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/ R1.DT. 10/03/2008
SPECIAL INSTRUCTIONS TO BIDDER

Please read following instructions carefully before submitting your bid.

1. All the drawings, i.e. elevation, side view, plan & cross sectional view in AutoCAD format and manuals in PDF format, for offered item shall be submitted. Also the hard copies as per specification shall be submitted.

2. The bidder shall submit Quality Assurance Plan for manufacturing process and Field Quality Plan with the technical bid.

3. The bidder shall have to submit all the required type test reports for the offered item. In absence of this, the evaluation shall be carried out accordingly as non-submission of type test reports.

4. 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.

5. All the points other than GTP, which are asked to confirm in technical specifications must be submitted separately with the bid.

6. The bidder is required to impart training in view of manufacture, assembly, erection, operation and maintenance for offered item, at his works, to the person/s identified by GETCO, in the event of an order, free of cost. The cost of logistics will be borned by GETCO.

7. Please note that the evaluation will be carried out on the strength of content of bid only. No further correspondence will be made.

8. The bidder shall bring out all the technical deviation/s only at the specified annexure.

9. The bidder should indicate manufacturing capacity by submitting latest updated certificate of a Chartered Engineer (CE).
QUALIFYING REQUIREMENT DATA
(For Supply)

Bidder to satisfy all the following requirements.

1) The bidder shall be Original Equipment Manufacturer (OEM). The offered equipment have to be designed, manufactured and tested as per relevant IS/IEC /ANSI with latest amendments.

2) The minimum requirement of manufacturing capacity of offered type, size and rating of equipment shall be 7 times tender / bid quantity. The bidder should indicate manufacturing capacity by submitting latest updated certificate of a Chartered Engineer (CE).

3) Equipment proposed shall be of similar or higher rating and in service for a minimum period of THREE (3) years and satisfactory performance certificate in respect of this is to be available and submitted.

4) The bidder should clearly indicate the quantity and Single Value Contract executed during last FIVE (5) years, for the offered equipment. Bidder should have executed one single contract during last five years for the quantity equivalent to tender / bid. The details are to be submitted in following format,

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>ITEM SUPPLIED TO</th>
<th>ORDER REFERENCE No. &amp; DATE</th>
<th>ITEMS</th>
<th>QUANTITY</th>
<th>ORDER FULLY EXECUTED. YES/NO</th>
<th>STATUS. IF ORDER UNDER EXECUTION</th>
<th>REMARK</th>
</tr>
</thead>
</table>

5) Equipment offered shall have Type Test Certificates from accredited laboratory (accredited based on ISO/IEC Guide 25 / 17025 or EN 45001 by the National accreditation body of the country where laboratory is located), as per IEC / IS / technical specification. The Type test reports shall not be older than FIVE years and shall be valid up to the expiry of validity of offer.
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 Substations 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** :

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) System Voltage (KV rms)</td>
<td>400/220/132/66</td>
</tr>
<tr>
<td>b) Max. Voltage (KV rms)</td>
<td>420/245/145/72.5</td>
</tr>
<tr>
<td>c) Lightning impulse withstand voltage (dry &amp; wet) (KVP)</td>
<td>1425/1050/650/350</td>
</tr>
<tr>
<td>d) Power Frequency withstand voltage (wet) (KV rms)</td>
<td>650/460/275/140</td>
</tr>
<tr>
<td>e) Short circuit level (KA)</td>
<td>40/40/40/25</td>
</tr>
<tr>
<td>f) Switching Surge withstand voltage (wet) KVP</td>
<td>1050/NA/NA/NA</td>
</tr>
<tr>
<td>g) Frequency – Hz</td>
<td></td>
</tr>
<tr>
<td>I) Normal</td>
<td>50</td>
</tr>
<tr>
<td>II) Maximum</td>
<td>51.5</td>
</tr>
<tr>
<td>III) Minimum</td>
<td>47</td>
</tr>
<tr>
<td>h) Number Of Circuits</td>
<td>Single / Double</td>
</tr>
<tr>
<td>i) Normal Span – m</td>
<td>400/350/350/260</td>
</tr>
<tr>
<td>j) Wind Span – m</td>
<td>440/385/385/290</td>
</tr>
<tr>
<td>k) Weight Span – m</td>
<td>600/525/525/390</td>
</tr>
<tr>
<td>I) Maximum</td>
<td>-200/-100/-100/-50</td>
</tr>
<tr>
<td>II) Minimum</td>
<td></td>
</tr>
<tr>
<td>l) Factor Of Safety (At Every Day Temp. &amp; No Wind)</td>
<td>4</td>
</tr>
<tr>
<td>m) Neutral Grounding</td>
<td>Effectively Earthed</td>
</tr>
<tr>
<td>n) Ball Socket dia in mm Suspension/Tension</td>
<td>16/20</td>
</tr>
<tr>
<td>o) Length of AF insulator string (in mm)</td>
<td>3335/2030/1305/725</td>
</tr>
<tr>
<td>400/220/132/66 KV for suspension location</td>
<td></td>
</tr>
<tr>
<td>p) Length of AF insulator string (in mm)</td>
<td>4080/2175/1450/870</td>
</tr>
<tr>
<td>400/220/132/66 KV for Tension location</td>
<td></td>
</tr>
<tr>
<td>Sr. No</td>
<td>Details</td>
</tr>
<tr>
<td>--------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Number Of Strands</td>
</tr>
<tr>
<td></td>
<td>a) Aluminum</td>
</tr>
<tr>
<td></td>
<td>b) Steel</td>
</tr>
<tr>
<td>2</td>
<td>Wire Diameter – mm</td>
</tr>
<tr>
<td></td>
<td>a) Aluminum</td>
</tr>
<tr>
<td></td>
<td>b) Steel</td>
</tr>
<tr>
<td>3</td>
<td>Approximate Weight – Kg / Km.</td>
</tr>
<tr>
<td>4</td>
<td>Overall Diameter – mm</td>
</tr>
<tr>
<td>5</td>
<td>Ultimate Tensile Strength – Kg</td>
</tr>
</tbody>
</table>

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

- **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
4.0 **STANDARDS**

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

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Indian Standards</th>
<th>Title</th>
<th>International Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IS:209-1992</td>
<td>Specifications for Zinc</td>
<td>BS:3436</td>
</tr>
<tr>
<td>2</td>
<td>IS:406-1991</td>
<td>Method of Chemical Analysis of Slab Zinc</td>
<td>BS:3436</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Composite insulators for A.C. Over head Power lines with a nominal voltage greater than 1000V</td>
<td>IEC:61109-1992</td>
</tr>
<tr>
<td>4</td>
<td>IS Part(II)-1991</td>
<td>Methods of High Voltage Testing.</td>
<td>IEC 60060-1</td>
</tr>
<tr>
<td></td>
<td>IS Part I-1993</td>
<td></td>
<td>IEC:575</td>
</tr>
<tr>
<td></td>
<td>IS Part II-1989</td>
<td></td>
<td>BS-3288</td>
</tr>
<tr>
<td></td>
<td>IS Part III-1991</td>
<td></td>
<td>IEC-6020</td>
</tr>
<tr>
<td>5</td>
<td>IS : 2486</td>
<td>Specification for Insulator fittings for Over Head Power Lines with a nominal voltage greater than 1000 V</td>
<td>IEC 60372</td>
</tr>
<tr>
<td></td>
<td>IS:2629-1990</td>
<td>Recommended practice for Hot dip galvanisation for iron and steel.</td>
<td>ISO-1461 (E)</td>
</tr>
<tr>
<td>7</td>
<td>IS : 6745-1990</td>
<td>Determination of weight of Zinc Coating on Zinc coated iron and steel articles.</td>
<td>BS : 443-1969</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ISO 1460-1973</td>
</tr>
<tr>
<td>8</td>
<td>IS : 8263-1990</td>
<td>Methods of RI Test of HV insulators</td>
<td>IEC-60437</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NEMA Publication No. 07/1964</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CISPR</td>
</tr>
<tr>
<td>9</td>
<td>IS : 8269-1990</td>
<td>Methods for Switching Impulse test on HV insulators.</td>
<td>IEC-60506</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Salt Fog Pollution Voltage Withstand Test.</td>
<td>IEC-60507</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Guide for the selection of insulators in</td>
<td>IEC-60815</td>
</tr>
</tbody>
</table>
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. For moulding of entire weathershed structure on to the rod in a one shot moulding process to
be employed to avoid multiple interfaces. Hardware i.e. metal fittings may 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), 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 hermatically 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 acoustical 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. Outer portion of ball or socket should be Zinc sleeved with minimum 99.95% purity of electrolytic high grade Zinc.
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 colours, 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:

± (0.04 d + 1.5) mm when d ≤ 300 mm.
± (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.

13.0  **PACKING:**

All insulators shall be packed in strong corrugated box of minimum 7 ply duly paletted or wooden crates. The gross weight of the crates along with the material shall not normally exceed 100 kg to avoid hackling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.

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

Suitable cushioning, protective padding, or Dunn age or spacers shall be provided to prevent damage or deformation during transit and handling.

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 corrugated box 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 **TYPE TESTS**

14.5.1 The type, acceptance, routine tests, any tests specifically demanded by the Purchaser and tests during manufacture shall be carried out on the Insulators free of cost. The test reports shall be in accordance with the socket cap material offered.
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 Five 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-despatch inspection, for the purposes of acceptance of that lot. These tests shall be carried out at the manufacturers works in presence of Purchaser’s representative before the despatch 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.

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

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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
   iv) 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

14.6 Sample Tests (Acceptance Tests) –
When specified on a purchase order, sample tests shall be performed per ANSI C29.11 & IEC:61109-1992.
(a) Verification of Dimensions
(b) Verification of Locking System-applicable only in the event ball and socket insulators is specified.
(c) Mechanical Load test- In process testing used to verify the mechanical system is acceptable.
(d) Galvanizing Test

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 insure 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 Additional Tests

14.8.1 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) copies 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.

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 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 judgement is not in full accordance therewith.

20.0 **DRAWINGS**

All the bidders have to submit the 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 80 Kg / m3 NACL.

2.0 **Composite Long rod Insulator Units**

2.1 **Brittle Fracture Resistance Test**
Assembled core load time test with container that contains in-HNO3 concentric acid, this is applied at 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.

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 analysed 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 recognised 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(IXT) 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**

(To be furnished by the bidder and submitted with the offer. Entering Duplicate/overwritten data may lead to rejection of offer.)

<table>
<thead>
<tr>
<th>SUSPENSION TYPE</th>
<th>TENSION TYPE TYPE</th>
</tr>
</thead>
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**A  GENERAL**
1. Voltage level KV
2. Type (e.g. Ball & Socket)
3. Material of Disc
4. Color
5. Surface
6. Type of Locking device and its material (Clip of SS/Phos.Bronze or better)
7. Size
8. Ball/Socket dia (in mm)
9. No. of units per single string
10. Length of insulator string (in mm)
11. Total length with hardware (in mm)
12. Guaranteed mechanical failing load (in KN)

**B  ELECTRICAL**
1. Total Min. creep age distance (in mm)
2. Power frequency withstand voltage - dry KV(peak)
3. Power frequency withstand voltage – wet KV(peak)
4. Impulse withstand voltage (+/-)1.2x50 micro-second ,KV (peak)
5. Visible discharge Voltage KV
6. Total connection length
7. Total minimum creep age distance
8. Dry Arc Distance
10. Core - ECR FRP rod
11. Housing - single mould
12. End fitting by acquistic method
13. Written verification of housing material

Signature of the Bidder : __________
Name : _______________________
Designation : ___________________
Date : _________________
Authorized common rubber
Stamp / seal of the bidder : __________