|   | Heavy  | Industrial   | 31    | 53.7  | state   |
|   | Very heavy                                       | Coastal Area   | 40    | 53.7  | state   |
| Insulator shed profile                              | Design of shed profiles                          |  |       |       | state   |
|   | Shed spacing projection ratio                    |  |       |       | state   |
|   | Minimum distance between sheds                   |  |       |       |         |
|   | Creepage to clearance ratio                      |  |       |       |         |
|   | Shed angle                                       |  |       |       |         |
|   | Creepage factor                                  | Medium pollution class   |       | state |         |
|   |  | Extra heavy pollution class                                      |       | state |         |
| Mechanical & electrical characteristics             | Line voltage in kV                               |  |       |       | state   |
|   | Maximum Line Voltage in kV                       |  |       |       | state   |
|   | Power frequency with stand                       | dry (kVrms)  |       |       | state   |
|   |  | wet (kVrms)  |       |       | state   |
|   | Lightning impulse withstand 1.2/50               | positive (kVpeak)  |       |       | state   |
|   |  | negative (kVpeak)  |       |       | state   |
|   | Visible discharge test voltage, min (kV)         |  |       |       | state   |
|   | Radio influence Voltage (RIV) at 100kHz          | Test (kV)  |       |       | state   |
|   |  | Maximum (µV)   |       |       | state   |
|   | Specified cantilever load (SCL) (kN)             |  |       |       | state   |
|   | Max Design cantilever load MCDL, 65% of SCL      |  |       |       | state   |
|   | Specified tensile load - STL                     |  |       |       | state   |
|   | Maximum design compression - MDC                 |  |       |       | state   |
|   | Maximum design torsion - MDT                     |  |       |       | state   |
|   | Number of sheds, A                               |  |       |       | state   |
|   | Dimensions                                       | vertical (mm)  |       |       | state   |
|   |  | horizontal (mm)  |       |       | state   |
|   | Leakage distance (mm)                            |  |       |       | state   |
|   | Dry arc distance (mm)                            |  |       |       | state   |
|   | Mean coating thickness                           | for iron and steel castings and forgings (g/m <sup>2</sup> (µm)) |       |       | state   |
| for bolts, nuts and washers (g/m <sup>2</sup> (µm)) |  |  | state |       |         |
| Approximate weight (kg)                             |  |  |       | state |         |
| Finish  | Complete post insulators and accessories offered |  |       |       | state   |
|   | High resistance to                               | moisture   |       |       | state   |
|   |  | high salinity  |       |       | state   |
|   |  | ultraviolet radiation  |       |       | state   |
|   |  | high temperature   |       |       | state   |
|   | tropical sunshine                                |  |       | state |         |
|   | color  |  |       |       | state   |
| Conductor sizes accommodated on top and side        |  |  |       | state |         |

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**TITLE:**  
**SPECIFICATION FOR 66kV & 132kV COMPOSITE LINE POST INSULATORS – VERTICAL & HORIZONTAL MOUNTING**

|               |                        |
|---------------|------------------------|
| Doc. No.      | KP1/6C.1/36/TSP/04/001 |
| Issue No.     | 1                      |
| Revision No.  | 0                      |
| Date of Issue | 2015-10-01             |
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|      |  |               |         |
|------|--|---------------|---------|
|      |  | grooves       |         |
|      | Galvanizing  | Smooth finish | state   |
|      |  | thickness     | state   |
| 4.4  | Quality Management System  |               |         |
|      | Quality Assurance Plan   |               | state   |
|      | Copy of ISO 9001:2008 Certificate  |               | state   |
|      | Manufacturer's experience  |               | state   |
|      | Manufacturing Capacity (units per month)   |               | state   |
|      | List of previous customers   |               | state   |
|      | Customer reference letters   |               | state   |
| 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 |
| 8.0  | Manufacturer's Guarantee and Warranty  |               | provide |
| 9.0  | List catalogues, brochures, technical data and drawings submitted to support the offer       |               | provide |
| 10.0 | List customer sales records and reference letters submitted to support the offer.            |               | provide |
| 11.0 | List Test Certificates submitted with tender   |               | provide |
| 12.0 | List test reports of the insulators to be submitted to KPLC for approval before shipment     |               | provide |
| 13.0 | Statement of compliance to specification (indicate deviations if any & supporting documents) |               | provide |

**NOTE:**

- 1) Bidders shall give full GTP values offered for each items on order as per Annex A. The details provided shall conform to the test reports and their certificates as required by clause 5.2., well labeled drawings complete with dimensions, catalogues and/or brochures for the purpose of tender evaluation. Bidders who shall not have complied with this requirement shall be automatically disqualified from bidding for this tender.
- 2) The schedule in Annex A does not in any way substitute for detailed information required elsewhere in the specification.

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

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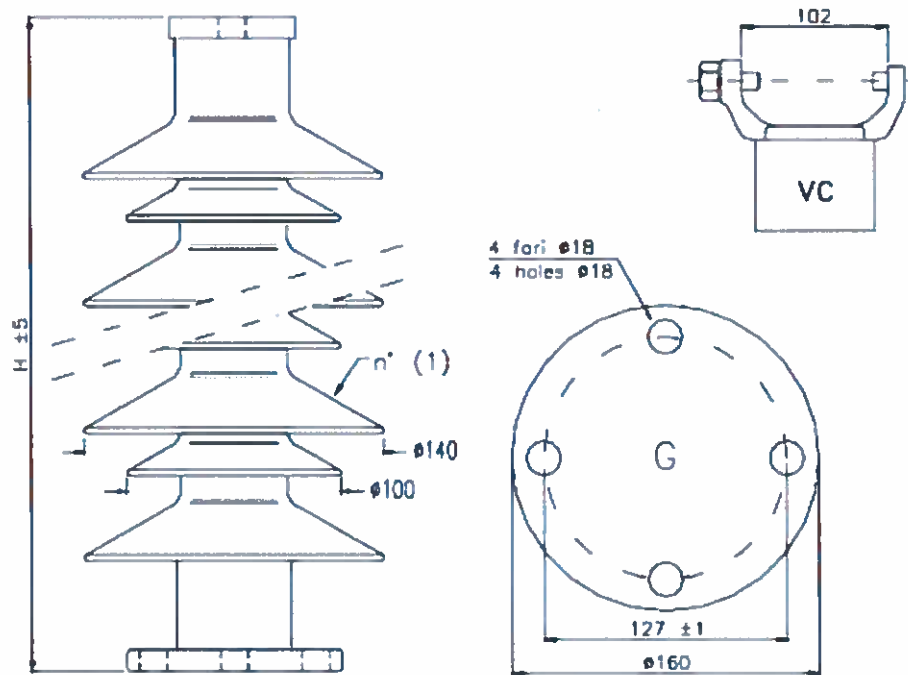
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**ANNEX B: DRAWINGS**



All dimensions are in millimetres  
 Dimensions tolerance acc. to IEC 61952

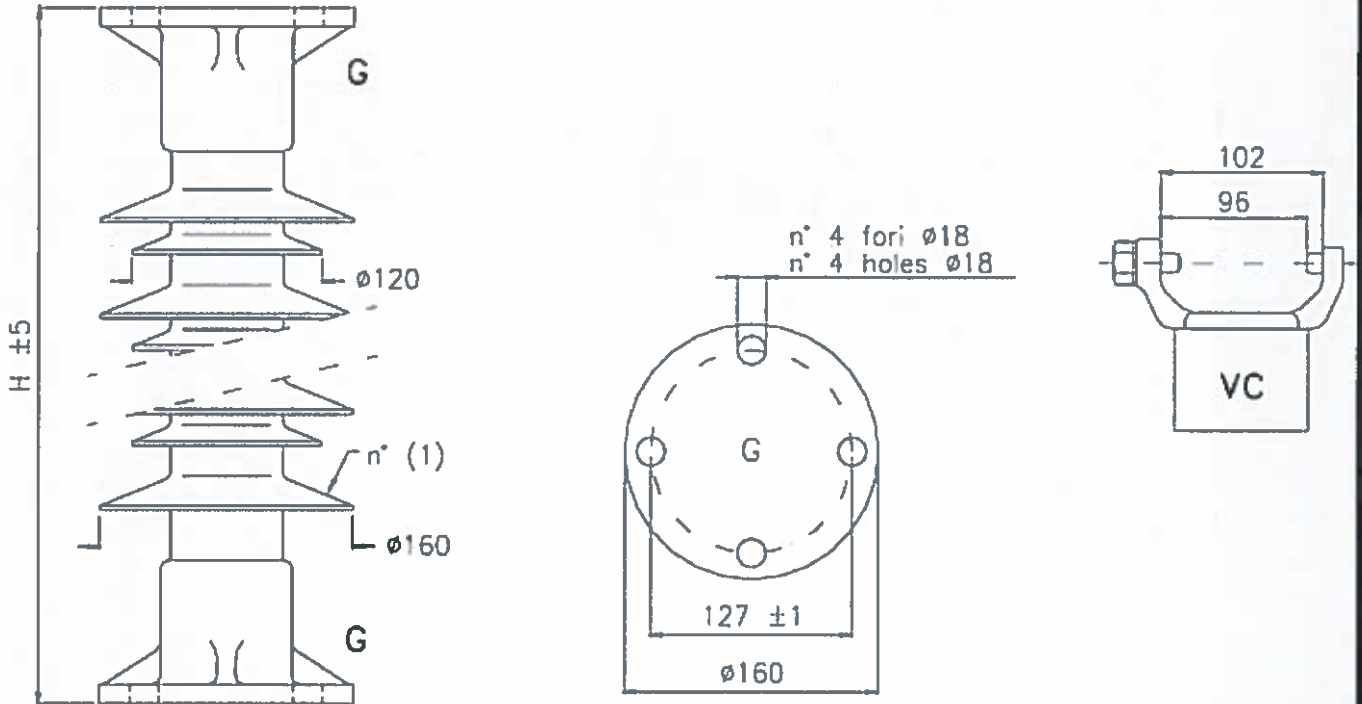
**NOTE:**

- Recommended line fitting by KPLC is **designation VC**
- Recommended Ground fitting by KPLC is **designation G**

**Fig. 1: COMPOSITE VERTICAL LINE POST INSULATOR – Rated 72.5kV**

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All dimensions are in millimetres  
 Dimensions tolerance acc. to IEC 61952

**NOTE:**

- Recommended line fitting by KPLC is **designation VC**
- Recommended Ground fitting by KPLC is **designation G**

**Fig. 2: COMPOSITE VERTICAL LINE POST INSULATOR – Rated 145kV**

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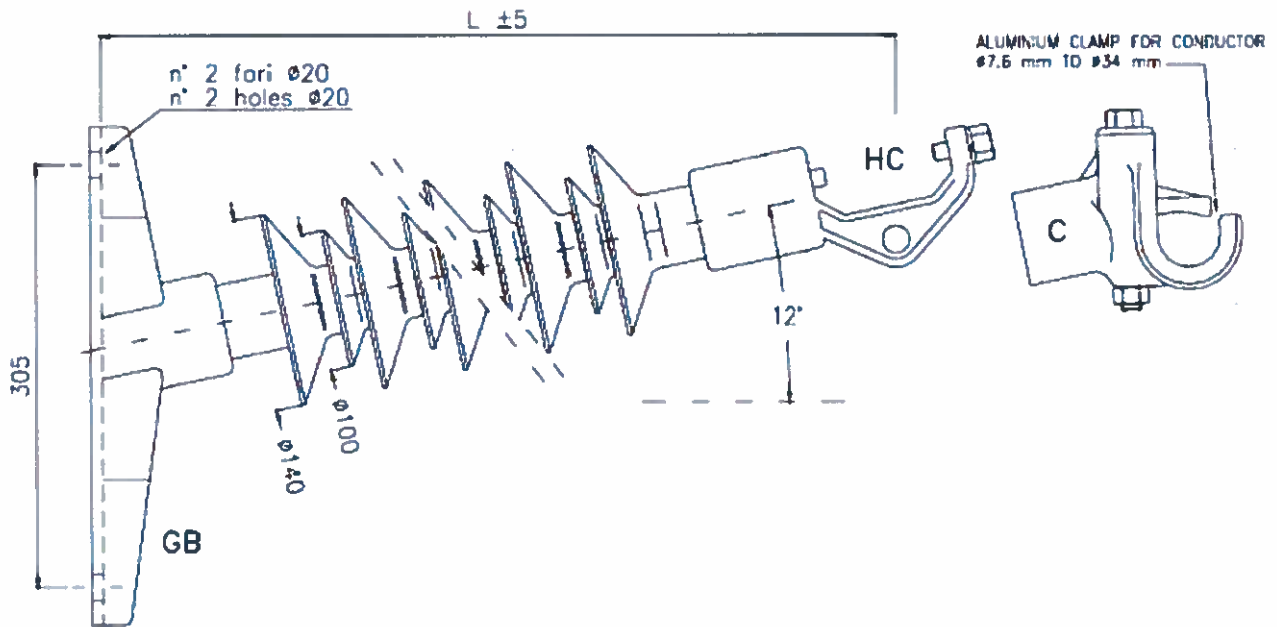


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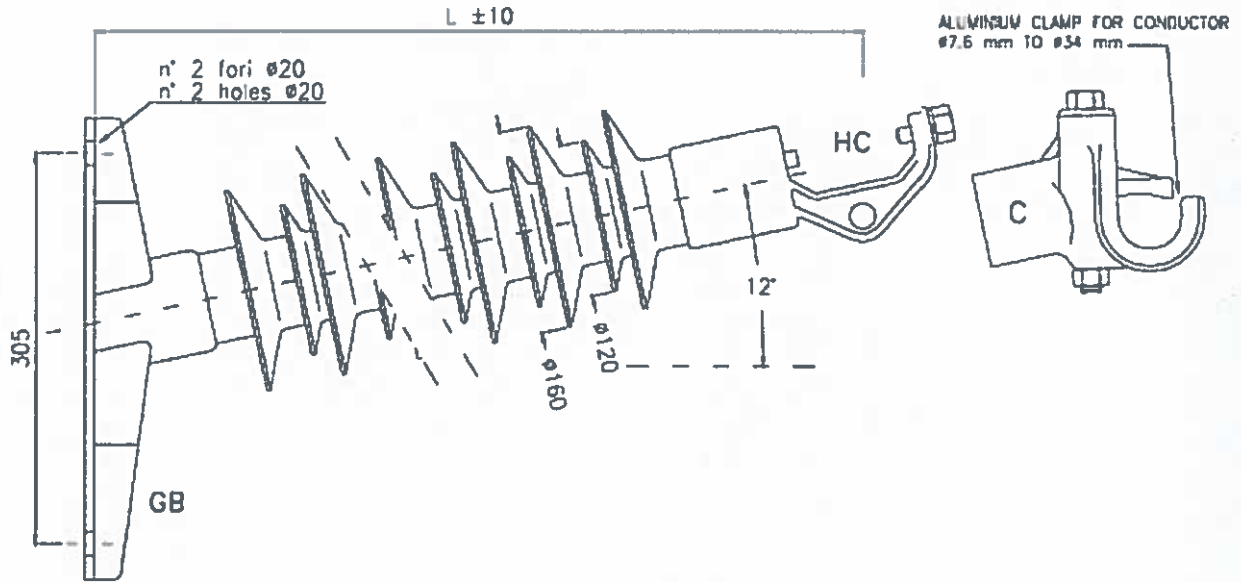
All dimensions are in millimetres  
 Dimensions tolerance acc. to IEC 61952

**NOTE:**

- Recommended line fitting by KPLC is **designation HC**
- Recommended Ground fitting by KPLC is **designation GB**
- The other fittings **designation C (Line fittings)** shall be recommended on request by KPLC during tender

**Fig. 3: COMPOSITE HORIZONTAL LINE POST INSULATOR – 72.5kV**

|  |  |
|--|--|
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| <b>Date: 2015-10-01</b>  | <b>Date: 2015-10-01</b>  |



All dimensions are in millimetres  
 Dimensions tolerance acc. to IEC 61952

**NOTE:**

- Recommended line fitting by KPLC is **designation HC**
- Recommended Ground fitting by KPLC is **designation GB**
- The other fittings **designation C (Line fittings)** shall be recommended on request by KPLC during tender

**Fig. 4: COMPOSITE HORIZONTAL LINE POST INSULATOR – Rated 145kV**

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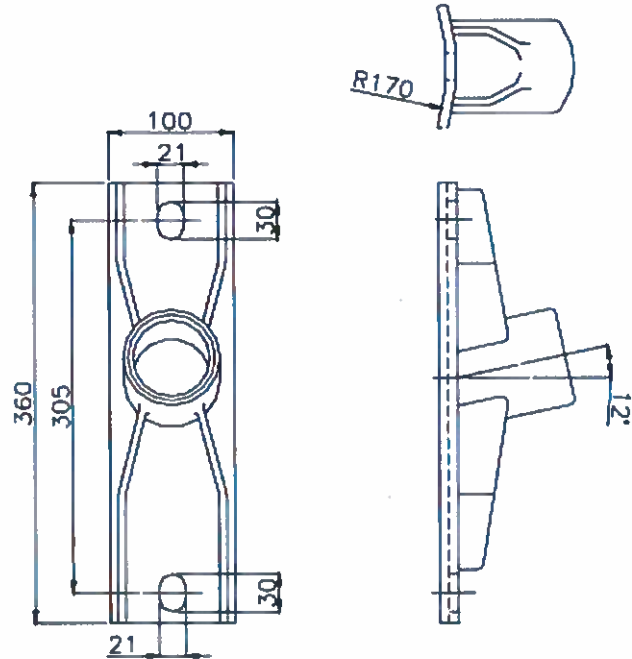


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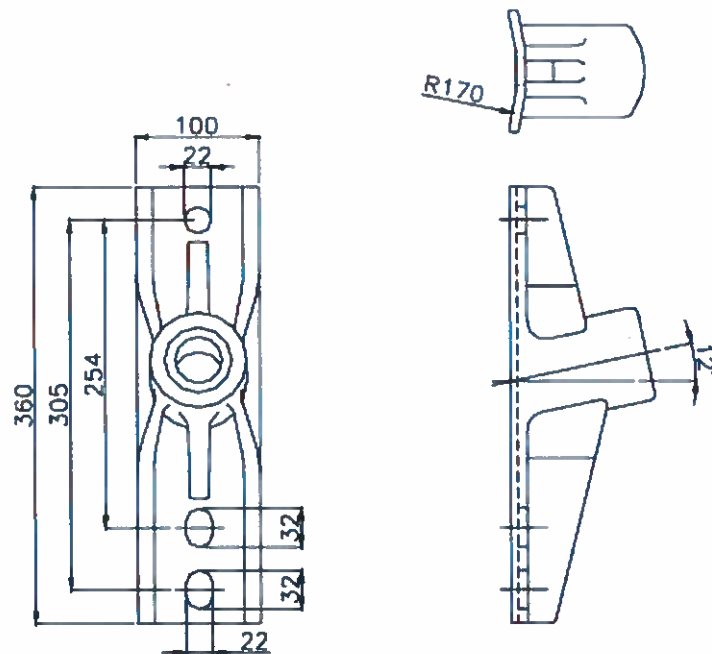


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**Fig. 5: Galvanized steel Gain Base (GB)**



**Fig. 6: Aluminium Gain Base (GB)**

Dimensions tolerance acc. to IEC 61952

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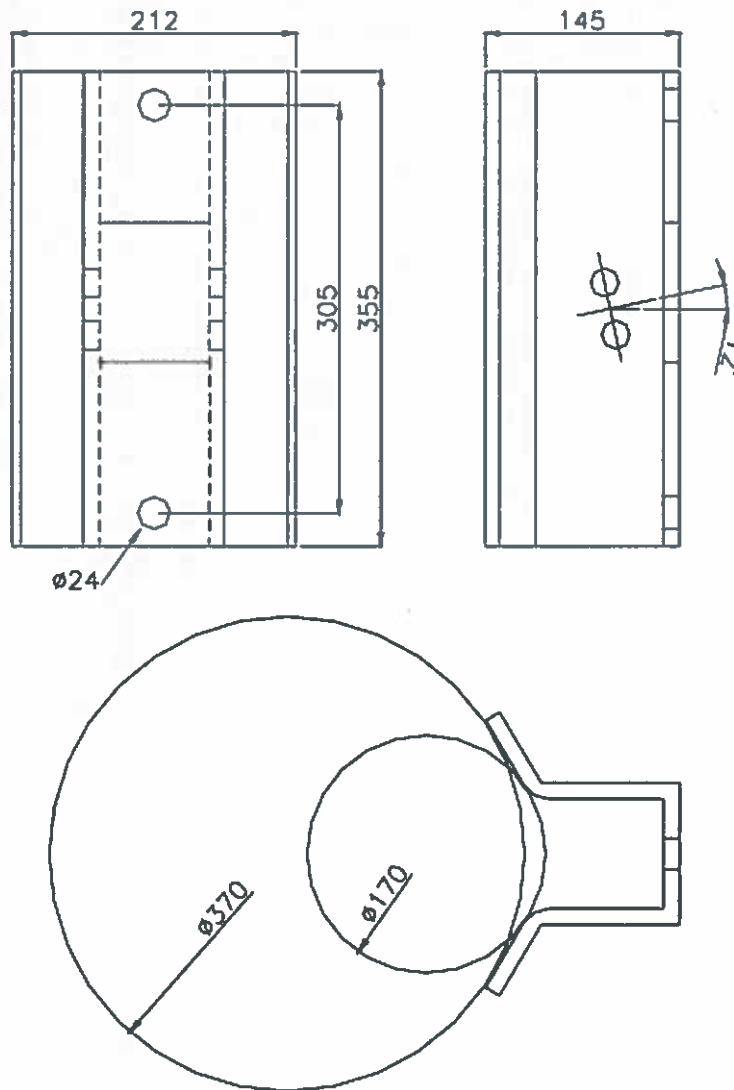
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All dimensions are in millimetres  
 Dimensions tolerance acc. to IEC 61952

**Fig. 7: Galvanized steel Horizontal Base (HB) for wooden pole**

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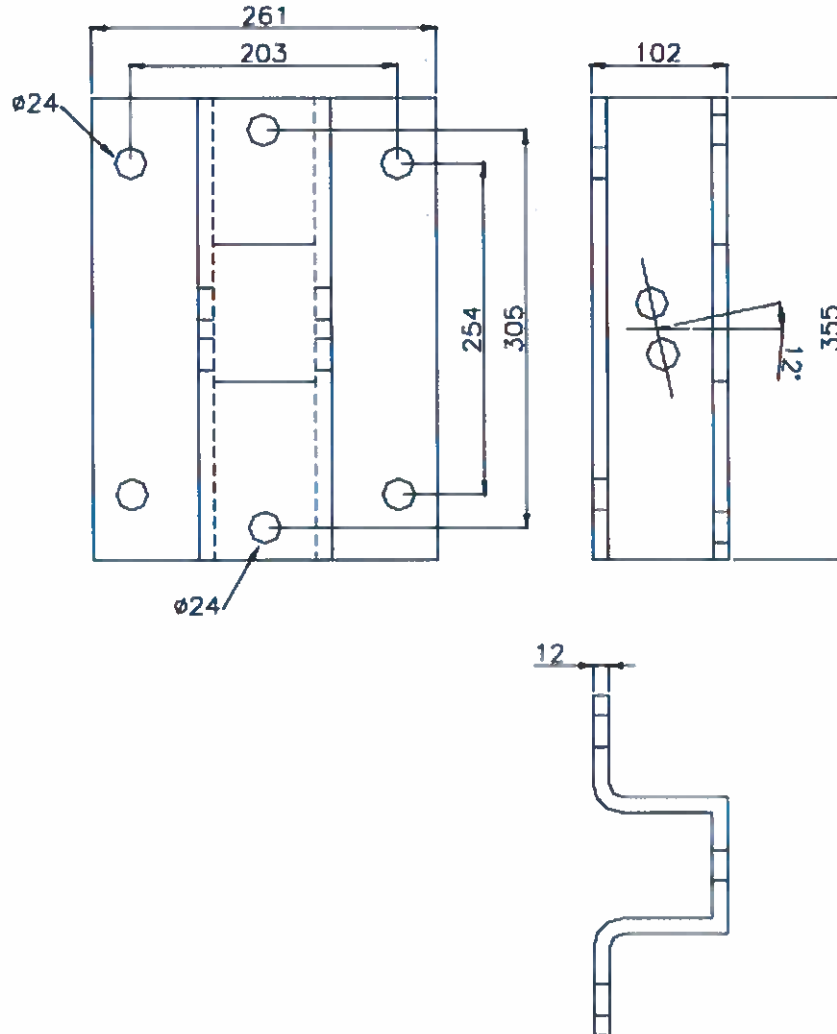


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All dimensions are in millimetres  
 Dimensions tolerance acc. to IEC 61952

**Fig. 8: Galvanized steel Horizontal Flat Base (HB)for steel pole**

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Issue No.

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Revision No.

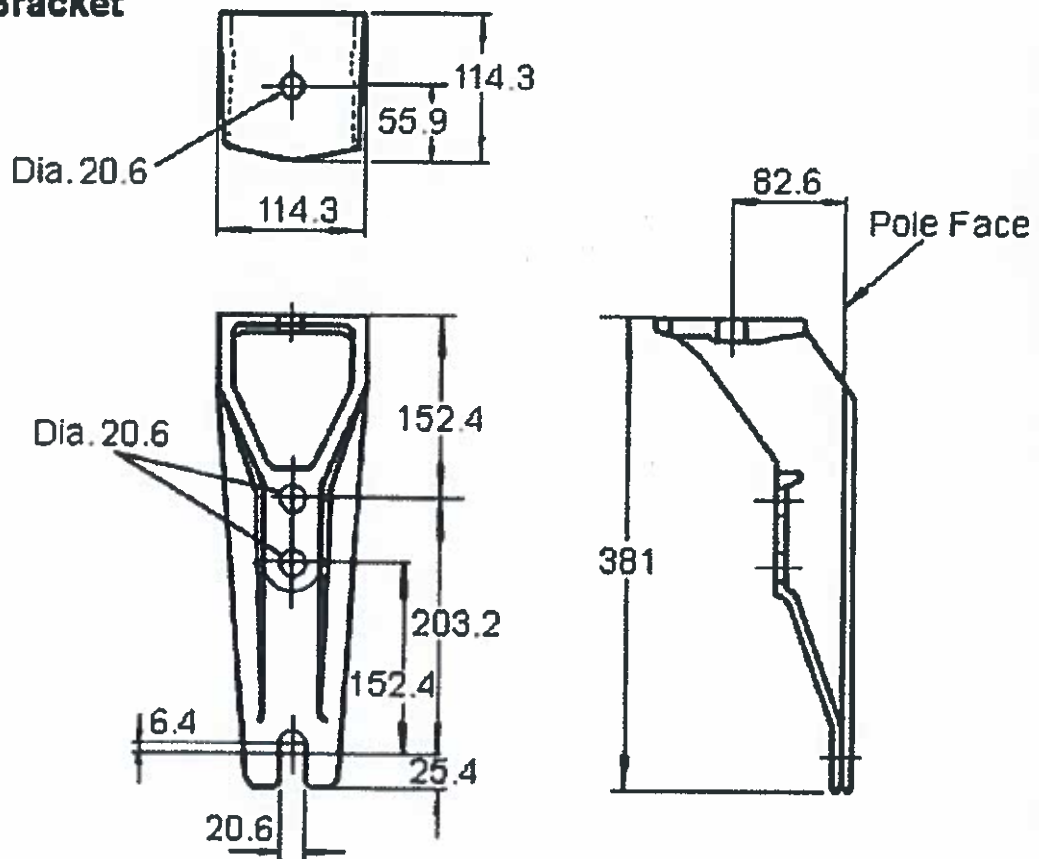
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**Mounting Bracket**



**Fig. 8: Vertical mounting base for wood poles**

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