

TENDER DOCUMENT AND SPECIFICATIONS

The Fiji Electricity Authority invites sealed tenders from reputable companies with the relevant experience, for the supply of Two Thousand (2000) Polymer Long-Rod Insulators and Corona/Grading Rings for the purpose of replacement of existing insulators on FEA's various 132kV Transmission Lines.

TECHNICAL SPECIFICATIONS FOR POLYMER LONG-ROD INSULATORS

1) Standards Applicable to this Tender

Polymer Suspension insulators shall be designed, manufactured, and tested in accordance with the requirements of the latest published edition of the following standards unless otherwise noted.

IEC 61109:	Composite insulators for A.C. overhead lines with a nominal voltage greater than 1000V - Definitions, test method and acceptance criteria.
IEC 60120:	Dimensions of Ball & Socket Couplings in String Insulators
IEC 62217:	Polymeric insulators for indoor and outdoor use with a nominal voltage > 1 000 V – General definitions, test methods and acceptance criteria
ANSI C29.12:	For insulators composite – Suspension Type
ASTM A 153:	Zinc Coating (Hot Dip) on Iron and Steel Hardware

Note: Bidders shall demonstrate / submit proof of ownership and possession of aforementioned standards

2) Manufacturer's Qualification

The manufacturer shall be ISO 9001-2000 and ISO 14001-2004 certified and shall maintain a development and engineering department to provide a technical after sales service and information related to the insulators.

Manufacturer shall have sufficient supply and manufacturing experience of polymer insulators for at least ten (10) years for the required system voltage and above. As proof, the manufacturer shall submit a supply-list indicating type of insulator, quantity supplied, name of client, system voltage and year of delivery. Certificates from customers with satisfactory usage shall be provided with the supply record. Polymer insulators shall be considered, for which a minimum 5 years manufacturing and successful service experience is available, without change of basic design and material. The qualified manufacturer shall have designed, manufactured, tested and supplied at least 3,000 units of similar insulators for the same system voltage and above.

3) Design and Material Requirements

a) Housing (Sheath and Weather-Sheds)

- i) The fiberglass core of the polymer insulators shall be protected with a rubber housing which shall be made of a silicone elastomeric compound having a minimum 30% silicone (*or having a Si-O chemical backbone with fumed silica and tracking control filler, ATH*). The housing shall be directly molded on the core through high temperature vulcanization (HTV) process and shall be seamless, smooth and free of imperfections. Molding in multiple steps

may cause flaws and residual stress in the joining seams and, therefore, shall not be applied. The weather sheds shall provide an open aerodynamic profile without any under ribs.

- ii) The housing shall be manufactured of 100 percent silicone rubber before fillers are added. The housing shall be in one-piece without any rubber-to-rubber joint in any part of the housing. The end fittings (electrodes) shall not be covered with the housing to prevent electrical puncture through the housing.
- iii) The housing shall be directly bonded to the FRP core. The interface between the housing and FRP rod shall be chemically bonded to prevent contaminants and moisture ingress. The strength of core-to-housing interface shall be greater than the tearing strength of the housing material itself. The thickness of the housing shall be no less than 3.0 mm.
- iv) The color of the housing material shall be gray, and uniform and consistent.
- v) Polymer insulators shall be designed to withstand high-pressure water washing of 3800kPa (570 psi), with a nozzle diameter of 6mm (1/4 inch) at a distance of 3meters (10 feet) from the nozzle to the polymer insulator.

b) Core

- i) The core shall be a high quality fiber reinforced plastic (FRP) rod. To reduce the risk of brittle fracture, the insulator FRP core shall be made of corrosion-resistant ECR glass.
- ii) The insulator core shall be mechanically and electrically sound, free of visible voids, foreign substances, and other manufacturing flaws.

c) End-fittings

- i) The mechanical load will be transferred to the FRP rod by end fittings attached to the ends of the rod. The end fittings shall be made of forged steel or ductile iron. Ball fittings shall be made of forged steel. The inner seal area must be galvanized in order to prevent any rusting if water were to intrude the interface between hardware and the RTV sealant.
- ii) The end fitting configuration and dimension shall conform to the applicable requirements and gauging according to IEC 60120 (Ball-Socket) or IEC 60471 (Clevis-Tongue).
- iii) All ferrous materials (except stainless steel) shall be hot-dip galvanized in accordance with ASTM A153.

d) Assembly

- i) The end fittings shall be attached to the FRP rod using a controlled compression process. The compression force used shall not be high enough to cause internal rod cracks.
- ii) All end fittings shall be attached to FRP rod by an automatic crimping process. The process must be controlled to detect, record, and reject damaged pieces during crimping by acoustic emission or an equivalent method. Prior to award of contract, documentation shall be submitted to completely describe the crimping method used.

- iii) The interface of the metal end fitting and the housing shall be permanently sealed to prohibit the access of moisture. This sealing system shall be multi-layered and offer true redundancy.

e) Corona Ring(s)

Polymer suspension and dead-end insulators shall have grading ring(s) attached if the system voltage is 115kV or greater. The maximum radio influence voltage (RIV) allowed is 100 microvolts when an insulator is energized at 115% of nominal line-to-ground voltage. *ANSI criteria for corona performance (ANSI C29.12 Clause 7.2.4) are usually specified because IEC has no stated criteria.*

Note: EPRI and STRI have published findings that show that electric stress control is important in preventing water droplet corona at lower voltages. They recommend 3-D modeling to demonstrate that the electric field gradient is below 0.42 kV/mm for more than 10mm on the rubber surfaces. Due to these findings, EPRI is recommending the installation of eight-inch (204 mm) diameter corona rings for voltages as low as 115 kV. Inspections of in-service polymer insulators from all manufacturers, including those that have failed due to corona damage, have validated these recommendations.

Grading ring requirements are influenced by local conditions such as elevation, phase spacing, hardware arrangement, proximity of another circuit and dead end installations. Since corona performance depends on the application of corona ring(s), requirements should be discussed between FEA and supplier/manufacture before design begins.

f) Marking

Markings shall be legible, durable and permanent to include the following:

- i) Manufacturer's name or trademark
- ii) Specified mechanical load
- iii) Routine mechanical load
- iv) Year of make and series number

4) Technical Requirements

Dimensional, electrical, and mechanical characteristics will be specified separately for each polymer insulator. Critical criteria to be specified are: section length, arcing distance, leakage distance, low frequency withstand ratings, critical impulse withstand ratings, and weight.

5) Test Requirements

The following table can be used as reference for IEC Standards. The insulator provider shall be able to demonstrate that the polymer insulators offered can meet the requirements of these institutions. Test reports shall be made available to FEA. All polymer suspension insulators shall have completed the following tests procedures described in IEC Pub. 61109, unless stipulated otherwise in this specification.

a) IEC Design tests

- i) Tests on interfaces and connection of end fittings
- ii) Assembled core load-time tests
- iii) Test of housing: tracking and erosion test
- iv) Tests for the core material
- v) Flammability test

vi) Ageing test under operating voltage simulating weather conditions (5,000hrs)

b) IEC Type tests

- i) Dry lightning impulse withstand voltage test
- ii) Wet power-frequency test
- iii) Wet switching impulse withstand voltage test (if highest voltage $U_m > 245\text{kV}$)
- iv) Mechanical load-time test
- v) Radio interference test (Criteria: ANSI C29.12 Clause 7.2.4)

c) IEC Sampling tests

- i) Verification of dimensions
- ii) Verification of locking system (if applicable)
- iii) Verification of specified mechanical load
- iv) Galvanizing test

d) IEC Routine tests

- i) Visual examination
- ii) Mechanical routine test

The FEA reserves the right to witness sample and routine tests at the manufacturing. The bidders shall factor in the entire costs (Visa, Airfare, Local Transportation, Hotel, Meals, etc) for facilitating one factory visit by two (2) FEA engineers at the manufacturing facility to witness sample and routine tests, as part of the factory acceptance testing of the insulators, prior to shipment.

6) Experience Evaluation

For evaluation of manufacturer's qualifications, manufacturer should submit a reference list showing supply experience for silicone rubber polymer insulators. In addition, if any in-service failures due to the quality of silicone rubber insulators have been experienced, the manufacturer should submit the information on the failures including cause of the failures and the countermeasures taken.

7) Packaging

The insulator shall be securely and effectively packaged in prefabricated packaging that has sufficient strength for normal handling and durability for short-term outdoor storage.

8) Duration Of Production And Delivery

The FEA requires at least 50% of all 3 insulator types to be delivered by the 1st of May 2015, and the remaining 50% of all insulator types to be delivered by 1st of November 2015. Bidders shall clearly indicate duration of production and shipping (both for sea freight and air freight).

9) Payment Terms

FEA's Standard 30 days payment policy upon delivery of goods and services applies. Bidder's to explicitly note all exceptions and/or reservations to the same, if any.

10) Liquidated Damages

Liquidated damages of 0.25% per calendar day, upto a maximum of 10%, shall apply on late delivery.

11) Defect Liability

Items offered shall be guaranteed against defect in material and workmanship for a period of 12 month's after delivery to port in Fiji.

12) Contractual Terms and Conditions

The supply of Goods and Services, within the scope of this tender shall be governed by Australian/New Zealand Standard, AS/NZS 4911:2003: General Conditions Of Contract For The Supply Of Equipment Without Installation, with any/all exceptions noted within this tender document. Upon the award of this tender to the successful bidder(s) the FEA shall furnish a formal contract for signing if deemed necessary.

13) Prices and Quantities Required

Prices shall be quoted in AUD, NZD, FJD, or USD Currency, **exclusive of:** all taxes, customs clearance charges, and duties payable in Fiji. (Incoterm - 2010: DAT). All import duties/taxes/customs costs in Fiji, are to be borne by FEA. Note: Goods and Services Tax (GST) or Value Added Tax (VAT) from bidder's country are not applicable.

Applicable Sea Ports in Fiji are:

- i. Port of Lautoka
- ii. Port of Suva

Applicable Air Ports in Fiji are:

- i. Nadi International Airport (IATA Code: NAN, ICAO Code: NFFN)
- ii. Nausori International Airport (IATA Code: SUV, ICAO Code: NFNA)

Prices shall be quoted both for sea freight and air freight.

Prices shall be valid for at least 90 calendar days, from the closing date of this tender.

ITEM	QUANTITY REQUIRED BY FEA	BIDDER'S PRICE (Sea Freight)	BIDDER'S PRICE (Air Freight)	Bidder's Notes / Remarks
Insulator Type 1 (See Appendix 1)	300			
Insulator Type 2 (See Appendix 2)	500			
Insulator Type 3 (See Appendix 3)	1,200			
11" Corona / Grading Rings	2,200			
TOTAL BID PRICE:				

Bidder's to utilize above table to submit prices.

SUBMISSION OF BID DOCUMENTS

Two (2) hard copies of the tender bids in sealed envelope shall be deposited in the tender box located at the Supply Chain Office at the FEA Head Office, 2 Marlow Street, Suva, Fiji.

Courier charges for delivery of Tender Document must be paid by the bidders.

This tender closes at 4:00pm, on Wednesday 4th of March, 2015.

Each tender shall be sealed in an envelope with:

The envelope bearing only the following marking:

Tender - MR 22/2015 – Supply of Insulators for 132kV Transmission Lines.

The Secretary, Tender Committee
Fiji Electricity Authority

Supply Chain Office

Private Mail Bag, Suva

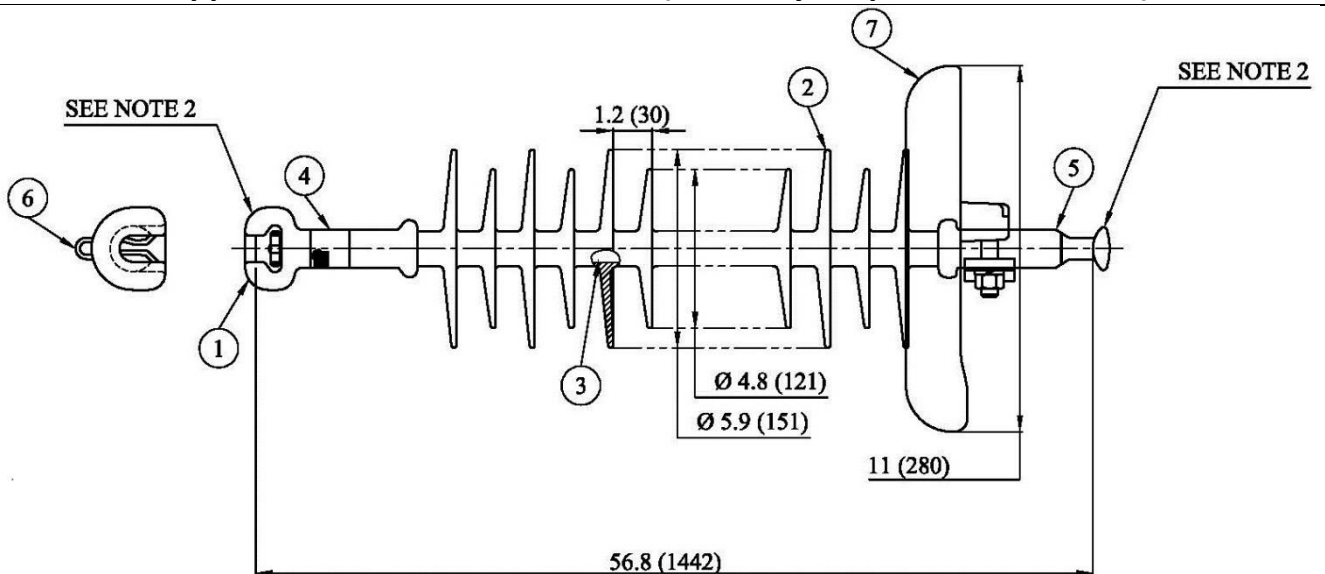
It must also indicate the name and address of the tenderer on the reverse of the envelope.

All late tenders, unmarked Envelopes and envelopes without bidder's name and address on the reverse of the envelope.

The lowest bid will not necessarily be accepted as the successful bid.

For further information or clarification please contact our Supply Chain Office on phone **(+679) 3224360 or (+679) 9991587.**

Appendix 1: INSULATOR TYPE 1 (Quantity Required = 300 Units)



⑦	11" CORONA RING	ALUMINUM ALLOY
⑥	COTTER PIN	STAINLESS STEEL
⑤	BALL FITTING	HIGH GRADE FORGED STEEL, HDG
④	LABEL	POLYESTER
③	CORE	HIGH QUALITY PULTRUDED FRP ROD
②	WEATHERSHEDS	GRAY SILICONE RUBBER
①	SOCKET FITTING	HIGH GRADE F.S. OR D.I., HDG
ITEM	COMPONENT	MATERIAL

NOTES:

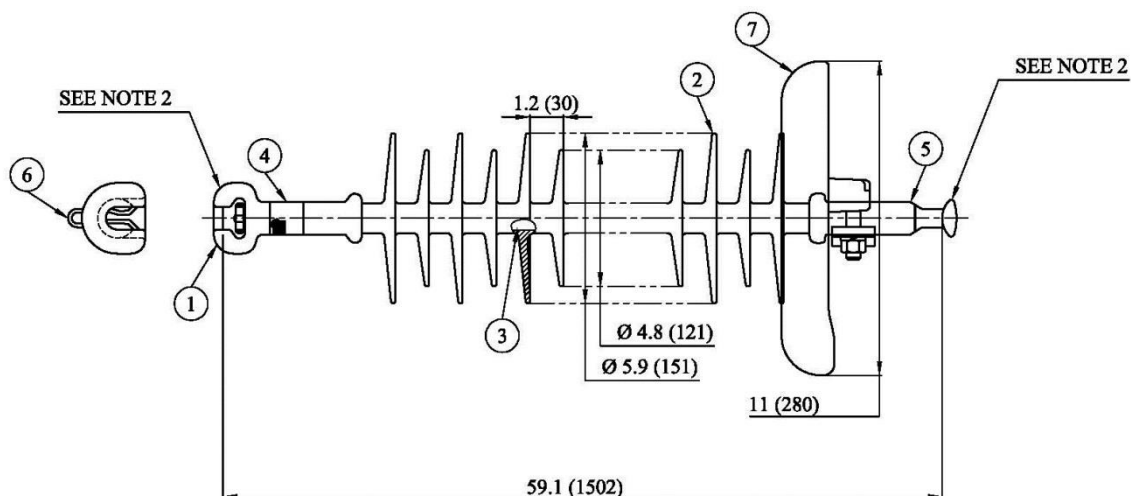
1. DIMENSIONS ARE IN INCHES, METRIC EQUIVALENTS (mm) ARE SHOWN IN ().
2. SOCKET AND BALL COUPLINGS CONFORM TO GAGES FOR IEC PUB. 60120, 16.
3. TOLERANCES ARE IN ACCORDANCE WITH IEC 61109, LATEST ISSUE.
POSITIVE TOLERANCE TO LEAKAGE (CREEPAGE) DISTANCE IS NOT LIMITED.

TECHNICAL DATA

Specification Applied: IEC 61109, Latest Issue

CHARACTERISTICS	RATING
<u>DIMENSIONS</u>	
Arcing Distance, mm	1204
Leakage (Creepage) Distance, mm	5095
Number of Sheds, "N"	39
Core Diameter, mm	17
<u>MECHANICAL VALUES</u>	
Specified Mechanical Load, kN	120
Routine Tension Load, kN	60
<u>APPROX. NET WEIGHT, kg</u>	10.1
<u>ELECTRICAL VALUES</u>	
Wet Power Frequency Withstand Voltage, kV	390
Dry Lightning Impulse Withstand Voltage, kV	685

Appendix 2: INSULATOR TYPE 2 (Quantity Required = 500 Units)



⑦	11" CORONA RING	ALUMINUM ALLOY
⑥	COTTER PIN	STAINLESS STEEL
⑤	BALL FITTING	HIGH GRADE FORGED STEEL, HDG
④	LABEL	POLYESTER
③	CORE	HIGH QUALITY PULTRUDED FRP ROD
②	WEATHERSHEDS	GRAY SILICONE RUBBER
①	SOCKET FITTING	HIGH GRADE F.S. OR D.I., HDG
ITEM	COMPONENT	MATERIAL

NOTES:

1. DIMENSIONS ARE IN INCHES, METRIC EQUIVALENTS (mm) ARE SHOWN IN ().
2. SOCKET AND BALL COUPLINGS CONFORM TO GAGES FOR IEC PUB. 60120, 16.
3. TOLERANCES ARE IN ACCORDANCE WITH IEC 61109, LATEST ISSUE.

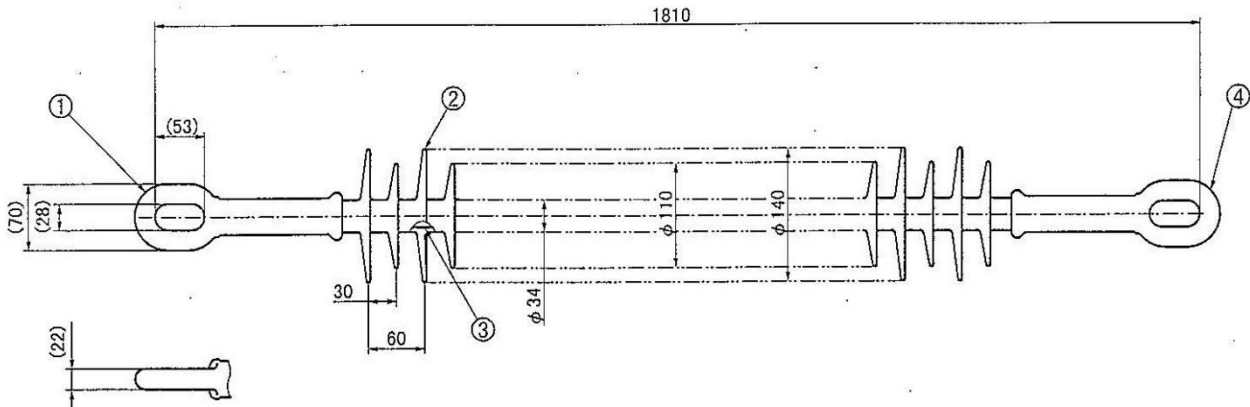
POSITIVE TOLERANCE TO LEAKAGE (CREEPAGE) DISTANCE IS NOT LIMITED.

TECHNICAL DATA

Specification Applied: IEC 61109, Latest Issue

CHARACTERISTICS	RATING
DIMENSIONS	
Arcing Distance, mm	1264
Leakage (Creepage) Distance, mm	5355
Number of Sheds, "N"	41
Core Diameter, mm	17
MECHANICAL VALUES	
Specified Mechanical Load, kN	120
Routine Tension Load, kN	60
APPROX. NET WEIGHT, kg	10.4
ELECTRICAL VALUES	
Wet Power Frequency Withstand Voltage, kV	405
Dry Lightning Impulse Withstand Voltage, kV	715

Appendix 3: INSULATOR TYPE 3 (Quantity Required = 1200 Units)



④	LOWER END FITTING	HIGH GRADE FORGED STEEL, HDG
③	CORE	HIGH QUALITY PULTRUDED FRP ROD
②	WEATHERSHEDS	SILICONE RUBBER
①	UPPER END FITTING	HIGH GRADE FORGED STEEL, HDG
ITEM NO.	COMPONENT	MATERIAL

NOTES:

1. OVAL EYE COUPLING CONFORMS TO GAGES FOR IEC Pub. 61466
2. TOLERANCES ARE IN ACCORDANCE WITH IEC Pub. 61109
POSITIVE TOLERANCE TO CREEPAGE DISTANCE IS NOT APPLIED.

TECHNICAL DATA

Specification Applied: IEC Pub. 61109

CHARACTERISTICS	RATING
<u>DIMENSIONS</u>	
Dry Arcing Distance, mm	1445
Creepage Distance, mm	5129
Number of Sheds, "N"	46
<u>MECHANICAL VALUES</u>	
Specified Mechanical Load, kN	160
Routine Test Load, kN	80
<u>ELECTRICAL VALUES</u>	
Dry Power Frequency Withstand Voltage, kV	530
Wet Power Frequency Withstand Voltage, kV	450
Dry Lightning Impulse Withstand Voltage (Positive), kV	815
Dry Lightning Impulse Withstand Voltage (Negative), kV	860
<u>APPROX. NET WEIGHT, kg</u>	12