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Kenya Power

66kV & 132kV COMPOSITE LINE POST INSULATORS – VERTICAL & HORIZONTAL MOUNTING- SPECIFICATION

A Document of the Kenya Power & Lighting Co. Plc

July 2022

TABLE OF CONTENTS

0.1 CIRCULATION LIST

COPY NO.	COPY HOLDER
1	Manager, Standards
2	Electronic copy (pdf) on Kenya Power server (http://172.16.1.40/dms/browse.php?fFolderId=23)

REVISION OF KPLC STANDARDS

To keep abreast of progress in the industry, KPLC Standards shall be regularly reviewed. Suggestions for improvements to approved Standards, addressed to the Manager, Standards Department, are welcome.

0.2 AMENDMENT RECORD

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Names)	Approved by (Name)
Issue 1 Rev. 0	2015-10-01	New Issue	M. Apudo J. Ng'ang'a	Dr. Eng. Peter Kimemia
Issue 1 Rev. 1	2022-07-07	Revision	B. Dianga Z. Rotich A. Akute	Eng. Simon Kimitei
Issue 1 Rev. 1	2022-07-07	Modified Clause 1.2 to indicate that a common insulator design shall be applicable on either Concrete, wooden or steel poles after mounting brackets redesign.		
Issue 1 Rev. 1	2022-07-07	Modified Clause 4.2.2.1.5 to revise Insulator core diameter from 63.5mm to 56mm.		
Issue 1 Rev. 1	2022-07-07	Modified and expanded clause 4.2.2.4 to describe in details(as shown on sub clauses), what requirements are desired for mounting clamps other assembly details		
Issue 1 Rev. 1	2022-07-07	Modified clause 4.2.4.5 to expand clamp size to accommodate 300mmsq conductors with a diameter of 24.71mm.(ref TSP/06/023)		
Issue 1 Rev. 1	2022-07-07	Modified clause 4.4.1(and other succeeding clauses quoting ISO 9001:2008) for current ISO certification of ISO 9001: 2015		
Issue 1 Rev. 1	2022-07-07	Modified Annex B Sections for explicit description of insulator dimensions and their associated assembly parts.		
Issue 1 Rev. 1	2022-07-07	Revised **Table 2** and updated Specified Cantilever Load -SCL and Maximum Design Cantilever Load-MCDL to be in accordance with **IEC 61952-1: 2019**, for Electrical characteristics of the Composite Line Insulators (Horizontal & Vertical)		

0.3 FOREWORD

This specification has been prepared by the Standards Department of Kenya Power and Lighting Company Limited (KPLC).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 the satisfactory service experience with products which fall within the scope of this specification.

There are no other specifications in this series.

The Specification has been revised by a team comprising personnel from Network Management and Standards to update some of the features required for 66 kV & 132 kV composite line post insulators.

This Specification stipulates the minimum requirements for 66 kV & 132 kV composite line post insulators acceptable for use in KPLC power system. It shall be the responsibility of the supplier and manufacturer to ensure that the offered design is of the highest quality and one that guarantees excellent service to KPLC, and to ensure good workmanship and 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. Users of this Kenya Power Specification are responsible for its correct interpretation and application.

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

Name	Department
Benson Dianga	Standards
Alistair Akute	Network Management
Zadock Rotich	Network Management

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 :

Concrete ,Steel or wooden pole mounting

a) Composite Vertical bus Post Insulator– Rated 72.5kV;

b) Composite Vertical Line Post Insulator – Rated 72.5kV;

c) Composite Vertical bus Post Insulator– Rated 145kV;

d) Composite Horizontal Line Post Insulator – Rated 72.5kV;

e) Composite Horizontal Line Post Insulator– Rated 145kV.

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 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.

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.

BS 4190; ISO Metric black hexagonal bolts , screw and nuts.

BS 14399; High strength structural bolting for preloading. Part 1 General requirements Part 3. Hexagonal bolts and nuts assemblies. Part 6 Plain Chamfered washers

ISO 7094: Plain Washers with round hole for construction

DIN 436; Square washers with round hole for construction

ISO 262; ISO 965; ISO 68-1; ISO General Purpose Metric Screw threads, bolts and nuts

ISO 898-2: Properties of fasteners made of carbon steel and alloy steel. Part 1 Bolts Screw and studs and specified property classes. course thread and fine pitch

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.
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

Abbreviation	Explanation
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.

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.

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 56 mm.

4.2.2.2. **Housing and Weather sheds**

4.2.2.2.1. The weather sheds 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 molded 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 molded 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 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.

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" in the drawings (Annex B) for Horizontal mounting or designation "VC" for vertical mounting complete with base (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 .The top and side grooves shall be galvanized steel and be designed to accept conductor sizes in the range 7 – 34mm overall diameter.
   (iii) A design with an additional eye(for "HC") for the attachment of other devices during installation or maintenance activities.

b) **K-Clamp** – designation "C" in drawing (Annex B -2b) and made of corrosion resistant galvanized steel 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.
   (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**

4.2.2.4.1 The line post insulators shall be supplied complete with a matching mounting bracket with shapes and sizes similar in design to the illustrations in Annex B drawings fig 1(a)(c)(f),2(a)(b)(c)

4.2.2.4.2 The mounting bracket shall be made of galvanized steel, manufactured in accordance with BS 4190/BS 14399 and surface integrity in accordance with ISO 6157-3.

4.2.2.4.3 The top and bottom flanges of the end fittings shall have holes of minimum diameter of 18mm for fastening to universal clamps, and 25mm middle hole for fastening the insulator member. as shown in Annex B drawings fig 1(a)(c)(f),2(a)

4.2.2.4.4 The design of the mounting base will be a hump of inclining angle of 12 deg and curvature subtending radius of R89° as shown in Annex B in Fig 3(a) & 3(b)

4.2.2.5 Fastening Stud bolt , Nut and Washer Plates

(i)Stud bolt

4.2.2.5.1 The fastening stud bolt shall be of M22 and shall be manufactured in accordance with BS 4190/BS 14399.The stud bolt should have a safe working sheer stress of not less than **120N/mm^2**, the ultimate sheer stress shall be 75% of the ultimate strength, the factor of safety shall not be less than **2.5**

4.2.2.5.2 The stud bolt properties shall comply with ISO 898-2 with triangular ISO thread in accordance with ISO 68-1, diameter/pitch combinations in accordance with ISO 262 and thread tolerance class of 6H for nuts as per ISO 965, for coarse tolerance quality.

4.2.2.5.3 The fastening stud bolt shall be finished, sound and free from defects in accordance with BS 4190 and BS 14399. The surface integrity shall be in accordance with ISO 6157-3.

The diameter/pitch combinations should be in accordance with ISO 262 and thread tolerance class of 6g as per ISO 965-2, for coarse tolerance quality.

4.2.2.5.4 The fastening stud shall be of M22 with and overall length of not less than (95mm for 72.6kV and 140mm for 145kV insulator) threaded with pitch of 2.5 on both ends as shown in Annex B drawings fig. 1(d)(g),2(d)

4.2.2.5.5 The stud shall have a rimmed ring (flange) at near its mid point. One side of the flange - of minimum (35mm for 72.6kV and 50.0mm for 145kV insulator) in length- and which shall be for screwing into the insulator base, shall be full threaded from the flanged rim to the tip end.

4.2.2.5.6 The other part of the stud will have a portion (bordering the rim) that is chamfered flat on opposite faces. This will be for tooling grip during assembly. The remaining part , onto which the mounting bracket will be assembled, shall be threaded to the tip as shown in Annex B drawings fig. 1(d)(g),2(d)

(ii)Washers

4.2.2.5.7 There will be two washers, one of a ring split and the other flat square shape, manufactured according to BS 14399, ISO 7094 and DIN 436 and as shown in Annex B drawings fig 1(d)(g),2(d)

4.2.2.5.8 The ring split type washer shall have an outer diameter of not more than 37 mm , an internal hole diameter of not less than 25mm and a thickness of not less than 5.5mm as shown in Annex B drawings fig 1(d)(g),2(d)

4.2.2.5.9 The square flat washer outer dimensions will not be less than 80mm on either side, internal hole diameter shall be 25mm and a thickness of above 8mm as shown in Annex B in Fig 3(b)

4.2.2.5.10 The square washers will be manufactured according to ISO 7094 and DIN 436 standards.

(iii)Nut

4.2.2.5.11 The nut shall have mechanical properties that comply with ISO 898-2 with triangular ISO thread in accordance with ISO 68-1, diameter/pitch combinations in accordance with ISO 262 and thread tolerance class of 6H for nuts as per ISO 965, for coarse tolerance quality.

4.2.2.5.12 The steel used for manufacture of the nut shall conform to the chemical composition limits specified in ISO 898-2 for nuts. The height shall be above 20mm and width across flats of hexagonal nuts shall be 36mm as stipulated according to ISO 898-2 and as shown in Annex B drawings fig 1(d)(g),2(d)

- 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 2.

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 values Cantilever Loads are tabulated in Table 2.

4.2.3.4.2. **Torsional strength**

Torsional failing load is critical for application in insulators. The minimum values shall be as per IEC 60273 and are tabulated in Table 2.

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 a spring washer and a nut for mounting the insulator to

NOTE: *The illustrations in Annex B does not restrict the manufacturer from offering a superior design of either a base that is permanently fused/molded with insulator member, or detached base with clamping 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.

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:

either steel channel iron cross arms channel or pole 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.

4.2.5. **Galvanizing**

4.2.5.1. 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.

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

4.3. CHARACTERISTICS

The mechanical and electrical characteristics of the insulators shall be as per Table 2:-

Table 2: Mechanical and electrical characteristics of the Composite Line Insulators (Horizontal & Vertical) in accordance with IEC 61952-1: 2019, IEC/TS 608715-3 and IEC 60071-1

Characteristics		Units	Ratings	
Line Voltage		kV	**66**	**132**
Highest System Voltages		kV	72.5	145
Power Frequency Withstand	Dry	kV_{rms}	230	395
	Wet	kV_{rms}	185	360
Lightning Impulse withstand 1.2/50	Positive	kV_{peak}	380	725
	Negative	kV_{peak}	450	750

Characteristics			Units	Ratings	
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	20.0	12.5
Maximum Design Cantilever Load-MCDL			kN	10.0	5.0
Specified Tensile Load STL			kN	15	40
Maximum Design Compression - MDC			kN	15	40
Maximum Design Torsion - MDT			daNm	15	20
Number of sheds			No.	23	43
Dimensions	Vertical		mm	985	1,515
	Horizontal		mm	975	1,500
Creepage distance	Inland	25mm/k/V	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^2 (µm)	610 (85)	
	For bolts, nuts and washers		g/m^2 (µm)	375 (54)	
Approximate weight			Kg	11.5	17.5

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 9001:2015.

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: 2015 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 17025, 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.

B. Mechanical Tests – IEC 61952

a) Mechanical load-time test and tightness test of the interface between end fittings and insulator housing;
b) Cantilever Failing Load Test
c) Recovery of hydrophobicity test (IEC 61442) ;
d) Brittle fracture resistance test.
e) Tests on interfaces and connections of metal fittings;
f) Assembled core load-time test;
g) 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).
(iii)Test specimens " duration of **1000 hours** "

h) Test specimens " duration of **5000 hours**
i) 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

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 Cantilever 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 450kg 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. 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 9001:2015 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,

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 9001:2015;
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).*

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.

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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APPENDICES

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 (a)	**Composite Vertical Post Insulator - Rated 72.5kV(buses)**				
	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			
				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	**Pollution zone**	**Application area**		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					state
			Creepage to clearance ratio					state
			Shed angle					state
			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
				Inland				state

			Creepage distance (mm)	Industrial	state
				Coastal regions	state
			Dry arc distance (mm)		state
			Mean coating thickness	for iron and steel castings and forgings (g/m^2 (μm))	state
				for bolts, nuts and washers (g/m^2 (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 9001:2015 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 (b)	**Composite Vertical Line Post Insulator - Rated 72.5kV(Pole)**				
	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			
				Casting	C30	galvanization		state
					C40			
		Mounting Brackets/ Fixing base	Drawings of top and bottom flanges of end fittings PCDs, holes and thread sizes					Attach
		Fastening stud, Nut and Washer Plate	Fastening Stud-Mechanical properties, design dimensions-diagrams					Attach
			Washers-Types, Mechanical properties, design dimensions diagrams					Attach
			Nut-Mechanical properties, design dimensions diagram					Attach
		Insulation creepage	**Pollution zone**	**Application area**		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					state
			Creepage to clearance ratio					state
			Shed angle					state
			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,		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 (μm))	state
				for bolts, nuts and washers (g/m^2 (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 9001:2015 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 (c)	**Composite Vertical Line Post Insulator Rated - 145kV for (buses)**				
	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	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	**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					state
			Creepage to clearance ratio					state
			Shed angle					state
			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
				Inland				state

			Creepage distance (mm)	Industrial	state
				Coastal regions	state
			Dry arc distance (mm)		state
			Mean coating thickness	for iron and steel castings and forgings (g/m^2 (μm))	state
				for bolts, nuts and washers (g/m^2 (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 9001:2015 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 (d)	**Composite Horizontal Line Post Insulator - Rated 72.5kV**					
	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 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
		Fastening stud, Nut and Washer Plate	Fastening Stud-Mechanical properties, design dimensions-diagrams					Attach
			Washers-Types, Mechanical properties, design dimensions diagrams					Attach
			Nut-Mechanical properties, design dimensions diagram					Attach
		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	
			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					state
			Creepage to clearance ratio					state
			Shed angle					state
			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

			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^2 (μm))	state
				for bolts, nuts and washers (g/m^2 (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 9001:2015 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 (e)	**Composite Horizontal Line Post Insulator - Rated 145kV**						
	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
				Forged	C30	galvanisation	state

			Steel used		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
		Fastening stud, Nut and Washer Plate	Fastening Stud-Mechanical properties, design dimensions-diagrams				Attach
			Washers-Types, Mechanical properties, design dimensions diagrams				Attach
			Nut-Mechanical properties, design dimensions diagram				Attach
		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				state
			Creepage to clearance ratio				state
			Shed angle				state
			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^2 (μm))	state
				for bolts, nuts and washers (g/m^2 (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 9001:2015 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.*

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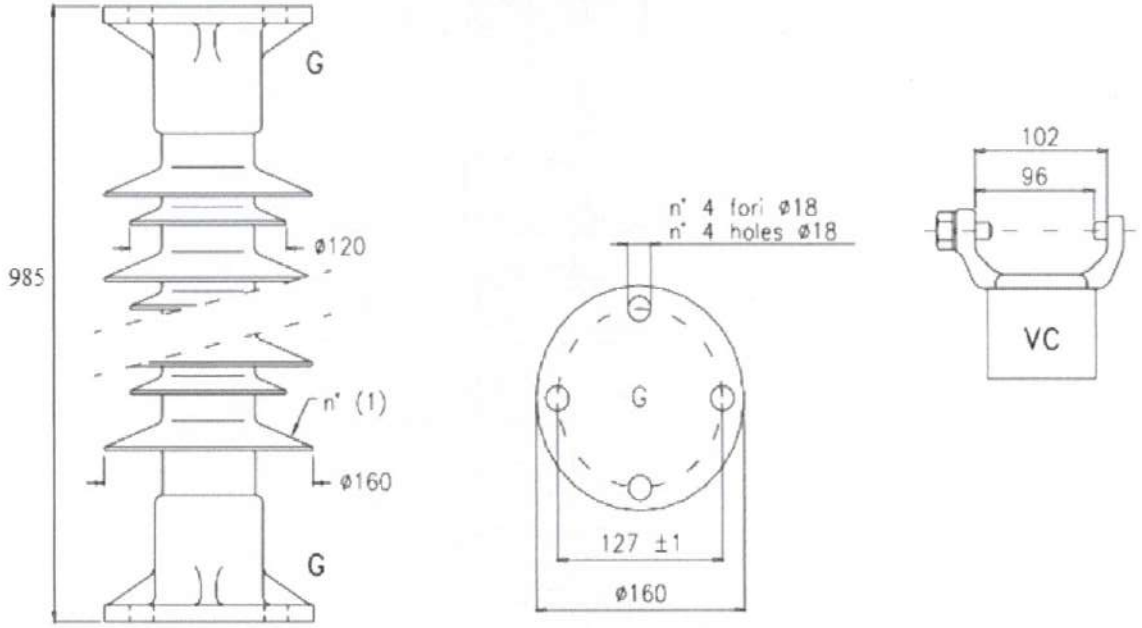
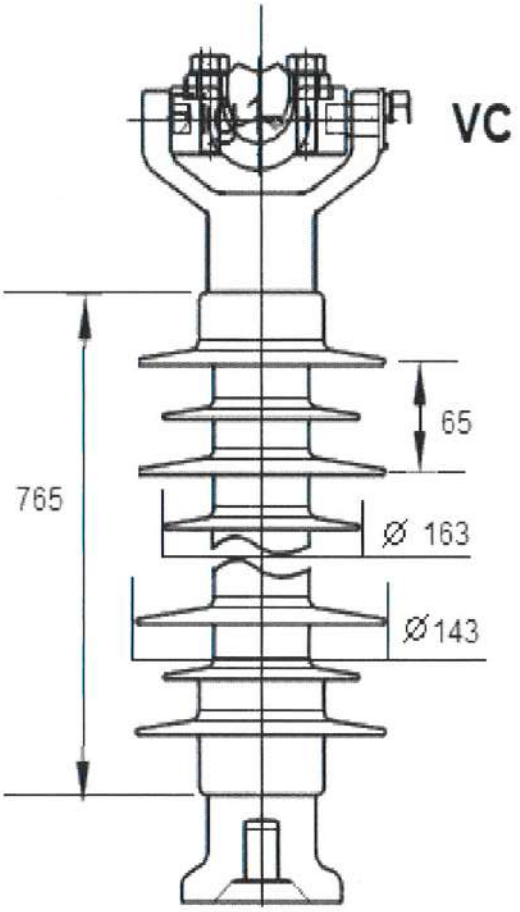
Manufacturer's Name, Signature, Stamp and Date

ANNEX B -DRAWINGS:



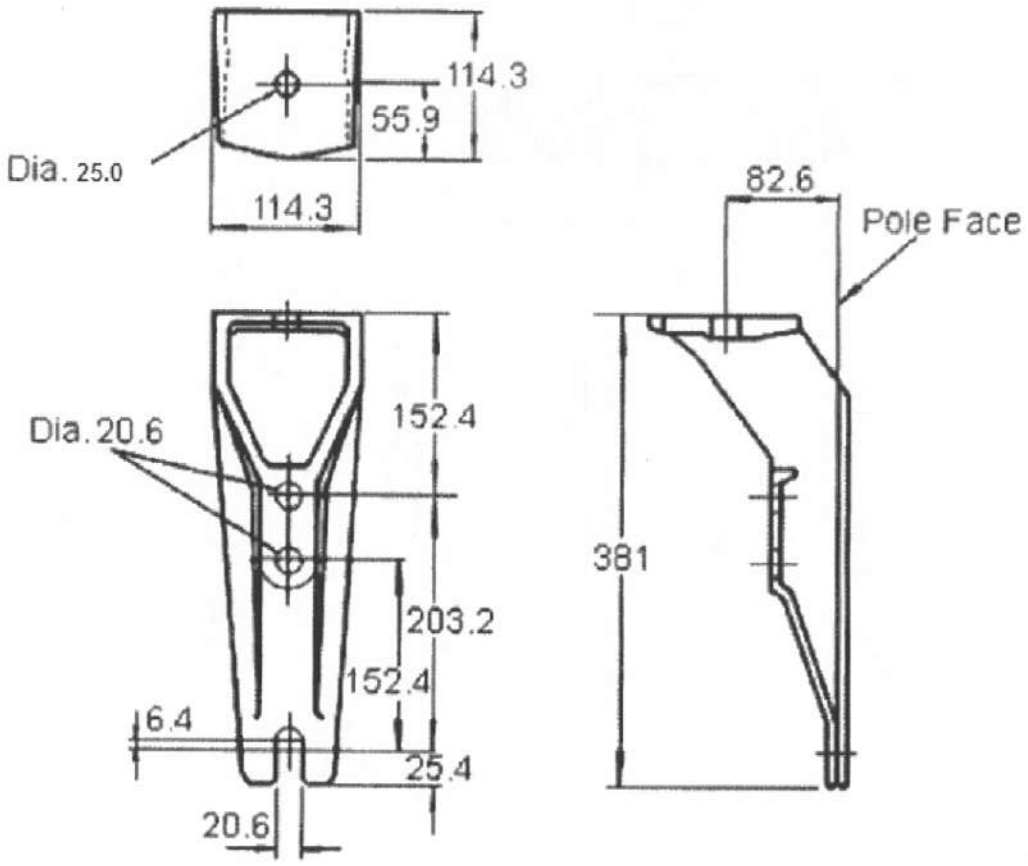
All dimensions are in millimetres
Dimensions tolerance according to IEC 61952

Fig. 1a: Composite 72.5kV vertical post Insulator (for buses)



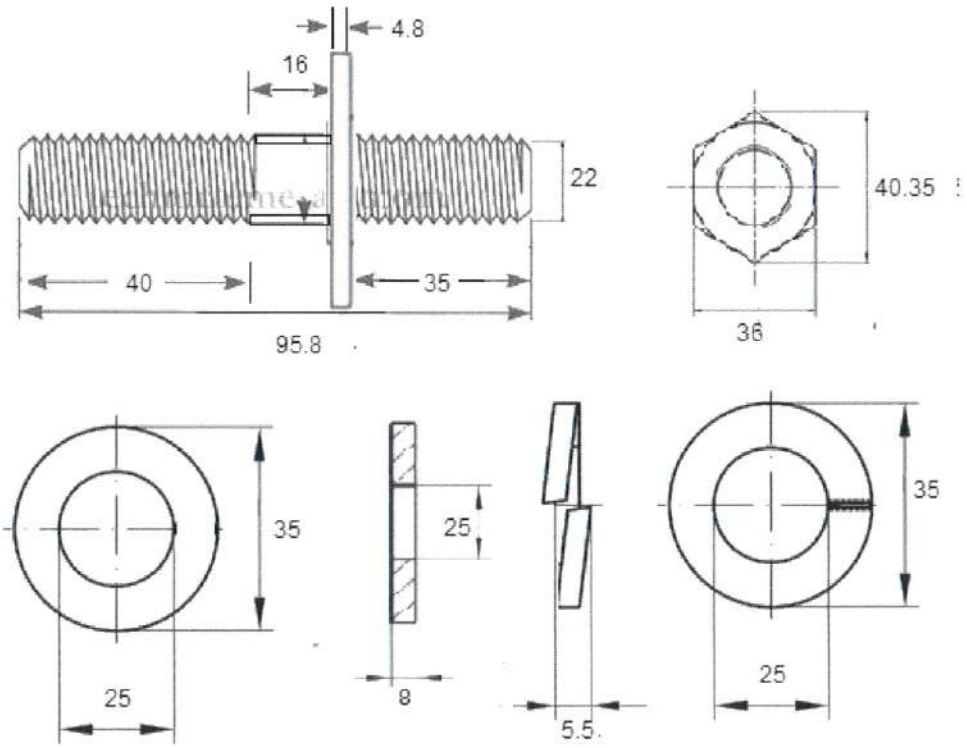
All dimensions are in millimetres
Dimensions tolerance according to IEC 61952

Fig. 1b: Composite 72.5kV vertical post Insulator (for poles)



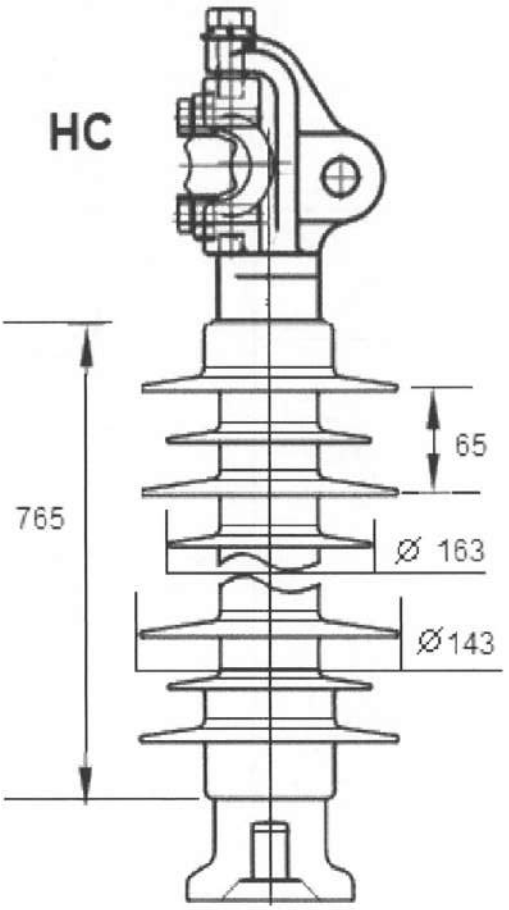
All dimensions are in millimetres
Dimensions tolerance according to IEC 61952

Fig. 1c: Mounting bracket for a 72.5kV vertical post insulator (for Poles)



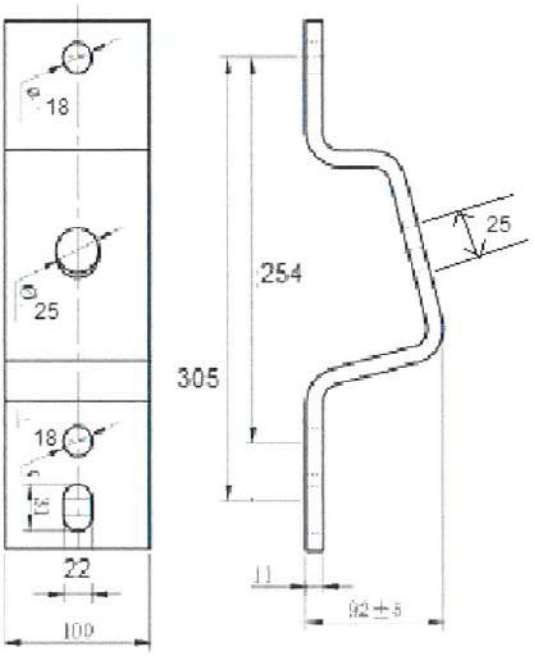
All dimensions are in millimetres
Manufacturing standards:
BS 14399;ISO 262 ;ISO 965-2;ISO 7094 ;ISO 68-1; ISO 898-2

Fig. 1d: Assembly Parts for a 72.5kV vertical post insulator(for poles)



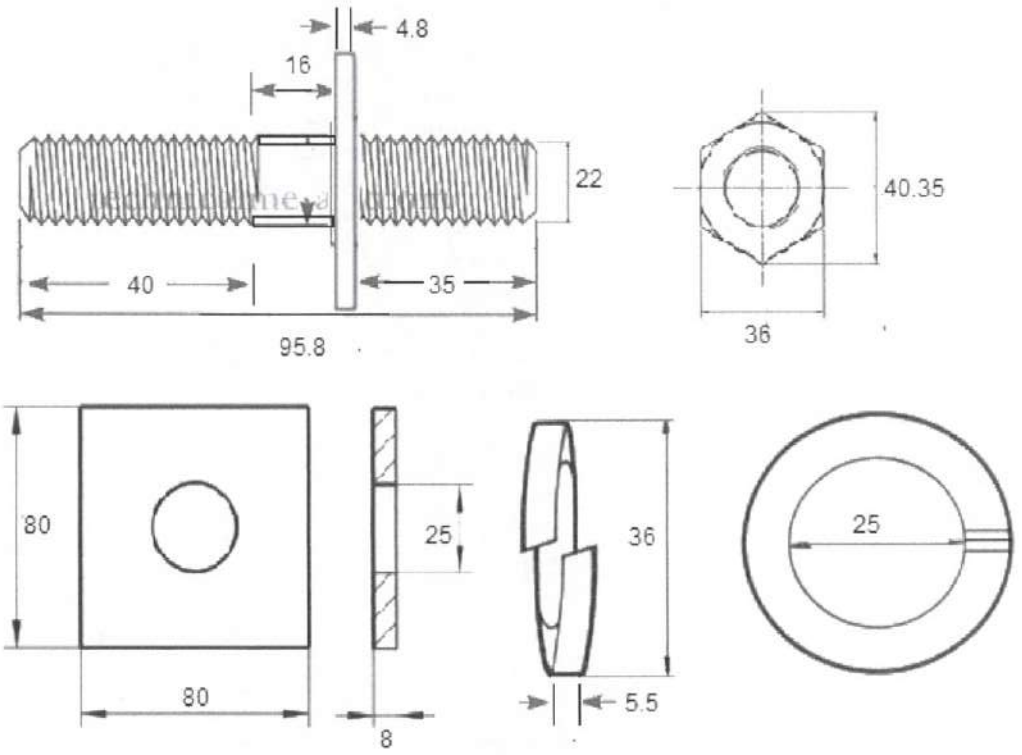
All dimensions are in millimetres
Dimensions tolerance acc. to IEC 61952

Fig. 1e: Composite 72.5kV Horizontal Insulator



All dimensions are in millimetres
Manufacturing standards:IEC 5922;

Fig. 1f: Mounting bracket for a 72.5kV Horizontal post insulator

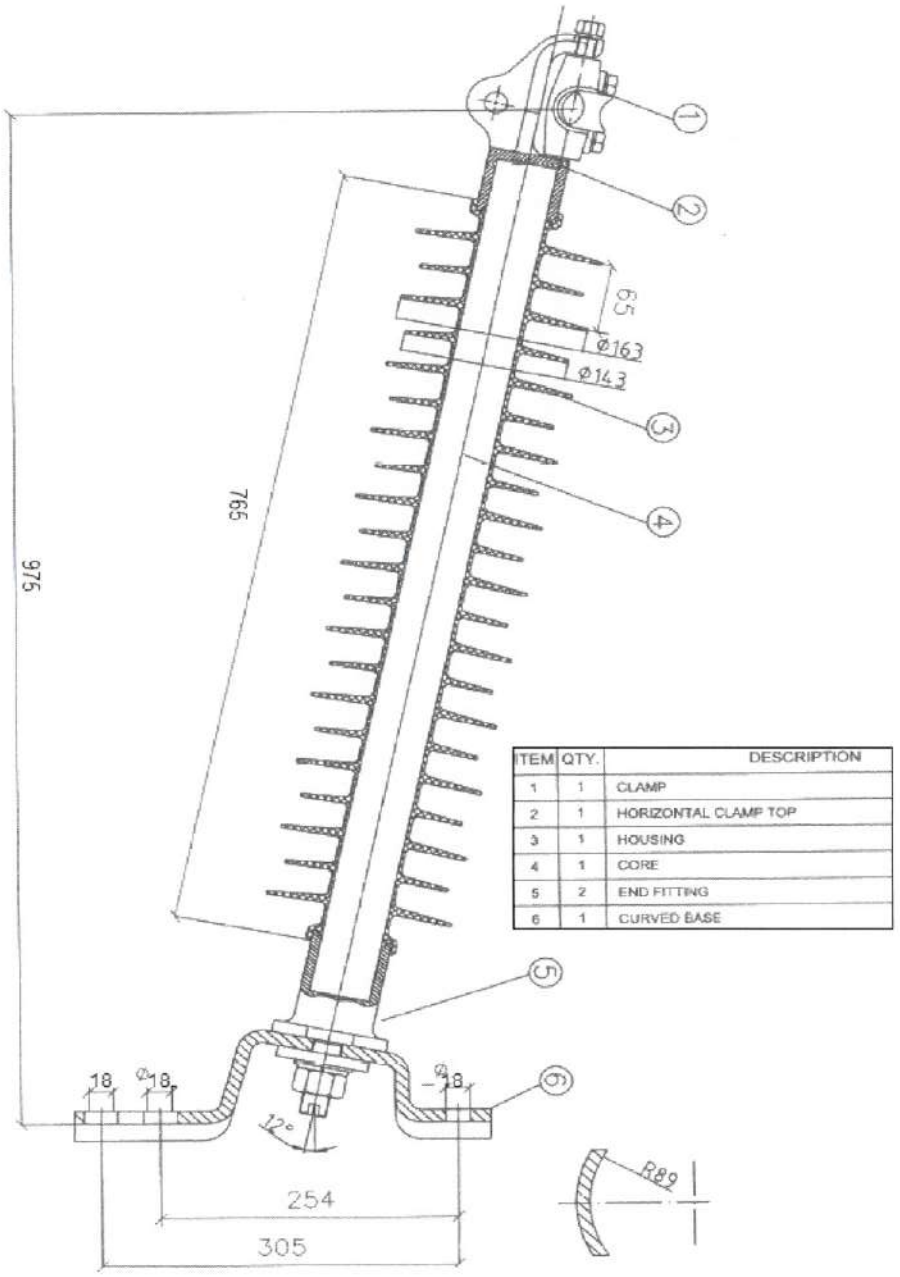


All dimensions are in millimetres

Manufacturing standards:

BS 14399;ISO 262 ;ISO 965-2;ISO 7094 ;DIN 436 ;ISO 68-1; ISO 898-2

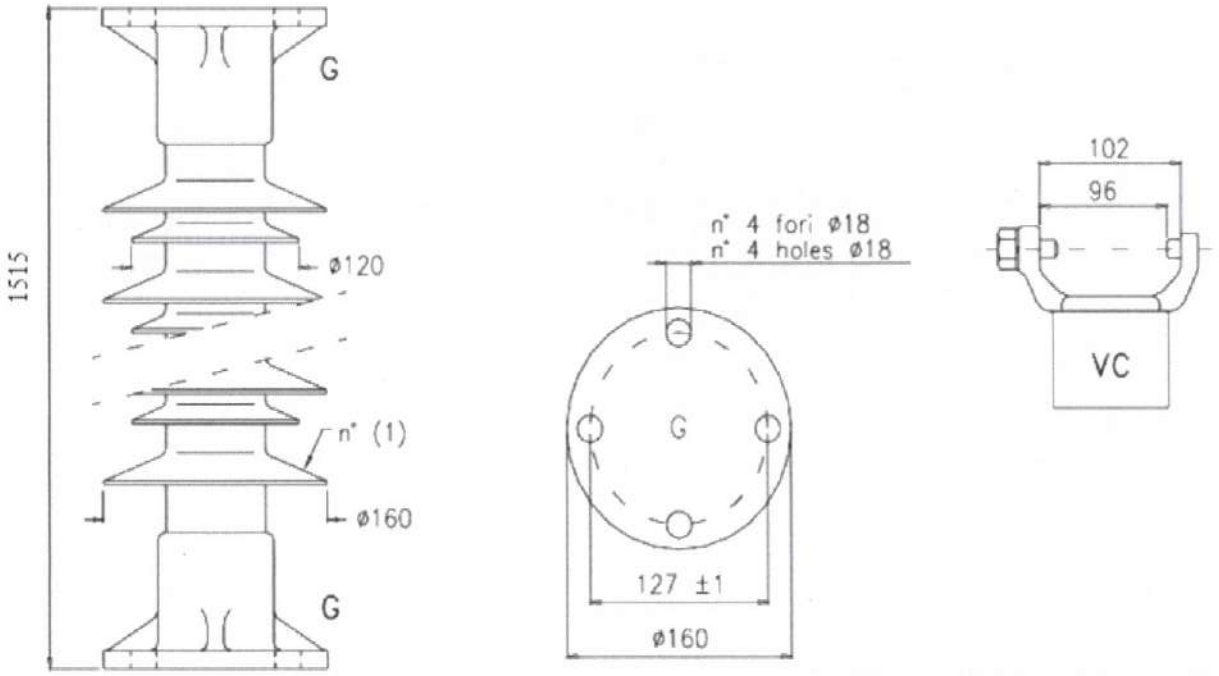
Fig. 1g: Assembly Parts for a 72.5kV Horizontal post insulator (for poles)



ITEM	QTY.	DESCRIPTION
1	1	CLAMP
2	1	HORIZONTAL CLAMP TOP
3	1	HOUSING
4	1	CORE
5	2	END FITTING
6	1	CURVED BASE

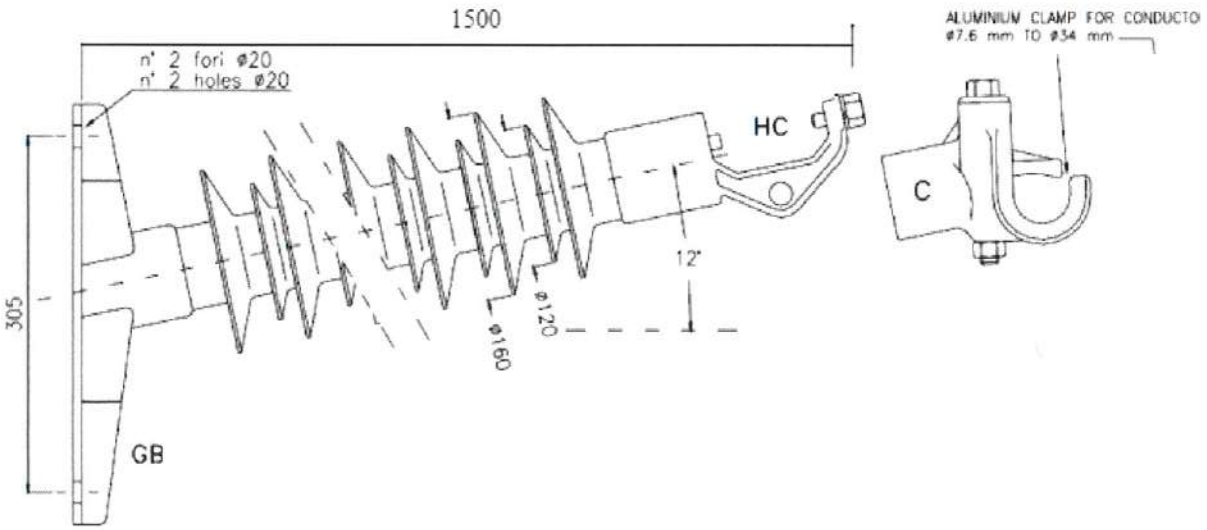
Dimensions tolerance acc. to IEC 61952 4, All dimensions are in millimetres

Fig. 1h: Assembled 72.5kV Horizontal post insulator



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

Fig. 2a Composite 145kV vertical post Insulator (for buses)



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

Fig. 2b: Composite 145kV Horizontal Insulator

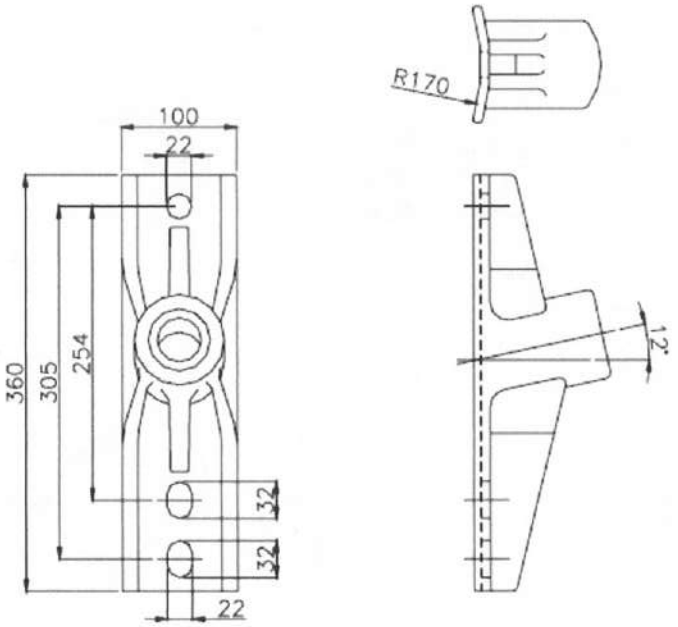
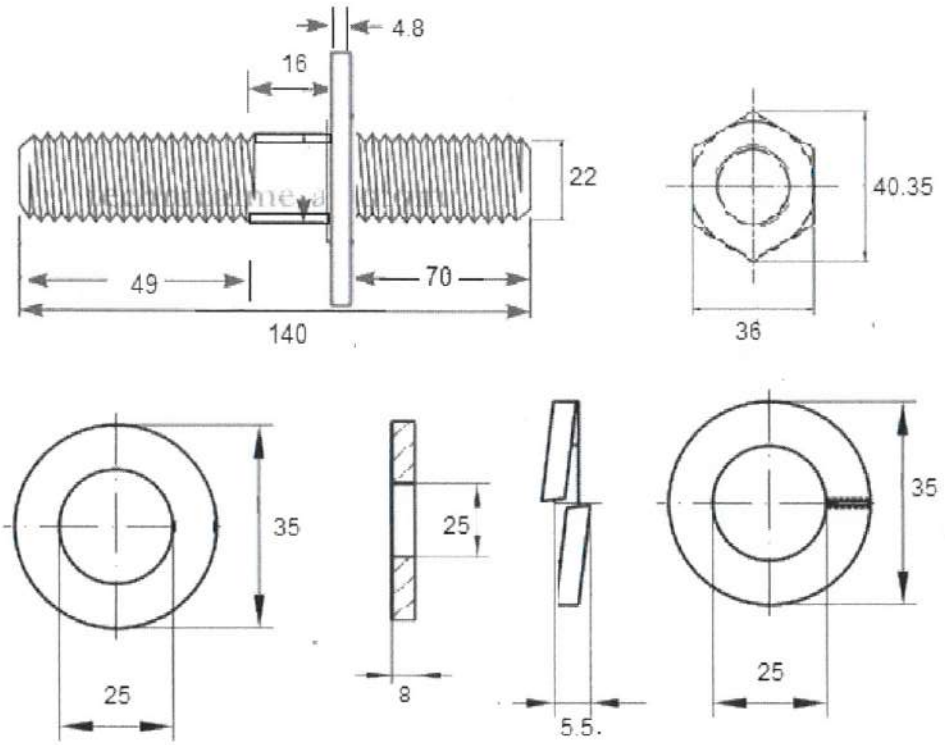


Fig. Galvanized steel Gain Base (GB)

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

Fig. 2c: Composite 145kV Horizontal Insulator



All dimensions are in millimetres
Manufacturing standards:
BS 14399;ISO 262 ;ISO 965-2;ISO 7094;ISO 68-1; ISO 898-2

Fig. 2d: and Assembly Parts for Mounting bracket of a 145kV Horizontal post insulator