GUJARAT URJA VIKAS NIGAM LTD.

(An ISO 9001:2008 Company)

Registered and Corporate Office:

Sardar Patel Vidyut Bhavan Racecourse, Vadodara-390007

CINU40109GJ2004SGC045195

TECHNICAL SPECIFICATIONS

FOR

11 KV, 45KN, 320 Creepage Distance, Long rod (B&S) type Composite (Polymer) Insulator

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Signature of the Tenderer

Date: Place: Company's Round Seal

Technical Specification for
11 KV, 45KN, 320 Creepage Distance,
Long rod, (B&S) type Composite (Polymer) Insulator

1. SCOPE:

This specification covers design, manufacture, testing, inspection, packing and supply of composite insulators for use in the 11 KV overhead transmission lines situated in any part of Gujarat State. The composite polymer insulators shall be of following type:

1.1 **Long rod insulators ball and socket type** for AAAC/ACSR conductors in **tension application** at dead end/angle/cut point.

1.2 The Bidder should be original manufacturer of the composite insulators and shall have all the facilities to manufacturing and in house testing or their product.

This will be pre-qualifying requirement as a "Bidder".

2. SERVICE CONDITIONS

The composite insulators to be supplied against this specification shall be suitable for satisfactory continuous operation under following tropical conditions.

2.1 Maximum Ambient Air Temperature ° C : 50
2.2 Minimum Ambient Air Temperature ° C : 0
2.3 Average daily ambient Air Temperature ° C : 40
2.4 Relative humidity (%) : 10 to 100
2.5 Average rainfall per annum (mm) : 1150
2.6 Maximum altitude above mean sea level – Mtr : 1000
2.7 Isoceraunic level (Days/Year) (i.e. Average number of Thunderstorm): 30
2.8 Maximum wind pressure (Kg/Sq. meters) : 200
2.9 Seismic level i.e Earthquake Acceleration
a) Horizontal Seismic Co-efficient (acceleration – g (Zone-5) 0.08
b) Vertical Seismic Co-efficient (acceleration – g (Zone-5): 0.08
2.10 Climate: Moderately hot, saline and humid and polluted by dust & smoke and conductive to rust and fungus.

As Gujarat state is having largest coastal area having saline & humid atmosphere, the insulators if installed in such area shall be able to function satisfactorily.

3. SYSTEM PARTICULARS

A	Nominal system voltage	11 KV (rms)
B	Highest System voltage	12 KV (rms)
C	Visible discharge test voltage	9 KV (rms)
D	Normal Frequency	50 HZ
E	Maximum Frequency	51.5 HZ
F	Minimum Frequency	47 HZ
G	Neutral Earthing	Effectively Grounded
H	Number of phases	3

4. STANDARDS:

Following Indian/International Standards, which shall mean latest revision, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification, shall be referred while accessing conformity of Insulators with these specifications.

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Sr. No.	Indian Standard Standard	Title	International Standard
1		Definition, test methods and acceptance criteria for composite Insulators for a. c. overhead lines above 1000V.	IEC:61109
		Composite Insulators for a. c. overhead lines above 1000V. Definition, test methods and acceptance criteria	IEC 1109
2	IS: 731	Porcelain insulators for overhead power lines with a nominal voltage greater than 1000V.	IEC: 60383
3	IS:2071	Methods of High Voltage Testing.	IEC:60060-1
4	IS:2486	Specification for Insulator fittings for overhead power lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements locking devices.	IEC:60120 IEC:60372
5	-	Thermal Mechanical performance test and mechanical performance test on string Insulators units.	IEC:60575
6	IS: 13134	Guide for the selection of insulators in respect of polluted condition.	IEC: 60815
7	-	Characteristics of string insulator units of the long rod type.	IEC: 60433
8	-	Hydrophobicity Classification Guide.	STRI guide 1.92/1
9	-	Radio interference characteristics of overhead power lines and high voltage equipment.	CISPR 18.2 Part 2
10	IS:8263	Methods of RI Test of HV Insulators.	IEC:60437
11		Standard for Insulators- Composite- Distribution Dead-end Type.	ANSI C 29.13-2000
12	IS:4759	Hot dip zinc coatings on structural steel & other allied products.	ISO:1459
13	IS:2629	Recommended practice for Hot Dip galvanization for iron and steel	ISO:1461(E)
14	IS:6745	Determination of weight of zinc coating on zinc coated Iron and steel articles.	ISO:1460
15	IS:3203	Methods of testing of local thickness of electroplated coatings.	ISO:2178
16	IS:2633	Testing of Uniformity of coating of zinc coated articles.	
17	-	Standard specification for glass fiber standards.	ASTM D 578-05
18	-	Standard specification for compositional analysis by Thermo-gravimeter.	ASTM E 1131-03
19	IS:4699	Specification for refined secondary zinc	

5. GENERAL REQUIREMENTS

5.1 The Composite insulators will be used on lines on which the conductor will be AAAC/ACSR of size up to 100 Sq.mm. The insulators should withstand the conductor tension, the reversible wind load as well as the high frequency vibrations due to wind.

5.2 Insulator shall be suitable for 3-ph 50 Hz effectively earthed 11KV Overhead distribution system in a moderately/heavily polluted atmosphere. **Long road insulators shall be of ball & socket type as specified.**

5.3 Bidder must be an indigenous manufacturer and supplier of composite insulators of rating 11KV or above OR must have developed proven in house technology and manufacturing process for composite insulators of above rating OR possess technical collaboration /association with a manufacturer of composite insulators of rating 11KV or above. The Bidder shall furnish necessary evidence in support of the above along with the bid, which can be in the form of certification from the utilities concerned, or any other documents to the satisfaction of the owner.

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5.4 **Insulator shall be suitable for the strain type of load & shall be of Ball & Socket type for long Rod Type.**.

5.5 Insulators shall have sheds with good self-cleaning properties. Insulator shed profile, spacing, projection etc. and selection in respect of polluted conditions shall be generally in accordance with the recommendation of IEC- 60815/IS: 13134.

5.6 The type/size of composite insulator, minimum Creepage distance and mechanical strength along with hardware fittings shall be as follows

A	Type of Composite insulators	B&S Type long Rod Insulators
B	Nominal system voltage	11 KV (rms)
C	Highest System voltage	12 KV (rms)
D	Visible discharge test voltage	9 KV (rms)
E	Mechanical characteristic	Min. failing load:45KN
F	Minimum Creepage distance (mm)	320mm (min)
G	Wet power frequency withstand voltage	45 KV(rms)
H	Dry lighting Impulse withstand voltage	a) Positive 110KV b) Negative: 110KV

5.7 **Dimensional Tolerance of Composite Insulators :-**

The tolerances on all dimensions e.g. diameter, length and creepage distance shall be allowed as follows in line with IEC 61109

± {0.04d+1.5) mm when d≤300 mm,

± (0.025d+6) mm when d>300 mm.

Where, d being the dimensions in millimeters for diameter, length or Creepage distance as the case may be. However, no negative tolerance shall be applicable to Creepage distance.

5.8 **Interchangeability**

The composite insulators including the end fitting connection shall be of standard design suitable for use with the hardware fittings of any other indigenous make conforming to relevant IEC/IS standards.

5.9 **Corona and RI Performance:-**

All surfaces shall be clean, smooth, without cuts, abrasions or projections. No part shall be subjected to excessive localized pressure. The insulator and metal parts shall be so designed and manufactured that it shall avoid local corona formation and not generate any radio interference beyond specified limit under the operating conditions.

6 TECHNICAL DESCRIPTION OF COMPOSITE INSULATORS

6.1 Composite Insulators shall be designed to meet the light quality, safety and reliability and are capable of withstanding a wide range of environmental conditions.

(a). Core- the internal insulating part

(b). Housing – the external insulating part.

(c). Metal and fittings – for attaching to hardware to support conductor

6.2 CORE

It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod). Glass fibers and resin shall be optimized in the FRP rod. Glass fibers shall be Boron free electrically corrosion resistant (ECR) glass fiber or Boron free E-Glass and shall exhibit both high electrical integrity and high resistance to

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acid corrosion. The matrix of the FRP rod shall be Hydrolysis resistant. The FRP shall be manufactured through Pultrusion process. The FRP rod shall be void free.

6.3 HOUSING (Sheath)

The FRP rod shall be covered by a seamless sheath of a silicone elastomeric compound or silicone alloy compound of a thickness of 3 mm minimum. It shall be one-piece housing using injection Molding Principle to cover the core. The elastomer housing shall be designed to provide the necessary creepage distance and protection against environmental influences, external pollution and humidity. Housing shall conform to the requirement of IEC 61109:2008 with latest amendments.

It shall be directly molded on core and shall have chemical bonding with the FRP rod. The strength of the bond shall be greater than the tearing strength of the polymer. Sheath material in the bulk as well as in the sealing/bonding area shall be free from voids. Manufacturer should furnish a description of its quality assurance programme including fabrication; testing and inspection for any material (i.e rubber). Components (i.e rod) or hardware (i.e. end filings). The manufacturer has had fabricated by others should also be included.

Manufacturing methods and material composition documentation will be a part of Technical Bid to be submitted along with offer.

6.4 WEATHERSHEDS

The composite polymer Weather sheds made of silicone elastometric compound or silicon alloy shall be molded as part of the sheath and shall be free from imperfections. The weather sheds should have silicon content of minimum 43% by weight. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids.

6.5 METAL AND FITTINGS :

End fittings transmit the mechanical load to the core. They shall be made of S G Iron or malleable cast iron or forged steel, Metal end fittings shall be suitable for Ball and socket type hardware of respective specified mechanical load and shall be hot dip galvanized in accordance with IS 2629. The material used in fittings shall be corrosion resistant.

Metal end fittings shall be uniform and without sharp edges or corners and shall be free of cracks, flakes, silvers, slag, blow-holes shrinkages defects and localized porosity.

They shall be connected to the rod by means of a controlled compression technique. As the main duty of the end fittings is the transfer of mechanical loads to the core the fittings should be property attached to the core by a coaxial or hexagonal compression process and should not damage the individual fibers or crack the core.

The gap between fittings and sheath shall be sealed by flexible silicone elastometric compound or silicone alloy compound sealant. System of attached of end fitting to the rod shall provide superior sealing performance between housing, i.e. seamless sheath and metal connection. The sealing must be moisture proof.

The dimensions of end fittings of insulators shall be in accordance with the standard dimensions stated in IEC: 60120/IS:2486 – Part-II/1989. Nominal dimensions of the ball and socket insulator shall be in accordance with the standard shown at Sr. No.4.0. No joints in ball and socket or pin will be allowed. Outer portion of ball or socket should be Zinc Sleeved with minimum 99.95% purity of electrolytic high grade Zinc.

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Sr. No.	Particular	Minimum requirement	Maximum requirement
1	R-Pins (Split pin)	F_{Min} = 50 N	F_{Max} =500 N
2	W-Clips	F_{Min} = 25 N	F_{Max} =250 N

The finished surface shall be smooth and shall have a good performance. The surface shall not crack or get chipped due to ageing effect under normal and abnormal service conditions or while handling during transit or erection.

The design of the fittings and the insulators shall be such that there is no local corona formation or discharges likely to cause the interference to either should or vision transmission.

The insulators shall have "W" type phosphors Bronze or R type Stainless steel security clips for ball sockets portion of insulators confirming to IS-2486.

The Common requirement of R-pin and W-clips shall be as under:
The values of the load F for operation of R-pin/ W-clip shall be between the values F_{Min} and F_{Max} as per table:

7.0 WORKMANSHIP::

7.1 All the materials shall be of latest design and conform to the best engineering practices adopted in the high voltage field. Bidders shall offer only such Insulators as are guaranteed by them to be satisfactory and suitable for continued good service in power transmission lines.

7.2 The design, manufacturing process and material control at various stages shall be such as to give maximum working load, highest mobility, best resistance to corrosion, good finish and elimination of sharp edges and corners.

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

7.4 The core shall be sound and free of cracks and voids that may adversely affect the Insulators.

7.5 Weather sheds shall be uniform in quality. They shall be clean, sound, smooth and shall be free from defects and excessive flashing at parting lines.

7.6 End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth with out projecting points or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.

7.7 All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/Sq.m, or 87μ m thickness and shall be in accordance with the requirement of IS: 4759, The zinc used for galvanizing shall be of purity 99.5% as per IS: 4699. The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least four successive dips each lasting for one H) minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

8.0 <u>TESTS AND STANDARDS::</u>

Insulators offered shall be manufactured with the same configuration & raw materials as used in the Insulators for which design & type test reports are submitted. The manufacturer shall submit a

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Certificate for the same. **The design & type test reports submitted shall not be more than 05 years old.**

8.1 Design tests (As per Clause 9.1 & 10 of IEC: 61109: 2008)

For polymeric insulators it is essential to carry out design test as per clause 9.1 and 10 of IEC 61109:2008 with latest amendments.

These tests are intended to verify the suitability of the design, materials and method of manufacture (technology). A composite suspension insulator design is defined by the following elements:

- materials of the core, housing and their manufacturing method;
- material of the end fittings, their design and method of attachment (excluding the coupling);
- layer thickness of the housing over the core (including a sheath where used);
- Diameter of the core.

When changes in the design occur, re-qualification shall be carried out in accordance with Table 1.

When a composite suspension insulator is submitted to the design tests, it becomes a parent insulator for a given design and the results shall be considered valid for that design only. This tested parent insulator defines a particular design of insulators which have all the following characteristics:

a) Same materials for the core and housing and same manufacturing method;
b) Same material of the fittings, the same connection zone design, and the same housing-tofitting interface geometry;
c) Same or greater minimum layer thickness of the housing over the core (including a sheath where used);
d) Same or smaller stress under mechanical loads;
e) Same or greater diameter of the core;
f) Equivalent housing profile parameters, see Note (a) in Table 1.

Manufacturer should submit test reports for Design Tests as per IEC-61109: 2008 along with the bid.

8.2 Type Tests:-

The type tests are intended to verify the main characteristics of a composite insulator. The type tests shall be applied to composite insulators, the class of which has passed the design tests.

Following type test shall be conducted on a suitable number of individual insulator units, components, materials or complete strings.

Sr.No.	Description of type test	Ten procedure/standard
1.	Dry lightning impulse withstand voltage test	As per IEC 61109 : 2008 (clause 11.1)
2.	Wet power frequency test	As per IEC 61109 : 2008 (clause 11.1)
3.	Damage limit proof test and test of the tightness of the interface between end fittings and insulator housing.	As per IEC 61109 : 2008 (clause 11.2)
4.	Radio interference test	As per IS: 8263/ IEC:437/CISPR 18-2.
5.	Recovery of Hydrophobicity test	Annexure-B (As per STRI guide) This test may be repealed every 3 yrs by the manufacturer
6.	Chemical composition test for silicon content	Annexure-B (As per EDX/ thermo-gravimetric Method)

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7.	Brittle fracture resistance test	Annexure – B
8	Water Diffusion test on FRP rod	As per IEC 1109 C.lno.5.4.2
9.	Dry power frequency test	As per IEC 61109 : 2008 (clause 11.1)
10.	UV test:	clause 7.2 of ANSI C29.13.

The bidder shall submit type test reports as per IEC 61109 (with latest amendments, if any) from NABL approved laboratory along with the bid. Additional type tests required if any shall be carried out by the manufacturer, after award of contract for which no additional charges shall be payable. In case, the tests have already been carried out, the manufacturer shall submit reports for the same.

8.3 Acceptance Tests On Tender Sample/Audit sample:

8.3.1 Test shall be carried out for audit test / Tender samples submitted with the bid at ERDA/ CPRI or any other NABL accredited laboratory.

The test samples after having withstood the routine test shall be subjected to the following acceptance tests. However, company may carry out any type test, if required, on sample his discretion:-

a.	Verification of dimensions	Clause 12.2 IEC: 61109:2008
b.	Verification of the end fittings	Clause 12.3 IEC: 61109:2008
c.	Galvanizing test	IS:2633/IS:6745
d.	Verification of tightness of the interface between end fittings and insulator housing (E2) and of the specified mechanical load, SML (E1)	Clause 12.4 IEC:61109: 2008
e	Dry Power-Frequency withstand	As per IEC:61109: 2008 & requirement as per GTP
f	Chemical composition test for silicon content	Annexure-B (As per EDX/ thermo-gravimetric Method)
g	Water diffusion test on FRP rod	As per IEC 1109 C.lno.5.4.2
h	Wet Power-Frequency withstand	As per IEC:61109: 2008 & requirement as per GTP

8.3.2 Acceptance Test shall be carried out during lot inspection.

The test samples after having withstood the routine test shall be subjected to the following acceptance tests:-

a.	Verification of dimensions & sealing	Dimension as per cl.no 5.7 & Sealing as per cl.no 6.5
b.	Verification of the end fittings	Clause 12.3 IEC: 61109:2008
c.	Galvanizing test	IS:2633/IS:6745
d.	Verification of tightness of the interface between end fittings and insulator housing (E2) and of the specified mechanical load, SML (E1)	Clause 12.4 IEC:61109: 2008
e	Dry Power-Frequency Withstand test (E2)	As per IEC:61109: 2008 & requirement as per GTP)

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8.4 Routine Tests:-

SN	Description	Standard
1.	Mechanical routine test	As per IEC: 61 109:2008 Clause 13.1
2.	Visual Examination	As per IEC: 61 109:2008 Clause 13.2
3	Dry Power-Frequency Withstand test	As per IEC:61109: 2008 & requirement as per GTP

Every polymeric insulator shall withstand mechanical routine test at ambient temperature tensile load at RTL corresponding to 0.5 x SML $(^{+10}_{0})$ for at least 10 s.

8.5 **Tests during Manufacture**

Following tests shall also be carried out on all components as applicable:-

a) Chemical analysis of zinc used for galvanizing

b) Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.

c) Chemical analysis, hardness tests and magnetic particle inspection for forgings.

8.6 Additional Tests:-

The Purchaser reserves the right of getting done any other test(s) of reasonable nature carried out at Purchaser's premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the specifications. In such case all the expenses will be to Suppliers account.

8.8 Sample submitted with bid will be sent for test at ERDA/Any NABL lab and shall considered For lot supply. No further change in dimension or drawing shall be allowed in lot supply.

9.0 Quality assurance plan:-

9.1 The successful bidder shall submit following information along with the bid:

9.1.1 Test Certificates of the raw materials and bought out accessories.

9.1.2 Statement giving list of important raw materials, their grades along with names of sub-suppliers for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of bidder's representative.

9.1.3 List of manufacturing facilities available.

9.1.4 Level of automation achieved and lists of areas where manual processing exists.

9.1.5 List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

9.1.6 List of testing equipments available with the bidder for final testing of equipments along with valid calibration reports.

9.1.7 The manufacturer shall submit Manufacturing Quality Assurance Plan (QAP) for approval and the same shall be followed during manufacture and testing.

9.2 The successful bidder shall submit the routine test certificates of bought out raw materials/accessories and central excise passes for raw material at the time of inspection.

9.3 The owner's representative shall all times be entitled to have access to the works and all places of Manufacture, where insulator, and its component parts shall be manufactured and the representative shall have full facilities for unrestricted inspection of the Supplier's and Sub-supplier's

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works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.

9.4 The material for final inspection shall be offered by the Supplier only under packed condition. The owner shall select samples at random from the packed lot for carrying out acceptance tests. The lot offered for inspection shall be homogeneous and shall contain insulators manufactured in 3-4 consecutive weeks.

9.5 The supplier shall keep the owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.

9.6 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived of by the owner in writing in the later case also the material shall be dispatched only after satisfactory testing specified herein has been completed.

9.7 The acceptance of any quantity of material shall in no way relieve the supplier at his responsibility for meeting all the requirements of the specification and shall not prevent subsequent rejection, if such materials are later found to be defective.

10. TEST CERTIFICATE :

The tenderer shall furnish detailed type test reports of the offered composite Insulators as per clause 8.2 of the Technical Specifications from the NABL laboratory to prove that the composite Insulators offered meet the requirements of the specification. **These type Tests should have been carried out within Seven years prior to the date of opening of this tender.**
(i) The offered composite Insulators are already fully type tested at approved Laboratory within five years prior to the date of opening of this tender.
(ii) There is no change in the design of type-tested composite Insulators and those offers against this tender.

11. TESTING FACILITIES :

The following additional facilities shall be available at Supplier's works:-

(a) The tenderer must clearly indicate what testing facilities are available in the works of the manufacturer and whether facilities are adequate to carryout all Routine & acceptance Tests. These facilities should be available to Discom's Engineers if deputed or carry out or witness the tests in the manufacturer works. If any test cannot be carried out at the manufacturer's work, the reasons should be clearly stated in the tender.
(b) The insulators shall be tested in accordance with the procedure detailed in IEC 61109:2008 with latest amendments.
(c) Calibration Reports from NABL approved testing laboratory of various testing and measuring equipment including tensile testing machine, resistance measurement facilities, burelle, thermometer, barometer etc.

(d) Finished insulator shall be checked for dimension verification and surface finish separately.
Manufacturers of foreign origin shall, in addition to the above, also have arrangements in India, either at works of their authorized representative/ licenses or in the NABL laboratory for conducting sampling test in accordance with IEC 81109/92-93 with latest amendments.

12. DRAWINGS:

The schematic drawing of the composite long rod (B&S) insulator is attached herewith for reference, the bidder has to submit their own drawing as under
12.1 The Bidder shall furnish full description and illustration of the material offered.

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12.2 The Bidder shall furnish along with the bid the outline drawing (3 copies) of each insulator unit including a cross sectional view of the long rod insulator unit. The drawing shall include but not be limited to the following information.

(a) Long rod diameter with manufacturing tolerances.
(b) Minimum Creepage distance with positive tolerance.
(c) Unit mechanical and electrical characteristics.
(d Size and weight of ball and socket.
(e) Weight of composite long rod units.
(f) Materials
(g) Identification mark.
(i) Manufacturer's catalogue number

12.3 After placement of awards, the Supplier shall submit full dimensioned manufacturing insulator drawings containing all the details in four (4) copies to owner for approval. After getting approval from owner and successful completion of all the type tests, the supplier shall submit 10 more copies of the drawing to the owner for further distribution and field use.

12.4 After placement of order, the Supplier shall also submit fully dimensioned insulator crate drawing for different type of insulators for approval of the owner.

13. RETEST AND REJECTION:

General Rules (Clause 12.1 of IEC: 61109: 2008)

For the sample tests, two samples are used, E1 and E2. The sizes of these samples are indicated in Table 4 below. If more than 10000 insulators are concerned, they shall be divided into an optimum number of lots comprising between 2 000 and 10 000 insulators. The results of the tests shall be evaluated separately for each lot. The insulators shall be selected from the lot at random. The purchaser has the right to make the selection. The samples shall be subjected to the applicable sampling tests.

The sampling tests are as follows:

a) Verification of dimensions. (E1 + E2)
b) Verification of the locking system. (E2)
c) Verification of the tightness of the interface between end fittings and insulator housing .(E2)
d) Verification of the specified mechanical load, SML. (E 1)
e) Galvanizing test. (E2)
f) Dry Power Frequency Voltage Withstand Test (E1 + E2)
g) Chemical composition test for silicon content-(E1 –Any one sample)
h) Verification of water diffusion test on FRP road shall be carried out as per IEC:1109 Cl.no.5.4.2) (E1 –Any one sample)
i) Wet Power Frequency Voltage Withstand Test (E1 + E2)

In the event of a failure of the sample to satisfy a test, the re-testing procedure shall be applied as prescribed in 12.6.

Insulators of sample E2 only can be used in service and only if the galvanizing test is performed with the magnetic method.

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The samples shall be subjected to the applicable sampling tests as per clause 12.2 to12.6 of IEC: 691109: 2008

Lot Size (N)	Sample Size	
	E1	E2
N ≤ 300	Subject to agreement	
300 < N ≤ 2000	4	3
2000 < N ≤ 5000	8	4
5000 < N ≤ 10000	12	6

The sampling tests are as per clause 12.2 to 12.5 of IEC: 61109:2008 as under:

12.2 Verification of dimensions - (E1+E2)
12.3 Verification of the End fitting - (E2)
12.4 Verification of tightness of the interface between end fittings and insulator housing (E2) and of the specified mechanical load, SML (E1)
12.5 Galvanizing test - (E2)
12.6 Dry Power Frequency Voltage Withstand Test (E1 + E2)
12.7 Chemical composition test for silicon content-(E1 –Any one sample)
12.8 Verification of water diffusion test on FRP road shall be carried out as per IEC:1109 Cl.no.5.4.2) (E1 –Any one sample)
12.9 Wet Power Frequency Voltage Withstand Test (E1 + E2)

In the event of a failure of the sample to satisfy a test, the retesting procedure shall be as per clause 12.6 of IEC: 61109:2008 as follows:

Verification of dimensions (E1 + E2) (Clause 12.2 of IEC:61109:2008)

The dimensions given in the drawings shall be verifiedThe tolerances given in the drawings are valid. If no tolerances are given in the drawings the values mentioned in Clause 8 shall be used.

Verification of the end fittings (E2) (Clause 12.3 of IEC:61109:2008)

The dimensions and gauges for end fittings are given in IEC 61466-1. The appropriate verification shall be made for the types of fitting used including. If applicable. Verification of the locking system in accordance with IEC 60383-1.

Verification of tightness of the interface between end fittings and insulator housing (E2) and of the specified mechanical load, SML (E1) (Clause 12.4 of IEC:61109:2008)

a) One insulator, selected randomly from the sample E2. shall be subjected to crack indication by dye penetration, in accordance with ISO 3452, on the housing in the zone embracing the complete length of the interface between the housing and metal fitting and including an additional area, sufficiently extended. beyond the end of the metal part.
The indication shall be performed in the following way:

- the surface shall be properly pre-cleaned with the cleaner;
- the penetrant, which shall act during 20 min. shall be applied on the cleaned surface;
- within 5 min after the application of the penetrant. the insulator shall be subjected, at the ambient temperature. to a tensile load of 70 % of the SML, applied between the metal fittings; the tensile load shall be increased rapidly but smoothly from zero up to 70 % of the SML, and then maintained at this value for 1 min;
- the surface shall be cleaned with the excess penetrant removed, and dried;
- the developer shall be applied, if necessary;
- the surface shall be inspected.

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Some housing materials may be penetrated by the penetrant. In such cases, evidence shall be provided to validate the interpretation of the results.

After the 1 min test at 70 % of the SML. If any cracks occur, the housing and, if necessary, the metal fittings---ancf the core shall be cut perpendicular to the crack in the middle of the widest of the indicated cracks. Into two halves. The surface of the two halves shall then be investigated to measure the depth of the cracks.

B) The insulators of the sample E1 shall be subjected at ambient temperature to a tensile load, applied between the couplings. The tensile load shall be increased rapidly but smoothly from zero to approximately 75 % of the SML and then gradually increased to the SML in a time between 30 s to 90 s.

If 100 % of the SML is reached in less than 90 s, the load (100 % of the SML) shall be maintained for the remainder of the 90 s (this test is considered to be equivalent to a 1 min withstand test at the SML).

In order to obtain more information from the test. Unless special reasons apply (for instance the maximum tensile load of the test machine), the load may be increased until the falling load is reached, and its value recorded.
The insulators have passed this test if

- no failure (breakage or complete pull-out of the core. or fracture of the metal fitting) occurs either during the 1 min 70 % withstand test (a)) or during the 1 min 100 % withstand test (b)),
- No cracks are indicated after the dye penetration method described in 12.4 a),
- The investigation of the halves described in 12.4 a) shows clearly that the cracks do not reach the core.

Galvanizing test (E2) (As per IS:2633/IS:6745)

This test shall be performed according to IS: 2633/IS : 6745 on galvanized parts.

Dry Power Frequency Voltage Withstand Test

This test shall be performed a s per IEC:61109: 2008 & requirement as per GTP

Chemical composition test for silicon content-(E1 –Any one sample)

Verification of water diffusion test on FRP road shall be carried out as per IEC:1109 Cl.no.5.4.2) (E1 –Any one sample)

Wet Power Frequency Voltage Withstand Test

This test shall be performed a s per IEC:61109: 2008 & requirement as per GTP

Re-testing procedure:
In general will not allow Retesting & Re-sampling.

14. MARKINGS:

Each insulator unit shall be legibly and indelibly Emboss/Engrave with the following details as per IEC-61109.

(a) Name or trademark of the manufacture.
(b) A/T No, Month and Year of manufacturing.
(c) Guaranteed mechanical strength in kilo Newton followed by the word 'KN' to facilitate easy identification.
(d) Name of DISCOM

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15. PACKING:

15.1 **All insulators shall be packed in strong corrugated box of minimum 7 ply duly paleted in good quality Polythin Plastic bag with 10 nos of insulators(Maximaum)** . The gross weight of the crates along with the material shall not normally exceed 15 Kg. to avoid handling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.

15.2 The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.

15.3 Suitable cushioning, protective padding of dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.

15.4 All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings.
Each wooden case/crate shall have all the markings stenciled on it in indelible ink.
15.5 The bidder shall provide instructions regarding handling and storage precautions to be taken at site.

16. INSPECTION:
Party has to offer the materials for inspection duly packed in crates as mentioned in GTP. The inspection approval is valid for a period of 15 days from the date of inspection to enable the firm to dispatch the materials by arranging transportation at destination allotted thereof within the said period. After this period of 15 days, the validity of the inspection will lapse. Thereafter, the inspection approval will be revalidated by competent authority on furnishing written application explaining therein the valid reasons for delay in affecting dispatches.

The firms shall not dispatch the offered lot unless the same is inspected by the inspector of PGVCL and accepted by him after passing in all acceptance tests, and/or receipt of waival of inspection in writing from competent authority of PGVCL.

17. GUARANTEE:
If the material found defective due to bad design or workmanship the same should be repaired or replaced by you free of charge if reported within 36 months from the date of supply of material.

The bidder will be responsible for the proper performance of the equipments/material for the respective guarantee period.

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ANNEXURE: A

Guaranteed Technical Particulars of 11 KV,45KN, Composite Insulator(B & S Type).

BIDDER HAS TO CONFIRM FOLLOWING IMPORTANT REQUIREMENT

Name of the Manufacturer:

Sr.No.	Description	Unit	**Min. requirement for11 kV 45 KN**	As per firm offer	
1.	Type of Insulator		Polymeric Composite		
2.	Standard according to which the insulators manufactured and Tested.		IEC 61109:2008		
3.	Name of material used in manufacture of the insulator with class/grade)		SILICON Wacker-Germany Dow Corning-USA		
(a)	Material of core(FRP rod) (i) E-glass of ECR-glass. (ii) Boom content		ECR or BORRON FREE		
(b)	Material of housing & Weather sheds (silicon content by weight)		SILICON RUBBER 43 %		
(c)	Material of end fittings		SGI		
(d)	Sealing compound for end fittings		RTV SILICON		
4.	Colour		GREY		
5.	Electrical characteristics				
(a)	Nominal system voltage		11 KV		
(b)	Highest system voltage		12 KV		
(c)	Dry Power frequency withstand voltage		70 KV		
(d)	Wet Power frequency withstand voltage		≥ 45 KV		
(e)	Dry lighting impulse withstand voltage a) Positive b) Negative		≥ 110 KV ≥ 110 KV		
(f)	Dry lighting impulse flashover voltage a) Positive b) Negative.		≥ 120 KV		
(i)	RIV at 1 MHz when energized at 10 kV/30kV (rms) under dry condition.		< 100 micro volts		

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Sr. No.	Description	Unit	**Min. requirement for11 kV 45 KN**	As per firm
(j)	Creepage distance (Min.)		≥ **320 MM(min)**	
6. (a)	Mechanical characteristics : Minimum failing load.		**45 KN**	
7.	Dimensions of insulator			
(i)	Weight	Kg.	**1.00 KG(Approx.)**	
(ii)	Dia of FRP rod	mm	**16 MM (min)**	
(iii)	Outer Dia of FRP rod with sheath	mm	**22 MM (min)**	
(iv)	Length of FRP rod	Mm	Min **200 MM**	
(v)	Dia of weather sheds	mm	≥ **90 MM**	
(vi)	Thickness of housing	mm	3 MM	
(vii)	Dry arc distance Dimensioned drawings of insulator (including weight with tolerances in weight) enclosed.	mm	**165 MM** (+ ve tolerance shall be allowed & no negative tolerance shall be allowed)	
8.	Method of fixing of sheds to housing (specify). Single mould or Modular construction (injection moulding		Injection moulding	
9.	No of weather sheds		3 (min.)	
10.	Type of sheds- Aerodynamic		Aerodynamic	
11.	Packing details			
(a)	Type of packing		**Strong corrugated box for minimum 7 ply duly palette in good quality Polythin Plastic bag with 10 nos. of Insulators**	
(b)	No. of insulators in each pack		10 nos.(Maximum)	
(c)	Gross weight of package.		15 KG. (Maximum)	
12.	Any other particulars which the Bidder may like to give.			
13	The insulators shall have "W" type phosphors Bronze or "R" type Stainless steel security clips for ball sockets portion of insulators confirming to IS-2486		YES	
14	Length of Crimping dye for crimping at both end of FRP Rod should be minimum	mm	25 MM	
15	Each Insulator unit shall have legibly and Indelibly Emboss/ Engrave Following parameters.		1.Name or Trademark of the Manufacture 2. AT no. (i.e. AT outward no.) 3. Month and year of Manufacturing. 4. Word - "Name of DISCOM"	

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ANNEXURE: B

Test on Insulator units

1. RIV Test (Dry)

The insulator string along with complete hardware fittings shall have a radio interference voltage level below 100 micro volts at one MHz when subjected to 50 Hz voltage of 10 kV & 30 kV for 11 kV & 33 kV class insulators respectively under dry condition. The test procedure shall be in accordance with IS: 8263/IEC: 437/CISPR 18-2.

2. Brittle Fracture Resistance Test

Brittle fracture test shall be carried out on naked rod along with end fittings by applying "1n HNO3 acid" (63 g conc.HNO3 added to 937 g water) to the rod. The rod should be held at 80% of SML for the duration of the test. The rod should not fail within the 96 Hour test duration. Test arrangement should ensure continuous wetting of the rod with Nitric acid.

3. Recovery of Hydrophobicity & Corona Test.

The test shall be carried out on 4 mm thick samples of 5 cm x 7 cm.

(i) The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the Hydrophobicity classification in line with STRI guide for Hydrophobicity classification (Extract enclosed at Annexure-D) Dry the sample surface.

(ii) The sample shall subjected to mechanical stress by bending the Sample over a ground electrode. Corona is continuously generated by applying 12 kV to a needle like electrode placed 1 mm above the sample surface. Tentative arrangement shall be as shown in Annexure-E. The test shall be done for 100 hrs.

(iii) Immediately after the corona treatment, spray the surface with Water and record the HC classification. Dry the surface and repeat the corona treatment as at Clause-2 above. Note HC classification. Repeat the cycle for 1000 Hrs. or until an HC of 6 or 7 is obtained. Dry the sample surface.

(iv) Allow the sample to recover and repeat hydrophobicity Measurement at several time intervals. Silicone rubber should recover to HC 1 – HC 2 within 24 to 48 hours, depending on the Material and the intensity of the corona treatment.

4. Chemical composition test for Silicon content

The content of silicon in the composite polymer shall be evaluated by EDX (Energy Dispersion X-ray) Analysis or Thermo-gravimetric analysis. The test may be carried out at CPRI or any other NABL accredited laboratory.

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ANNEXURE: C

Enclosures:

Bidder has to enclose following documents and has to confirm for the same.

Sr. No.	Particulars	Confirmation
1	Drawing with detailed dimension duly signed & stamped	Yes/No
2	Type test certificate covering all the tests as per CL. No. 8.2 along with attested drawing from Govt. approved Laboratory.	Yes/No
3	List of Plant & Machinery at firms works	Yes/No
4	List of Testing Equipments at firms works	Yes/No
5	List of orders pending/executed at least for past three Years for the items offered. (a). With GUVNL or its DISCOMs. (b). With the other DISCOM\s. (c). With Private Parties.	Yes/No
6	Performance Certificate	Yes/No

ANNEXURE: D

Bidder has to mention below deviation if any, quoting relevant Clause of specification

DEVIATION :

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