



**GUJARAT ENERGY TRANSMISSION**  
**CORPORATION LTD.**  
**Sardar Patel Vidyut Bhavan, Race Course,**  
**Vadodara: 390 007**

**TECHNICAL SPECIFICATION**  
**OF**  
**SILICON RUBBER HOUSED**  
**COMPOSITE INSULATORS**  
**FOR**  
**TRANSMISSION LINES**

GETCO/E/TS – SRI 053/R5 Jul 2022

**BLANK**

**BLANK**

## **TECHNICAL SPECIFICATION FOR SILICON RUBBER HOUSED COMPOSITE INSULATORS**

### **1.0 SCOPE**

- 1.1 This specification covers design, manufacturing, testing, inspection, packing and supply of Silicon Rubber housed composite Insulators for satisfactory operation on various transmission lines and Sub-stations situated in any part of Gujarat state.
- 1.2 Now, hereunder, where composite insulator is mentioned, describes only Silicon Rubber housed composite insulators.
- 1.3 These insulators are to be used as insulating part on single circuit or double circuit lattice tower structures single/double suspension & tension(dead end) for 400/220 / 132 / 66 KV and 66 KV double pole H-frame structures for transmission lines. The configuration on structure may be single or double insulators per phase at required locations.
- 1.4 The Bidder should be original manufacturer of the SIR housed composite insulators and shall have all the facilities to manufacture 90KN/120KN/160KN and higher sizes of composite insulators.

This will be pre-qualifying requirement as a “Bidder”

### **2.0 SERVICE CONDITIONS**

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

- |       |   |   |      |
|-------|---|---|------|
| 2.1.1 | Maximum Ambient Air Temperature. °C.        | : | 50   |
| 2.1.2 | Minimum Ambient Air Temperature. °C.        | : | 0    |
| 2.1.3 | Average daily ambient Air Temperature °C.:  |   | 35   |
| 2.1.4 | Maximum relative humidity. - %              | : | 95   |
| 2.1.5 | Average rainfall per annum. (mm)            | : | 1150 |
| 2.1.6 | Maximum altitude above mean sea level – Mtr | : | 1000 |
| 2.1.7 | Iso-ceraunic level i.e. Average number of   |   |      |

Thunderstorm - Days/annum : 30

2.1.8 Maximum wind pressure.(kg/Sq. meters) : 200

2.1.9 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

### 3.0 **SYSTEM PARTICULARS**

#### A) **Electrical System Data** :

a)	System Voltage (KV rms)	400/220/132/66
b)	Max. Voltage (KV rms)	420/245/145/72.5
c)	Lightning impulse withstand voltage (dry & wet) (KVP)	1425/1050/650/ 350
d)	Power Frequency withstand voltage (wet) (KV rms)	650/460/275/140
e)	Short circuit level (KA)	40/40/40/25
f)	Switching Surge withstand voltage (wet) KVP	1050/NA/NA/NA
g)	Frequency – Hz I) Normal II) Maximum III) Minimum	50 51.5 47
h)	Number Of Circuits	Single / Double
i)	Normal Span – m	400/350/350/260
j)	Wind Span – m	440/385/385/290
k)	Weight Span – m I) Maximum II) Minimum	600/525/525/390 -200/-100/-100/-50
l)	Factor Of Safety (At Every Day Temp. & No Wind)	4
m)	Neutral Grounding	Effectively Earthed
n)	Ball Socket dia in mm Suspension/Tension	16/20
o)	Length of AF insulator string (in mm) 400/220/132/66 KV for suspension location	3335/2030/1305/725
p)	Length of Silicon Rubber Insulator (in mm) 400/220/132/66 KV for suspension location	3335/2030/1305/870

q)	Length of AF insulator string/Silicon Rubber Insulator (in mm) 400/220/132/66 KV for Tension location	4080/2175/1450/870
r)	Minimum failing load (KN) For 400KV For 220/132 KV For 66 KV	120/160 90/120 90/120
s)	Minimum Creepage distance in mm	
	400KV	13020
	220KV	7595
	132KV	4495
	66KV	2248

**B) DETAILS OF CONDUCTORS as per IS: 398(Part-I),1996 :**

Sr. No	Details	Moose - 400KV	Zebra – 220KV	Panther – 132KV	Dog – 66KV
1	Number Of Strands a) Aluminum b) Steel	54 7	54 7	30 3	6 7
2	Wire Diameter – mm a) Aluminum b) Steel	3.53 3.53	3.18 3.18	3 3	4.72 1.57
3	Approximate Weight – Kg / Km.	1998	1621	974	394
4	Overall Diameter – mm	31.77	28.62	21	14.15
5	Ultimate Tensile Strength – Kg	16275	13289	9144	3305

#### 4.0 **STANDARDS**

The Manufacturer should confirm the product with following Indian Standard, International Standards containing latest revisions, amendments, changes adopted.

Sr. No.	Indian Standards	Title	International Standards
1	IS:209-1992	Specifications for Zinc	BS:3436
2	IS:406-1991	Method of Chemical Analysis of Slab Zinc	BS:3436
3		Composite insulators for A.C.Over head Power lines with a nominal voltage greater than 1000V	IEC:61109-1992
4	IS Part Part(II)-1991 Part(II)-1991	Methods of High Voltage Testing.	IEC 60060-1
5	IS : 2486 Part I-1993 Part II-1989 Part-III1991	Specification for Insulator fittings for Over Head Power Lines with a nominal voltage greater than 1000 V General Requirements and Tests. Dimensional Requirements. Locking Devices.	IEC : 575 BS-3288 IEC-6020 IEC-60372
6	IS : 2629-1990	Recommended practice for Hot dip galvanisation for iron and steel.	ISO-1461 (E)
7	IS : 2633-1992	Testing of Uniformity of Coating of zinc coated articles.	
8	IS -6745-1990	Determination of weight of Zinc Coating on Zinc coated iron and steel articles.	BS : 443-1969 ISO 1460-1973
9	IS : 8263-1990	Methods of RI Test of HV insulators	IEC-60437 NEMA Publication No. 07/1964 CISPR
10	IS : 8269-1990	Methods for Switching Impulse test on HV insulators.	IEC-60506

11		Salt Fog Pollution Voltage Withstand Test.	IEC-60507
12		Guide for the selection of insulators in respect of polluted conditions.	IEC-60815
13		Tests or insulators of Ceramic material or glass or glass for overhead lines with a nominal voltage greater than 1000 V	IEC-60363

However, in an event of supply of insulators conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent to those specified. In case of award, salient features of comparison between the standards proposed by the Bidder and those specified in this document will be provided by the Supplier to establish equivalence.

## **5.0 GENERAL REQUIREMENT**

The design, manufacturing, processes, tolerances and inspection of composite insulators shall confirm to the following.

### **5.1 Language and units.**

5.1.1 All correspondence, literature, drawings and markings shall be in the English language.

5.1.2 Dimensioning shall be in the SI (Metric System) units. Manufacturer should mention the standard adopted for Dimensioning & tolerancing principals considered for design.

## **6.0 DESIGN AND MATERIAL REQUIREMENT**

### **6.1 Core:**

The core shall be glass-fibre reinforced epoxy resin rod (FRP) of high strength. Both, glass fibre and resin shall be optimized in the FRP rod. Glass fibres with low content in alkalies shall be boron free E glass or Boron free electrically corrosion resistance (ECR) glass. Use of resin with hydrolysis trend due to water penetration should be prevented i. e. matrix of the FRP rod shall be Hydrolysis resistant. Suitability of Epoxy matrix as well as interface between matrix and fibres is to be considered as design parameter to prevent brittle fracture. The FRP rod should be void free and shall be manufactured through Pultrusion process.



6.2 Housing:

The core of the composite insulator shall be completely covered by a continuous housing consisting of a sheath-weathershed. The weathersheds shall be moulded as part of the sheath (injection moulding process). The track resistance of housing and shed material shall be class 1A4.5 according to IEC:60587. The strength of the weathershed to interface shall be greater than the tearing strength of the polymer. The composite insulator shall be capable of high pressure washing. The metal fittings shall be installed on the rod prior to moulding of the shed controlling moulding lines.

The base polymer shall be 100% Silicon Rubber prior to the addition of reinforcing fillers.

The thickness of compounding material on core should be minimum 3 mm.

Manufacturer should furnish a description of its Quality Assurance Programme including fabrication, testing and inspection for any material (i.e. rubber & Polymer Compound), components (i.e. rod) or hardware (i.e. end fittings). 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.

Insulator should have hermetically sealed structure in which the housing material is moulded to cover the interface between the end fittings and the FRP rod. This seal should never be broken during testing or otherwise.

6.3 End fittings:

The composite insulators shall be socket and ball type with the necessary coupling arrangement such that pin shall move freely in the socket but do not get disengaged while in service under various operating and atmospheric conditions.

The socket & ball type metal end fittings shall be designed to transmit the mechanical load to the core & the end fittings shall maintain uniform and consistent mechanical strength. Material and methods used in the fabrication of metal parts shall be selected to provide good toughness and ductility. Metal end fittings shall be made from a quality malleable cast iron or forged steel or Spheroidal Graphite Iron (SGI) and shall be hot dipped galvanized in accordance with IS 2629. Metal end fittings shall be uniform and without sharp edges or corners and shall be free of cracks, flakes, slivers, slag, blow-holes shrinkage defects and localized porosity. The attachment to the FRP rod shall be performed with a symmetrically controlled

crimping method control by acoustic method that compresses the metal radially onto the rod without damage to the rod fibres or resin matrix while providing a strength equal to or greater than the defined and specified ultimate strength to the insulator.

The material used in fittings shall be corrosion resistant.

Nominal dimensions of the pin, ball and socket interior shall be in accordance with the standard shown at cl. no. 4. No joints in ball & socket or pin will be allowed. 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 sound or vision transmission.

#### **6.4 GRADING RINGS:**

Grading rings shall be provided when system voltages are equal to or greater than 220 KV. For 220 KV transmission, grading ring is to be provided at energized end only. For 400 KV transmission, grading ring is to be provided at both ends of an insulator.

All grading rings and brackets shall be designed as an integral part of the insulator assembly with a positive mounting system that allows mounting in only one position. The design of the grading ring shall be such that ring can only be mounted with its orientation towards the weather sheds for maximum RIV and corona control. Grading rings shall be designed in such a manner that the rings can be readily installed and removed with hot line tools without disassembling any other part of the insulator assembly.

Grading ring height (is the distance from the end of the end fitting to the top of corona ring) should be so selected that maximum field minimizes & uniformly distributed along the insulator. Manufacturer should provide reports of successful electrical field modeling testing for the specific insulator design. The EFM should be three dimensional with results containing drawing depicting the electric field in various colors, each of a different voltage level. The result of this study should show that the voltage field surrounding the

composite insulator is optimum along the entire length of insulator, with the effected hot end of the insulator being a critical location. The threshold at which corona may or may not be present should be defined as a figure in kV/mm for the designed insulator.

## **7.0 VERIFICATION OF HOUSING MATERIAL**

The manufacturer should provide written verification about housing material, for which base polymer shall be 100% Silicon Rubber prior to the addition of reinforcing fillers considered will provide satisfactory performance in the particular environment mentioned at cl.no.3

It shall meet following requirements

Be homogenous, impermeable, with no fissures, bubbles and strange materials inclusions.

Be designed in order to avoid formation of localized discharges and to prevent interfaces humid penetration.

Be resistant to corona, KV radiation, ozone, atmospheric contamination, water penetration and power arcs.

## **8.0 BALL AND SOCKET DESIGNATION**

The dimensions of the Ball and Socket shall be 16mm designation for 90KN and 20mm designation for 120KN & 160KN insulators in accordance with the standard dimensions stated in IEC:120/IS:2486(Part-II)

## **9.0 DIMENSIONAL TOLERANCE OF COMPOSITE INSULATORS:**

The tolerance on all dimensions e.g. diameter, length and creepage distance shall be allowed as follows:

$\pm (0.04 d + 1.5)$  mm when  $d \leq 300$  mm.

$\pm (0.025 d + 6)$  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.

#### **10.0 INTERCHANGEABILITY:**

The composite insulators including the ball socket connections shall be standard design suitable for use with the hardware fittings of any make conforming to relevant IS/IEC standards.

#### **11.0 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.

#### **12.0 MARKINGS:**

Each insulator shall be legibly and indelibly marked with the following details as per IEC – 61109.

- a. Name or trademark of the manufacturer.
- b. Voltage and Type.
- c. Month and year of manufacturing.
- d. Minimum failing load / guaranteed mechanical strength in kilo Newton followed by the word 'KN' to facilitate easy identification.
- e. Country of manufacture.

For above, kV-KN & Type of Insulator (e.g. "66 KV 90 KN S" for 66 kV 90 KN Suspension) shall be marked on end fittings with embossing or with indelible ink. Also placement of corona control ring, in accordance with EFM test report, shall be marked on end fitting for appropriate placement of ring.

#### **13.0 PACKING:**

All insulators shall be packed in strong wooden / Plywood crates with maximum 50 nos. of insulators in one pack or PVC tubes with PVC end caps. The size of crate shall be supportive to handling ease. The crates shall be suitable for outdoor storage and stacking under wet climate during rainy season.

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

Suitable cushioning, protective padding, or Dunn age or spacers shall be provided to avoid direct contact of insulators with wood & to prevent damage or deformation during transit and handling. Long insulators shall be supported intermediate to avoid bending. Boards shall be tightly in contact to avoid access by small animals like rat.

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/Plywood case / crate or PVC tube shall have all the markings stenciled on it in indelible ink.

The bidder shall provide instructions regarding handling and storage precautions to be taken at site.

#### **14.0 INSPECTION , TESTS AND STANDARDS:**

- 14.1 Proto type or Design or Type: To evaluate core material, housing material, core assembly (core & end fittings), interfaces and connections of sample insulators.

Inspection includes the performance of acceptance, type and design tests. GETCO reserves the right to carry out design and type tests to check conformity of the material with the proto type unit previously approved.

GETCO reserves the right to attend the tests and perform inspections in any stage of the supply, appointing its inspectors and following the approved manufacturing schedule. Inspection and tests scheduled to happen during manufacture shall have their dates informed to GETCO at least 10 days in advance.

The manufacturer shall assure GETCO's inspector the right to being fully acquainted with installations and apparatus, check calibrations, is present at the tests, check results and in case of doubt, perform new inspections and claim the repetition of any test.

- 14.2 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected, tested, and necessary dispatch instructions are issued in writing, except for the cases where waiver of inspection is granted by competent authority of the Purchaser,

and even in this case also written dispatch instructions will be issued. Any dispatches before the issue of Dispatch Instructions in writing will be liable for rejection and non-acceptance of the materials by the consignee.

14.3 The acceptance of any quantity of material shall in no way relieve the Bidder of any of his responsibilities for meeting all requirements of the specification, and shall not prevent subsequent rejection if such material is later found to be defective.

14.4 The sample taken from any numbers of crates for carrying out any type of tests will be to the suppliers account.

#### **14.5 TESTS**

14.5.1 The following type, acceptance, routine tests, any tests specifically demanded by the purchaser and tests during manufacture shall be carried out on the insulator material free of cost. For the purpose of this clause:

14.5.1.2 Type tests shall mean those tests, which are to be carried out to prove the process of manufacture and general conformity of the material to this specification. These tests shall have to be carried out at the Government Approved Testing Laboratory. Purchaser reserves the right to specify the name of the laboratory also, if so felt. The Type test reports shall not be older than Seven years and shall be valid till validity of offer.

14.5.1.3 Acceptance Tests shall mean those tests, which are to be carried out on samples taken from each lot offered for pre-dispatch inspection, for the purposes of acceptance of that lot. These tests shall be carried out at the manufacturer's works in presence of Purchaser's representative before the dispatch of the materials to the site.

14.5.1.4 Routine Tests shall mean those tests which are to be carried out on each of the Insulator to check requirements which are likely to vary during production. These tests shall be carried out by the manufacturer on each Insulator and shall have to furnish these reports to the Purchaser's representative during his visit for acceptance tests.

14.5.1.5 Tests during manufacture shall mean those tests, which are to be carried out during the process of manufacture and end inspection by the supplier to ensure the desired quality of the end

product to be supplied by him, including all Quality Control checks and Raw Materials testing.

14.5.1.6 The standards to which these tests will be carried out are listed against them. Where a particular test is a specific requirement of this specification, the norms and procedures of the test shall be as specified as mutually agreed between the Bidder and the purchaser in the Quality Assurance Programme.

14.5.1.7 For all type and acceptance tests, the acceptance values shall be the values guaranteed by the Bidder in the "Guaranteed Technical Particulars", of his proposal or the acceptance value specified in this specification, whichever is more stringent for that particular test.

#### **TYPE TEST**

Bidder shall submit following tests from NABL accredited/Government Laboratory. The test shall be carried out in accordance with latest /amended /up to date IS/IEC. The bidder has to submit the all type test reports as stated hereunder for the offered item along with the technical bid. The type test reports from NABL accredited/Government Laboratory shall not be older than Five years. Type test reports shall be valid as on the last date of submission of bid.

#### **14.5.2 On the complete composite Insulator with Hardware Fittings:**

- a) Power frequency voltage withstand test with corona control rings /grading ring and arcing horns under wet condition- IEC:383-1993
- b) Impulse voltage withstand test under dry condition.-IEC:383-1993
- c) Wet switching Impulse withstand voltage.- For 400KV only IEC:61109-1992
- d) Salt-fog pollution withstand test-Annexure-A
- e) Grading device test- Applicable to 220KV and above voltage class
- f) Electrical Field Modeling test (EFM) - Applicable to 220KV and above voltage class
- g) Power arc test- Applicable to 220KV and above voltage class

All the above type test shall be conducted on Single 'I' suspension and Double tension insulator along with hardware fittings.

### **14.5.3 On Composite Insulator Units**

- (a) Tests on interfaces and connections IEC:61109-1992
  - i) Dry Power Frequency Voltages Test
  - ii) Sudden Load Release Test
  - iii) Thermal Mechanical Test
  - iv) Water immersion
  - v) Steep Front Impulse Voltage Test
  - vi) Dry Power Frequency Voltage Test
- (b) Assembled Core Load -Time Tests- IEC:61109-1992
  - i) Average Falling Load of the Core of the assembled Insulator
  - ii) Control of the slope of the strength-time curve of the Insulator
- (c) Test of Housing IEC:61109-1992
  - i) Tracking and Erosion test.
- (d) Test for the Core Material IEC:61109-1992
  - i) Dye Penetration Test
  - ii) Water Diffusion Test
- (e) Brittle fracture resistance test -Annexure-A
- (f) Multi stress test for 5000 hours as per Annex C-IEC:1109
- (g) Mechanical load time test IEC:61109-1992 Clause 6.4

### **14.5.4 On Silicone material**

- (a) Flammability test IEC:61109-Amd.1 or Test as per UL94.
- (b) Recovery of Hydrophobicity test-Annexure-A

#### **Important Note:**

In case of non-submission / partial submission or type test reports of which validity is over, the bidder shall submit pending type test report/s from NABL accredited/Government Laboratory, in the event of an order, before commencement of supply without affecting delivery schedule, free of cost to GETCO. Confirmation for above shall be invariably submitted along with technical bid. Furthermore, purchaser reserve right to select the sample from Manuf. Works & recommend the NABL lab to carry out type tests in case of non-submission/ partial submission or type test reports of which validity is over.



#### **14.6 Acceptance Tests –**

Acceptance tests shall be performed per ANSI C29.11, IEC:61109-1992 and GETCO Specifications.

- (a) Verification of Dimensions
- (b) Verification of Locking System
- (c) Verification of tightness of interface between end fittings and insulator housing and of specified mechanical load.
- (d) Galvanizing Test
- (e) Silicone content test.
- (f) Tracking & Erosion Test as per IEC:60587 1A4.5.
- (g) Dye Penetration Test
- (h) Brittle Fracture Resistance Test

The tests at (e) and (f) above shall be performed on weathershed cut from insulators one from each type offered for inspection in each lot. The test (g) above shall be performed on one additional sample randomly selected from each type offered for inspection in each lot by clearing housing material.

The test (h) above shall be performed on one additional sample randomly selected from each type offered for inspection in each lot by clearing housing material. The prepared sample shall be properly signed & sealed by GETCO inspector & test shall be performed at NABL accredited laboratory. Report shall be submitted in original to GETCO for issuance of dispatch instruction.

The Insulators used for (c) above shall be disposed by cutting insulators in pieces in presence of purchaser Inspector.

In the event of failure of the sample to satisfy the acceptance test(s) specified in 14.6 above, the retest procedure shall be as per IEC 61109.

If the bidder is not having facility for in-house testing, the tests shall be carried out at third party NABL laboratory, and the report shall be submitted.

#### **14.7 Routine Tests:**

The following tests shall be performed on every insulator produced as per IEC:61109-1992.

- (a) Mechanical Test: Every insulator shall withstand for a period not less than 10 seconds a tensile load equal to or greater than its Routine Test Load (50% of the Specified Mechanical Load)
- (b) Visual Examination: Every insulator shall be examined to ensure its conformance to the manufacturer's drawing. Superficial polymer surface defects of an area less than 25 square millimeters (total area not to exceed 2% of total

insulator surface area) and depth less than 1 mm shall be acceptable.

#### **14.8 Tests During Manufacture**

On all components as applicable

- (a) Chemical analysis of Zinc used for galvanizing Annexure-A
- (b) Chemical analysis, Hardness test and Magnetic Particle inspection for forgings Annexure-A
- (c) Tracking and erosion test on insulating material IEC: 60587

#### **14.9 Additional Tests**

- 14.9.1 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.

#### **14.9 Sample Batch For Type Testing**

14. 9.1 The Bidder shall offer at least 10% of the ordered quantity or 300 nos. whichever is higher, for selection of samples required for conducting all the type tests.
14. 9.2 The Bidder is required to carry out all the acceptance tests successfully in the presence of Purchaser's representative before dispatch of the selected sample to the testing laboratory for type test.

#### **15.0 TEST REPORTS**

- 15.1 Copies of type test reports shall be furnished in at least two (2) Hard copies/ Color Scan along with one original. One copy shall be returned duly certified by the Purchaser only after which the material already inspected i.e. the materials manufactured for selection of sample for type test, shall be dispatched on receipt of Dispatch Instructions from the Chief Engineer (Project), GETCO, Corporate Office, Vadodara.

- 15.2 Record of routine test reports shall be maintained by the Bidder at his works for periodic inspection by the purchaser's representative.
- 15.3 Test Certificates of test during manufacture shall be maintained by the Bidder. These shall be produced for verification as and when desired by the Purchaser.
- 15.4 The following details shall be specified in Tender drawing as well as to be conducted test report & verified by testing agency (Values shall be tabulated in type test report as a part of Dimension measurement) for validation of design.
- a) For all Mechanical/Design Type tests – Drawing shall contain. length & Dia. of end fitting along with detailed drawing of end fittings, rod & housing diameter, material for end fitting, crimping length etc.
  - b) For Electrical /Design Type tests- Drawing shall contain actual Creepage distance, actual Dry arc distance, nos. of (Big & Small/intermediate) sheds, distance from end fittings to first shed, Corona ring dimensions & placement marking distance of test sample.
  - c) Please note that for above tests the profile shall be identical to offered profile by Bidder in Tender.

## **16.0 TEST FACILITIES**

- 16.1 The following additional facilities shall be available at Supplier's works:-
- a) Calibration Reports from Government approved testing laboratory of various testing and measuring equipment including tensile testing machine, resistance measurement facilities, burette, thermometer, barometer etc.
  - b) Finished insulator shall be checked for dimension verification and surface finish separately.
  - c) The bidder should have all the routine and acceptance testing facilities, in house **in accordance with IEC: 383 & 61109. 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 lab. like CPRI, IISC, ERDA etc. for conducting sampling test in accordance with IEC : 383 & 1109.**

## **16.0 QUALITY ASSURANCE PLAN**

16.1 The bidder shall invariably furnish following information along with his offer, failing which his offer shall be rejected.

- i) Statement giving list of important raw materials, proposed to be used in the manufacture of the insulator against this Specification, names of sub suppliers for the 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 as routine and / or acceptance during production and on finished goods, copies of test certificates.
- ii) Information and copies of test certificates as in (i) above in respect of bought out accessories.
- iii) List of manufacturing facilities available.
- iv) Level of automation achieved and lists of areas where manual processing exists.
- v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- vi) List of testing equipment available with the Bidder for final testing of Insulator specified. In the case if the Bidder does not possess all the Routine and Acceptance testing facilities the tender will be rejected.
- vii) The Purchaser reserves the right for factory inspection to verify the facts quoted in the offer. If any of the facts are found to be misleading or incorrect the offer of that Bidder will be out rightly rejected and he may be black listed.
- viii) Special features provided to make it maintenance free.
- ix) Bidder shall also submit the Field Quality Plan (FQP) along with Technical Bid.

16.2 The bidder shall also submit following information to the purchaser along with the technical Bid. .

- i) List of raw materials as well as bought out accessories, and the name of suppliers of raw materials as well as bought out accessories.
- ii) Type test certificates of the raw material and bought out accessories.
- iii) Quality assurance plan (QAP) with hold points for purchaser's inspection.

16.3 The Bidders shall submit the routine test certificates of all the bought out items, accessories etc.

## **17.0 DOCUMENTATION**

17.1 Two sets of type test reports, duly approved by the Purchaser shall be submitted by the Bidder, before commencement of supply. A copy of acceptance and routine test certificates, duly approved by the purchaser shall accompany the dispatch consignment.

17.2 **The bidder shall submit the detailed drawings in triplicate for the offered insulators well within the commencement period for approval.** The manufacturing of the insulator shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the Purchaser. All manufacturing and fabrication work in connection with the insulator prior to the approval of the drawing shall be at supplier's risk.

17.3 Approval of drawings etc. by the purchaser shall not relieve the Bidder of his responsibility and liability for ensuring correctness and correct interpretation of the latest revision of applicable standards, rules and codes of practices. The insulator shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards in vogue on the day of opening of the Technical Bid and purchaser shall have the power to reject any work or material which in his judgment is not in full accordance therewith.

## **20.0 DRAWINGS**

All the bidders have to submit the detailed drawings for Composite long rod (Silicon Rubber) insulator with the offer. In the event of an order the successful bidder shall submit the drawings stated above in triplicate for approval during the commencement period to CE (Project) GETCO Corporate Office Vadodara. The set of approved drawings shall be submitted in soft copy in Auto CAD format.

## **21.0 DEVIATIONS**

- 21.1 Any deviation to this tender Specification will be out rightly rejected. All the Bidders have to submit this specification duly authenticated without any alterations, additions etc. on each page along with the Technical Bid. Any offer without this will be out rightly rejected.

## **22.0 MAINTENANCE:**

The insulator shall be capable of high pressure washing at a maximum nozzle pressure of 550psi. The insulators offered shall be suitable for employing Hot Line Maintenance Techniques with required speed, ease and safety.

## ANNEXURE-A

### 1. Tests on Complete composite Insulator with Hardware Fittings.

#### 1.1 Salt - fog pollution withstand test

This test shall be carried out in accordance with IEC-60507. The salinity level for composite long rod insulators shall be 160 Kg / m<sup>3</sup> NaCl.

### 2.0 Composite Long rod Insulator Units

#### 2.1 Brittle Fracture Resistance Test.

Assembled core with container in middle that contains 1 N HNO<sub>3</sub> concentric acid, covering the naked 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.

#### 2.2 Recovery of Hydrophobicity Test

- (1) The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the HC classification. Dry the sample surface.
- (2) Treat the surface with corona discharges to destroy the hydrophobicity. This can be done utilizing a high frequency corona tester. Holding the electrode approximately 3 mm from the sample surface slowly move the electrode over an area approximately 1" x 1". Continue treating this area for 2-3 minutes, operating the tester at maximum output.
- (3) Immediately after the corona treatment, spray the surface with water and record the HC classification. The surface should be hydrophilic with an HC value of 6 to 7. If not, dry the surface and repeat the corona treatment for a longer time until an HC of 6 or 7 is obtained. Dry the sample surface.
- (4) Allow the sample to recover and repeat the 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.

#### 2.3 Silicone Content Test

Minimum content of silicone as guaranteed by supplier shall be verified through FT-IR spectroscopy & TGA analysis or any other

suitable method mutually agreed between GETCO and supplier in Quality Assurance Plan.

### **3.0 Test on All components (As applicable).**

#### **3.1 Chemical Analysis of Zinc used for Galvanizing.**

Samples taken from the zinc ingot shall be chemically analyzed as per IS 209-1979. The purity of zinc shall not be less than 99.95%.

#### **3.2 Tests for Forgings.**

The chemical analysis hardness tests and magnetic particle inspection for forgings, will be as per the internationally recognized procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Supplier and Owner in Quality Assurance Programme.

#### **3.3 Tests on Castings.**

The chemical analysis, mechanical and metallographic tests and magnetic, particle inspection for castings will be as per the internationally recognized procedures for these tests. The samplings will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Supplier and Owner in Quality Assurance Programme.

### **4.0 Grading device test:**

#### **4.1** In addition to the electrical design tests, for 220 KV & above class insulator design with applicable grading device test, similar to the following described test:

Grading devices shall be tested using a mechanical shaker with at least a one inch stroke at the grading device and a frequency of no less than three cycles per second for a duration of 2,000,000 cycles. Movement shall be along the long axis of the insulator. The grading device shall be attached to the shaker in a vertical position. The test shall be considered successful if no movement is detected in the ring with respect to the insulator and there is no physical damage to the grading device and the attachment assembly.

The manufacturer should provide with documentation that the insulator design with applicable grading devices will minimize or eliminate corona discharge activity under wet and dry conditions.



5.0 **Power Arc Test:**

- 5.1 One insulator having any one design of end fittings shall be tested for power arc endurance while tensioned horizontally at 3000lb. An arc shall be initiated across the insulator by means of a Copper shorting fuse wire. The arc shall burn 15 to 30 cycles and its current magnitude is determined by ampere- time product ( $I \times T$ ) equal to a minimum of 150kA cycles. Each insulator is only acceptable if there is no exposure of the core, no mechanical separation of the insulator, and no cracks in the housing (As per IEC61467-1997)

# **GUARANTEED TECHNICAL PARTICULARS**

**FOR**

**SILICON RUBBER HOUSED COMPOSITE  
INSULATORS**

## **GURANTEED TECHNICAL PARTICULARS OF SILICON RUBBER HOUSED COMPOSITE INSULATORS**

The bidder must fill up all the point of GTP for offered item/s. Instead of indicating “refer drawing, or as per IS/IEC”, the exact value/s must be filled in.

		SUSPENSION TYPE	TENSION TYPE
<b>A</b>	<b>GENERAL</b>		
1.	Voltage level (kV)		
2.	Type ( e.g. Ball & Socket)	Ball & Socket	Ball & Socket
3.	Material of weathershed		
4.	Color		
5.	Type of Locking device and its material (clip of SS/Phos. Bronze or better)		
6.	Housing material is moulded to cover the interface between the end fittings and the FRP rod	Yes	Yes
7.	Ball/Socket dia. (in mm)		
8.	Length of insulator (in mm)		
9.	Guaranteed mechanical load (in KN)		
10.	% Silicone content		
<b>B</b>	<b>ELECTRICAL</b>		
1.	Total Min. creepage distance (in mm)		
2.	Power frequency withstand voltage - dry KV (rms)		
3.	Power frequency withstand voltage – wet KV(rms)		
4.	Impulse withstand voltage (+/-) 1.2x50 micro-second, KV (peak)		
5.	Switching Impulse Voltage Withstand Test – (for 400 kV only)		
6.	Visible discharge voltage KV		
7.	Connection length of SRI		
8.	Dry Arc Distance		
9.	Standard Applicable	IEC1109 & IEC:383	
10.	Insulator & profile parameters conforming to	IEC:60815 P3	
11.	Core – Boron free ECR glass FRP rod	Boron free ECR glass FRP rod	
12.	Housing – Injection Moulded	Injection Moulded	
13.	End fitting by acoustic method	Yes	
14.	Written verification of housing material	Silicon Rubber	

Signature of the Bidder : \_\_\_\_\_

Name : \_\_\_\_\_

Designation : \_\_\_\_\_

Date : \_\_\_\_\_

Authorized common rubber

Stamp / seal of the bidder : \_\_\_\_\_