



**KENYA ELECTRICITY TRANSMISSION CO.**

Kawi Complex, Block B,  
Popo Lane, Off Red Cross Road, South C  
P. O. Box 34942 – 00100, NAIROBI  
Phone: 020 4956000, 0719018000, 0732128000  
Web: [www.ketraco.co.ke](http://www.ketraco.co.ke) • email: [info@ketraco.co.ke](mailto:info@ketraco.co.ke)

**Our Ref: KETRACO/PT/014/2023**

**8<sup>th</sup> May,2023**

**Notice to all Bidders.**

**RE: TENDER ADDENDUM AND CLARIFICATION 1**

**RE: TENDER FOR PROCUREMENT OF TRANSMISSION LINE INSULATORS FOR OVERHEAD LINES MAINTENANCE WORKS. (TENDER NO. KETRACO/PT/014/2023)**

The following amendments are made to the specified provisions of the tender for Procurement of Transmission Line Insulators for Overhead Lines Maintenance Works. **(Tender No. KETRACO/PT/014/2023).**

Find herein the Tender Addendum and Clarification No. 1, consisting of ten pages. This document should be attached to the completed Form of Tender.

The Closing Date shall be **25<sup>th</sup> May 2023 at 10.00am** Local time.

**PETER NJEHIA**  
**SENIOR MANAGER, SUPPLY CHAIN**



**TENDER FOR PROCUREMENT OF TRANSMISSION LINE INSULATORS FOR OVERHEAD LINES MAINTENANCE WORKS. (TENDER NO. KETRACO/PT/014/2023) TENDER CLARIFICATION 1**

<b>s.no</b>	<b>CLARIFICATION SOUGHT BY BIDDERS</b>	<b>KETRACOS RESPONSE</b>
1	There appears to be an incorrect specification of the insulators	Refer to the guaranteed technical particulars in the bid document. Additional specifications are as attached.
2	Special Conditions of contract (SCC) as provided in the tender document refer to Conductors and not Insulators as per this tender	Refer to the special conditions as provided in the bid document.
3	The basis for the quote, in essence whether it will be CIF or CIP or DDP or any other?	DDP, KETRACOS Isinya yard
4	This is to request for extension of the above-mentioned tender for another 2 weeks.	Tender closing date has been extended to 25 <sup>th</sup> May 2023 at 10.00am Local time.





**EMPLOYERS REQUIREMENTS & TECHNICAL SPECIFICATIONS FOR  
TRANSMISSION LINE INSULATORS AND FITTINGS**

**TABLE OF CONTENTS**

1. SCOPE.....2

2. SERVICE CONDITIONS.....2

3. MATERIALS & CONSTRUCTION.....2

4. INSULATOR SETS.....2

5. QUALITY MANAGEMENT  
SYSTEM.....9

6. TESTS AND INSPECTION.....9

7. TECHNICAL DATASHEETS FOR INSULATORS AND FITTINGS.....10



## **1. SCOPE**

- 1.1 This specification is for composite insulators for use on overhead lines for tension and suspension purposes for inland application.
- 1.2 The specification also covers inspection and test of the insulators as well as schedule of Guaranteed Technical Particulars to be filled in, signed by the manufacturer and submitted for tender evaluation.
- 1.3 The specifications stipulate the minimum requirements for 132kV, 220kV & 400kV Suspension/Tension type Composite Insulators acceptable for use by KETRACO and it shall be the responsibility of the manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the insulators

## **2. SERVICE CONDITIONS**

- 2.1 The insulators shall be suitable for continuous operation outdoor in tropical areas at altitudes of up to 2200m above sea level, humidity of up to 90%, ambient temperature of +30 degrees centigrade with a minimum of -1 degree centigrade and a maximum of +40-degree centigrade, heavy saline conditions along the coast and tropical sunshine conditions.
- 2.2 The weather isokeraunic levels reach up to 180 thunderstorms days per year.
- 2.3 The level of galvanizing for all parts and materials used shall be suitable for these conditions.

## **3. MATERIALS AND CONSTRUCTION**

- 3.1 The insulators shall be manufactured to IEC 61109 and other applicable/Latest standards and requirements of this specification.
- 3.2 The insulator shall have a core made of resin-impregnated glass fiber free from defect. The housing of the insulator shall be manufactured from high quality rubber.
- 3.3 The housing of the insulator shall be made of high quality reinforced high temperature vulcanized (HTV) silicone rubber based on dimethyl siloxane, which exhibit hydrophobicity with the capability to transfer hydrophobicity to the layer of pollution.
- 3.4 Insulator sheds shall be open type, designed to minimize trapping of contaminations. It shall be made of polymer having glazed gray color. The silicon rubber housing shall be made by direct molding method.
- 3.5 The insulator shall be of high resistance to moisture and ultraviolet radiation and withstand high tropical sunshine conditions.
- 3.6 The final color of the insulator housing shall be GREY.
- 3.7 The insulator shall be fitted with ball and socket coupling in accordance with IEC 60120. The ball pin and socket shall be of medium carbon steel. The ball pin diameter shall be supplied complete with a corresponding "R" form retaining pin. The security clip shall be of stainless steel.

#### **4. INSULATOR SETS**

##### **4.1 Insulator Units**

Insulator units shall be the long rod polymeric (composite) type with metal fittings and shall comply in all aspects with the requirements of relevant IEC standards.

##### **4.2 Types of Insulators**

Insulators shall be special aerodynamically shaped insulators designed to minimize the adherence of dust and other solids. The insulators shall be used to determine tower top geometry and dimensions.

The long rod polymeric (composite) insulators with shed material formed from RTV silicone elastomer, shall comply with the requirements of the Specification and shall be to the approval of the Employer's representative. The materials used for the polymeric insulators shall be of proven quality and formulation and shall meet all the technical and test requirements given in IEC Standard 61109, IEC Standard 61466-1, ANSI Standard C29-11 and ANSI/IEEE Standard 987. The Contractor shall provide documentary evidence to confirm that any composite insulators being proposed have proven service histories, when operating at voltages at least as high as that for which they are now being offered and in environments at least as aggressive. Confirmation shall be provided that both the material from which the insulators are made and the method of manufacture are identical for the insulators being proposed and for those whose service history is being presented. Copies of previous type test reports shall be provided.

Insulators on straight-line towers shall normally be of the suspension type. Suspension insulators shall have alternate large and small diameter sheds. Phase conductors shall be supported on suspension and tension sets of types specified in the Technical Schedules. Alternative "V" string configured insulators may also be considered. Yoke plates of a suitable design shall be used to support bundled conductors.

Composite long rod insulators shall be preferably provided with ball and socket fittings in accordance with IEC 60120 and "W" type security clips for the insulator units themselves, in accordance with IEC 60372. Other types of end fittings shall be to the approval of the Employer's representative.

The locking devices shall be so formed that when set and under any conditions there shall be no risk of the locking device being displaced accidentally and that nothing but extreme deformation of the locking device shall allow separation of the insulator units or fittings. Locking device design shall be such as to allow easy removal or replacement of the insulator units or fittings under live line conditions. Locking devices when in position shall be independent of rotation, and the efficiency of the locking shall be independent of the degree of opening applied to the locking device after insertion. The locking device shall be of austenitic stainless steel or phosphor bronze and of the same design for all the complete insulator sets.

##### **4.3 Grading rings & Corona devices**

Grading rings and other corona shield equipment, formed from galvanized mild steel and of approved types, shall be attached in an approved manner to all suspension and tension insulator sets. The devices shall be attached to the insulator fittings, but not directly to conductor clamps or to the caps of insulator units. The design of the devices shall be such as to reduce, as far as reasonably possible, damage to the line conductors, clamps, insulator strings and devices themselves under all flashover conditions. The general shape and method of attachment of the live end device shall also not restrict the replacement of insulators under live line conditions.

The grading rings of the insulator sets must fulfil simultaneously the functions of arcing rings, corona shield and potential distribution devices. As arcing device, the guard rings



shall be designed to protect insulators and conductors when flashover occurs. The arcing fittings shall be made of hot dip galvanized steel and must have the capability to withstand a short circuit current of 10 kA for 1 sec.

The arcing fittings must be designed such that in case of a flashover the arc will be led to the end burning spot. They may reach a final temperature not exceeding 600°C during the short-circuit. The function of arcing protection must not be greatly altered by the power arc.

As corona shield devices, the grading rings shall be designed to ensure a corona-free insulator and string set.

As potential distribution devices, the grading rings must be designed to ensure that for each insulator fin a potential value as required by the insulator manufacturer is ensured.

The design of the grading rings shall consider and optimize simultaneously all the functions required. The rings shall be strong enough to support a maximum point load of 90 kg.

Grading rings shall be supplied for all composite long rod insulators and the Contractor shall provide data and previous service histories to confirm that suitable protective devices have been offered.

All suspension and tension insulator sets for the general run of lines shall be provided with grading rings at both line and earth ends.

#### **4.4 Electrical design**

All insulators and insulator sets shall comply with the technical requirements of the Technical Schedules.

#### **4.5 Mechanical design**

The mechanical strength of the insulators shall be as stated in the Technical Schedules.

The design shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to the development of defects.

Insulating material shall not engage directly with hard metal. All fixing material shall be of approved quality and applied in an approved manner and shall not enter into chemical action with the metal parts or cause fracture by expansion in service.

#### **4.6 Marking, Packing & Labelling**

4.6.1 Each insulator unit shall be legibly and indelibly marked with the name and trademark of the manufacturer, the year of manufacture and the SML (specified mechanical load) in accordance with IEC 61109.

4.6.2 The following information shall be marked indelibly in a permanent manner by embossing on each insulator during manufacture:

- a) Manufacturer's name or Trademark.
- b) Voltage rating
- c) Specified mechanical load
- d) The letters "**property of KETRACO**"

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

4.6.4 The insulators shall be packed in wooden crates which are reinforced and held closed by external steel wire binding. Each crate shall be internally braced to permit stacking and



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

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

#### 4.7 Clamps and fittings

Suspension and tension anchor clamps for line and earth conductors shall be of approved types and shall be as light as possible. All clamps shall be designed to avoid any possibility of deforming the stranded conductor or of separating the individual strands.

All connecting fittings between the conductor and the tower steelwork such as a clevis to tongue, shackle to plate or link which are subject to a tensile load in service shall comply with IEC 61284 except that each fixing pin shall be secured by a threaded nut and a split pin. A backing washer is not required and the unthreaded shank of the fixing pin shall extend 3 mm through the clevis or shackle. The nut shall, during erection, be tightened to the end of the thread and be backed by a phosphor bronze or austenitic stainless steel split pin. A clevis or shackle opening shall not exceed the thickness of the corresponding tongue, plate or link by more than 3 mm. Adequate bearing area between fittings shall be provided and point contacts shall be avoided wherever this is possible without adversely affecting the flexibility of the fitting.

Fittings made of steel or malleable iron shall be galvanized in accordance with the Specification. All bolts and nuts shall comply with the requirements for tower bolts and nuts and shall, unless otherwise specified, be locked by locknuts. The mechanical strength of the fittings shall be as stated in the Technical Schedules and the minimum failure load of each fitting shall be stated on the drawings. All clamps and fittings (except grading rings) which could be the subject of direct or indirect lightning or short circuit current shall withstand at least 40kA for 1 second without alteration of their electrical or mechanical performance values.

Fittings shall be provided in all insulator sets to allow live line replacement of insulator units to be carried out. Insulator sets shall be fitted with shouldered extension links, at each end of the insulator strings, suitable for standard strain carrier yokes of live line maintenance equipment and for bundled line conductor, an attachment plate behind the tension clamp to enable the load on the tension set to be relieved when making adjustment to the sag-adjusting links.

Suspension clamps for ACSR line conductor and ACS steel earth conductors shall be free to pivot in the vertical plane about a horizontal axis passing through and transverse to the centre line of the conductor. Suspension clamps shall permit the complete conductor to slip at approximately 15% of the UTS tension stated in the Technical Schedules, but the conductor shall be mechanically clamped in an approved manner. The supporting groove beyond the clamp shall be curved in the vertical plane to allow for the conductor leaving the clamp at the maximum inclination to be obtained in service. The mouth of the supporting groove shall also be slightly flared in plan. The grooves in the clamping piece or pieces shall be bell-mouthed at each end. All conductor grooves and bell-mouths in ferrous clamps shall, after galvanizing, be smooth and free from waves, ridges or other irregularities. Suspension clamps for earth conductor shall be designed for attachment of the required flexible earthing bond that is to be bolted between each suspension clamp and the tower steelwork. Suspension clamps (except pilot/auxiliary suspension string clamp) for ACSR line conductor and ACS steel earth conductors shall be sized for the use of amour rods. Suspension clamps in pilot/auxiliary suspension strings for single line ACSR conductors shall have the facility for attaching 200kg of counterweights. Use of Amour Grip Suspension clamp or cushion clamp with integrated preformed rods may also be offered subject to approval of the Employer's



representative.

Bundled line conductors shall be supported on suspension sets with a yoke plate that provides a conductor centre to centre separation as specified in the Technical Schedules. All yoke plates shall be rigidly constructed and shall withstand the maximum vertical, transverse and longitudinal forces applied simultaneously or separately without sign of deformation. Yoke plates shall be designed to permit swings of the conductor clamps to angles at least 90° from the vertical. Attachment of a yoke plate to a vertical string of suspension insulators shall be by means of a single bolt allowing the conductors to swing transversely. Each string comprising an insulator set shall be separately bolted to a yoke plate. Provision shall be made in the manufacture of yoke plates for attaching 200 kg of counterweights.

Suspension clamps for optical fiber (OPGW) earth conductors shall be free to pivot in the vertical plane about a horizontal axis passing close to and transverse to the centre line of the conductor. The conductor shall be mechanically clamped in an approved manner. Suspension clamps shall permit controlled axial movement of the conductor through the clamp, without causing damage to the conductor, under unbalanced load conditions. The tension unbalance at which this slippage can occur shall be approximately 15% of UTS. Unless otherwise approved, the suspension clamp unit shall be designed such that there is progressive stiffening of the optical fibre conductor up to the suspension clamp, which is a point of maximum bending. Complete protection of the optical fibres from damaging radial crushing loads under the clamp shall be ensured by the use of a suitable armored suspension clamp, of either the Armour Grip Suspension (AGS type with Armour Rods and an internal elastomeric clamp liner) or an armored metallic suspension clamp which is specially designed for the specific size OPGW and incorporates armor rods and positive metallic 'stops' in the suspension clamp body. Suspension clamps for OPGW earth conductor shall be designed for attachment of the required flexible earthing bond that is to be bolted between each suspension clamp and the tower steelwork.

Elastomers or other non-metallic materials used in suspension clamps shall have good resistance to ageing and be capable of withstanding temperatures between +0°C and +110°C without change of essential properties. The materials shall have adequate resistance to the effects of ozone, ultraviolet radiation and air pollution over the entire temperature range.

Tension anchor clamps for ACSR line and ACS earth conductors shall be of the compression type and shall comply in all respects with the provision of the Specification for line conductor joints where applicable to either the tension or non-tension components. The mechanical efficiency of such tension clamps shall not be affected by methods of erection involving the use of auxiliary erection clamps before, during or after assembly and erection of the tension clamp itself.

For bundled line conductors tension insulator sets shall be equipped with sag-adjusting plates, links or other devices to provide a total range of longitudinal adjustment for each separate conductor from plus to minus 150 mm in steps not greater than 25 mm.

Tension anchor clamps for OPGW earth conductor shall be of the pre-formed helical type. They shall comply with the provision of the Specification for line conductor joints, but shall also support the OPGW earth conductor such that up to the Specified Maximum Working Tension (SMWT), the maximum increase in attenuation in the optical system does not exceed  
0.05 dB/km.

All fittings for OPGW earth conductor shall be in accordance with the recommendations provided by CIGRE in the series of Reports entitled "Guide to fittings for optical cables on transmission lines, Part 1 Selection and Use" Electra No 176 (1998) and "Part 2 Testing Procedures" Electra No 188 (2000).

Tension insulator sets and clamps shall be arranged to give a minimum clearance of 150 mm between the jumper conductor and the rim of the live end insulator units.

Suspension and tension string tower attachments shall be of 'hinge' type. U-bolt or shackle attachment type shall not be allowed. Use of turnbuckles shall not be allowed.

The single suspension insulator set shall be used as standard set on suspension towers.

The double suspension insulator set shall be used for significant crossings as well as on the suspension towers where the weight span is greater than 500m.

A single tension insulator shall generally be used for overhead lines with a single-phase conductor.

A double tension insulator set shall be used for overhead lines with bundled multiple phase conductors.

A double tension insulator set shall be used for significant crossings of the overhead line with single phase conductors.

For the full length of the OHL route, all types of insulator sets shall be fitted with arcing devices on both ends, i.e. live end and line end of the respective insulator string.

The double suspension insulator set shall be orientated in the longitudinal plane of the overhead line.

Spacing between double strings shall be sufficient to prevent clashing of adjacent insulator units.

In order to enable the installation of double tension insulator sets, double point attachments for all tower cross arms shall be provided.

Double insulator strings shall be designed to ensure that following the breakage of one insulator string, the set shall remain intact and withstand the resulting static and dynamic loadings imposed.

The electrical and mechanical performances required for the insulator sets are shown in the Technical Schedules.

All insulator sets including their clamps and fittings shall, in fair weather, be free from corona discharges. This shall be proven by test. An extinction corona voltage at least 5% higher than the phase-to-earth value of the specified highest voltage for equipment shall be obtained.

All insulator sets must be equipped with all necessary shield devices in order to keep their radio and television noise as low as possible. The radio interference (RI) performance of the insulator sets shall be proven by test. A noise level less than 45 dB above 1 microvolt must be ensured.

## **5. QUALITY MANAGEMENT SYSTEM**

- 5.1 The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the insulator design, material, manufacture workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2008.



Insulator units shall be the long rod polymeric (composite) type with metal fittings and shall comply in all aspects with the requirements of relevant IEC standards.

- 5.2 The manufacturer's Declaration of conformity to reference standards and copies of quality management certification including copy of valid and relevant ISO 9001:2008 certificate shall be submitted with the tender for evaluation.

## 6. TESTS AND INSPECTION

- 6.1 Design tests, type tests, sampling tests and routine tests shall be done in accordance with the requirements of IEC 61109, IEC 60383, ISO 1460 and the requirements of this specification. It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified.
- 6.2 Copies of the previous design and type test reports by relevant Independent International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation (all in English language). A copy of the accreditation certificate for the laboratory shall also be submitted. Copies of the test reports for the following Design and Type Tests to IEC 61109 shall be submitted with the tender for evaluation.
- 6.2.1 Tests on interfaces and connections of metal fittings.
- 6.2.2 Flammability test.
- 6.2.3 Dry Lightning impulse withstand voltage test.
- 6.2.4 Wet power frequency test.
- 6.2.5 Wet power frequency test.
- 6.2.6 Mechanical load time test and test of the tightness of the interface between end fittings and insulator housing.
- 6.3 Routine and sample test reports for the insulators to be supplied shall be submitted to KETRACO for approval before shipment/delivery of the goods. KETRACO Engineers (2) shall witness acceptance tests at the factory before shipment. The cost of travelling, Accomodation, Visa fees, Local and off-shore airport transfers shall be borne by the manufacturer/Supplier.
- In addition, the manufacturer/supplier shall provide a daily subsistence allowance equivalent to USD 250 for each KETRACO engineer that will witness the factory acceptance test.
- Factory Acceptance tests (FAT) shall include Routine and Sample tests as per IEC 61109 and applicable latest IEC standards and the following:
- 6.3.1 Verification of Dimensions.
- 6.3.2 Verification of locking systems
- 6.3.3 Verification of Tightness of the interface between and fittings and insulator housing.
- 6.3.4 Verification of specified mechanical load.
- 6.3.5 Galvanization test.