SILICON RUBBER COMPOSITE INSULATOR

(for Overhead Transmission Line)

September 2021

Engineering Department

WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED

পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড

(পশ্চিমবঙ্গ সরকারের একটি উদ্যোগ)

Regd. Office: VidyutBhawan, Block – DJ, Sector-II, Bidhannagar, Kolkata – 700091.

CIN: U40101WB2007SGC113474; Website: www.wbsetcl.in

TECHNICAL SPECIFICATION FOR SILICON RUBBER COMPOSITE INSULATOR

1. SCOPE:

This specification covers design, manufacture, testing at manufacturer's works before dispatch and supply of Silicone Rubber Composite Insulators as per the requirements for use in for 132/220/400KV Transmission Lines. The insulators of the strings shall consist of composite long rod insulators for at three phase, 50 Hz, effectively earthed transmission system application in a very heavy polluted environment. Couplings shall be ball and socket type. Bidder shall quote such composite insulators which have proven use under foggy/ humid operational conditions in polluted industrial environment combined with smoke & dust particles. Insulators shall have sheds of the "open aerodynamic profile without any under ribs" with good self-cleaning properties. Insulator

2.STANDARDS

The Manufacturer should confirm the product shall comply in all respect with the provision of following Indian Standards, International Standards as amended upto date unless otherwise specified here under.

Sl. No.	. Indian Standard	Title	International Standard
1	IS:209-1992	Specification for zinc	BS:3436
2	IS:406-1991	Method of Chemical Analysis of Slab Zinc	BS:3436
3	IS:731-1991	Porcelain insulators for overhead Power lines with a nominal voltage greater than 1000 V	BS:137-(I&II) IEC:60383
4	IS:2071 Part (I) –1993 (Part(II)-1991 Part(III)-1991	Methods of High Voltage Testing	IEC:60060-1
5	IS:2486 Part- I-1993 Part- II- 1989 Part-III- 1991	Specification for Insulator fittings for Overhead Power Lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements Locking Devices	BS:3288 IEC:60120 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:433-1969 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		Thermal Mechanical Performance test and mechanical performance test on string insulator units	IEC: 60575
12		Salt Fog Pollution Voltage Withstand Test	IEC:60507
13		Composite insulators for A.C. Overhead lines with nominal voltage greater than 1000V – Definitions, test methods and acceptance criteria	IEC 61109
14		Selection and dimensioning of high voltage insulators intended for use in polluted conditions: Polymer Insulators for AC systems	IEC:60815-3
15		Tests on insulators of Ceramic material or glass or glass for overhead lines with a nominal voltage greater than 1000V	IEC:60383
16		Composite string insulator units for overhead lines with a nominal voltage above 1000V : Standard strength classes and end fittings	IEC 61466-1
17		Composite string insulator units for overhead lines with a nominal voltage above 1000V : Dimensional and electrical characteristics	IEC 61466-2
18		Electrical Insulating materials used under severe ambient conditions –Test methods for evaluating resistance to tracking and erosion	IEC 60587
19		Polymeric insulators for indoor and outdoor use with nominal voltage greater than 1000V- General definitions, tests, methods and acceptance criteria.	IEC 62217

3. DEVIATIONS:

Normally the offer should be as per Technical Specification without any deviation. But any deviation felt necessary to improve performance, efficiency and utility of equipment must be mentioned in the 'Deviation Schedule' with reasons duly supported by documentary evidences and advantages of such deviation. Such deviation suggested may or may not be accepted. But deviations not mentioned in 'Deviation Schedule' will not be considered afterwards.

4 .SERVICE CONDITIONS:

The climate condition and other related data are given below:

a) Maximum temperature : 50 degree C
b) Minimum temperature : 4 degree C
c) average temperature : 32 degree C
d) related humidity:
  i) Maximum : 100%
  ii) Minimum : 50%
e) Average rainfall per annum : 2000 mm
f) Average no. of thunderstorm days 75
g) Snowfall : Nil
h) basic wind speed (wind zone-5) :50 m/sec

all the material offered shall be suitable for satisfactory operation in the aforesaid tropical climate.

5. GENERAL REQURIMENTS:

5.1 **LOCATIONS: -** The Silicone Rubber Composite Insulators are to be used for the EHV Transmission Lines where the clause of pollution may be considered as very heavily polluted and creepage distance required is 31 mm/KV.

5.2 DESIGN AND MATERIAL REQUIRMENT

5.2.1 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.

5.2.2 HOUSING & WEATHERSHEDS

The FRP rod shall be covered by a sheath of a silicone rubber compound of a thickness of minimum 3mm. The housing & weather sheds should have silicon content of minimum 30% by weight. It should protect the FRP rod against environmental influences, external pollution and humidity. It shall be extruded or directly molded on the core. The interface between the housing and the core must be uniform and without voids. The strength of the bond shall be greater than the tearing the steel strand shall be hot dip galvanised and shall have zinc coating of minimum 260 gms/sq.m on uncoated wire surface. The zinc coating shall be smooth continuous and of uniform thickness and shall withstand minimum three dips of one-minute duration.

- The wire used in construction of a steel core aluminium conductor, before stranding shall satisfy the requirements for solid wires given in Tables 1 & 2 of IS: 398 (Part - V). Values given in this specification will hold good in case of any difference.

5.2.3 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 case iron or forged steel or Spherical 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 acquistic 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 orsocket 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.

5.2.4 GRADING RINGS:

Grading rings shall be provided when system voltages are equal to or greater than 220 KV. For 220 KV transmission line, grading ring is to be provided at energized end only. For 400 KV transmission line, 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.
The design and supply of Grading ring shall be in the scope of Insulator manufacturer.

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 (EFM) 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.

6. 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 CI. No.3 It shall meet following requirements

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

ii) Be designed in order to avoid formation of localized discharges and to prevent interfaces humid penetration.
iii) Be resistant to corona, KV radiation, ozone, atmospheric contamination, water penetration and power arcs.

7. BALL AND SOCKET DESIGNATION

The dimensions of the Ball and Socket shall be 16mm designation upto 70KN and 20mm designation for 120KN/160 KN insulators in accordance with the standard dimensions stated in IEC:120/IS:2486(Part-II)

8. 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 $\leq$300 mm.
(0.025*d +6) mm when d > 300mm.

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.

9. INTER CHANGEABILITY:
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 IEC standards.
10. 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 part 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.
11. MARKINGS:
Each insulator shall be legibly marked with the following details as per IEC – 61109.

i) Name or trademark of the manufacturer.
ii) Voltage and Type.
iii) Month and year of manufacturing.
iv) Minimum failing load/ guaranteed mechanical strength in kilo Newton followed by the word 'KN' to facilitate easy identification.
v) Country of manufacture.

12. WORKMANSHIP

All the materials shall be of latest design and conform to the best modern practices adopted in the extra high voltage field. Bidders shall offer only such insulators as are guaranteed by him to be satisfactory and suitable for transmission lines specified and will give continued good service.
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 to limit corona and radio interference.
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.
The core shall be sound and free of cracks, impurities and voids that may adversely affect the insulators.
Housing shall be uniform in quality. It shall be free from voids and impurities.
Housing shall be clean, sound, smooth and free from gross defects and excessive flashing at parting lines.
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 the 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.
All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 600 gm/sq.m. and shall be in accordance with the requirement of ISO:1461 (E) and shall satisfy the tests mentioned in ISO:1460 (E). The zinc used for galvanizing shall be of purity of 99.95%. The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from perfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least six successive dips each lasting for one (1) minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

13. PACKING:

All insulators shall be packed in strong corrugated box of minimum 7 ply duly palette or wooden crates. The gross weight of the crates along with the material shall not normally exceed 100 kg to avoid handling 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. 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. WBSETCL reserves the right to carry out design and type tests to check conformity of the material with the proto type unit previously approved.

WBSETCL 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.
The manufacture shall assure WBSETCL's inspector the right to being fully acquainted with installations and apparatus, check calibrations, is present at the test, 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 TEST:

14.5.1.1 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 NABL/ Government Approved Testing laboratory/any International test laboratory of repute. 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-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 value 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.

ON THE COMPLETE COMPOSITE INSULATOR WITH HARDWARE FITTINGS:

(a) Power frequency voltage withstand test with grading ring and arcing horns under wet condition-IEC:383-1993
(b) Impulse voltage withstand test under wet condition.-IEC:383-1993
(c)Corona & RIV test as per Annexure-A
(d) Salt-fog pollution withstand test-Annexure-A
(e) Grading device test-Applicable to 220KV and above voltage class-Annexure-A
(f)Mechanical Strength Test-Annexure-A

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

ON COMPOSITE INSULATOR UNITS:
(a) Tests on interfaces and connections IEC:61109-1992
Dry Power Frequency Voltages Test
i) Sudden Load Release Test
ii)Thermal Mechanical Test
iii)Water immersion
iv)Steep Front Impulse Voltage Test

(b) Assembled Core Load – Type 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)Tracking and Erosion test.IEC: 61109-1992

(d) Dye Penetration Test IEC: 61109-1992

(e)Water Diffusion Test IEC: 61109-1992

(f) Brittle fracture resistance test – Annexure-A

(g)Accelerated ageing Test for 5000 hours as per Annexure- C-IEC: 61109/IEC 62217

(h) Mechanical load time test IEC: 61109-1992 Clause 6.4

(i)Flammability test IEC: 61109-Amd. 1 or Test as per UL94.

(j)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 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.

15. ADDITIONAL TESTS:

The Purchaser reserves the right of having at his own expenses any other test(s) ofreasonable nature carried out at Supplier's premises, at site, or in any other placein addition to the aforesaid type, acceptance and routine tests to satisfy himselfthat the material comply with the Specifications.

The Purchaser also reserves the right to conduct all the tests mentioned in thisspecification at his own expense on the samples drawn from the site at Supplier'spremises or at any other test centre. In case of evidence of non compliance, itshall be binding on the part of the Supplier

16. GUARANTEE:
The Supplier of insulators shall guarantee overall satisfactory performance of the insulators. In case of failure of materials to meet the guarantee, WBSETCL shall have right to reject the material.

17. CONTRACT DRAWINGS AND MANUALS:
In the event of placement of P.O., an order the successful bidder shall submit the drawings stated above in six copies for approval during the commencement period to CE(Engineering) WBSETCL Corporate office Kolkata. The set of approved drawings shall be submitted in soft copy in auto CAD format.

18. TEST REPORTS:

i) All routine tests at manufacturer works shall be carried out for all Insulators and test reports are to be submitted to the Chief Engineer, Engg. Deptt, Bidyut Bhavan,(9thfloor),salt lake, Kolkata-700091.

ii) 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.
iii) All acceptance tests shall be carried out at manufacturer works on every lot offered for inspection as per this technical specification , in presence of representative of WBSETCL. Selection of samples for acceptance test as well as rejection and retesting shall be guided by relevant IEC & IS. Three(3) copies of test reports shall be submitted to the Chief Engineer ,Engg. Deptt, Bidyut Bhavan,(9thfloor),salt lake, Kolkata-700091 for approval and adequate extra copies for distribution to site.

iv) The contractor shall give at least 21(twenty one) days' advance notice intimating the actual date of inspection and details of all tests that are to be carried out.

19. TEST FACILITIES:

19.1 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.

20. QUALITY ASSURANCE PLAN:
20.1 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.
Information and copies of test certificates as in (i) above is respect of bought out accessories.

ii) List of manufacturing facilities available.

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

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

v) List of testing equipment available with the Bidder for final testing of Insulator specified. In case if the Bidder does not possess all the Routine and Acceptance testing facilities the tender will be rejected.

vi) 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 our rightly rejected and he may be black listed.

vii) Special features provided to make it maintenance free.

viii) Bidder shall also submit the Field Quality Plan (FQP) along with Technical Bid.
20.2 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) The bidder shall submit credentials/capabilities, supply record, Clientele Certificate for materials used in transmission lines of respective/higher voltage class, technical details including Factory test certificates and Type Reports(both for Insulators and complete strings) and guaranteed Technical particulars filled in prescribed format.

iii) Quality assurance plan (QAP) with hold points for purchaser's inspection.

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

21. TENDER DRAWING, CATALOUGES AND TEST REPORTS:

21.1 Bidder has to submit drawing and manual/leaflet, with each tender, giving all details with electrical/mechanical characteristics.

21.2 Bidder shall submit complete type test report carried out in Govt. recognized Test House or laboratory/ NABL accredited laboratory/any international test laboratory of repute as relevant IS/IEC.

The submitted type tests shall amply prove that type tests have been carried out within five years from the date of submission of Bid. Guranteed Technical particulars in prescribed format of WBSETCL.

22. STANDARDS TECHNICAL PARAMETERS:

Electrical system data:							
a)System voltage(KV rms)	132 220 400						
b)maximum voltage(KV rms)	145 245 420						
c)Lighting impulse withstandVoltage(Dry & Wet)(KVP)	650 1050 1550						
d)power frequency withstand Voltage(Wet)(KVP)	275 460 680						
e)Electro Mechanical failing load .	70KN	120KN	70KN	120KN	120 KN(I Sus.)	120 KN(V Sus.)	160 KN (D.Ten.)
f)Min Creepage distance(mm)	3625		6125		10500		
g)Sectional Length(mm)	1305	1450	2030	2175	3335	3335	4080
h)Ball and Socket designation(mm)	16	20	16	20	20	20	20

ANNEXURE-A

1. A TESTS ON COMPLETE STRINGS WITH HARDWARE FITTINGS FOR 132/220/400 KV AC TRANSMISSION LINES

1.1.1 CORONA EXTINCTION VOLTAGE TEST (DRY)

The sample assembly when subjected to power frequency voltage shallhave a corona extinction voltage of not less than 320 KV (rms) for 400KV, 155KV (rms) for 220 KV and 105 KV for 132KV(rms) line to ground underdry condition. There shall be no evidence of corona on any part of the sample. The atmospheric condition during testing shall be recorded and thetest results shall be accordingly corrected with suitable correction factor asstipulated in IEC : 383.

1.1.2 RIV TEST (DRY)

Under the conditions as specified under (1.A.1) above, the insulator stringalong with complete hardware fittings shall have a radio interferenceVoltage level below 1000 micro volts at one MHz when subjected to 50 HzAC voltage of 320 KV (rms) for 400KV, 155KV (rms) for 220 KV and 105 KV for 132KV(rms) line to ground under dry condition. The test procedure shall be in accordance with IS:8263 /IEC:60437.

1.1.3 MECHANICAL STRENGTH TEST

The complete insulator string along with its hardware fitting excluding arcing horn, corona control ring, grading ring and suspension assembly/dead end assembly shall be subjected to a load equal to 50% of the specified minimum ultimate tensile strength (UTS) which shall be increased at a steady rate to 67% of the minimum UTS specified. The load shall be held for five minutes and then removed.

After removal of the load, the string components shall not show any visual deformation and it shall be possible to disassemble them by hand. Hand tools may be used to, remove cotter pins and loosen the nuts initially. The string shall then be reassembled and loaded to 50% of UTS and the load shall be further increased at a steady rate till the specified minimum UTS and held for one minute. No fracture should occur during this period. The applied load shall then be increased until the failing load is reached and the value recorded.

1.1.4 SALT-FOG POLLUTION WITHSTAND TEST

This test shall be carried out in accordance with IEC : 60507. The salinitylevel for composite long rod insulators shall be 160 Kg/m3 NACL

2.0 COMPOSITE LONG ROD INSULATOR UNITS

2.1 BRITTLE FRACTURE RESISTANCE TEST

The test arrangement shall be according to Damage limit proof test with simultaneous application of 1N-HNO3 acid directly in contact with naked FRP rod. The contact length of acid shall not be less than 40mm and thickness around the core not less than 10mm.The rod shall withstand 80% of SML for 96 hours.

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 3mm 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 or 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 2within 24 to 48 hours, depending on the material and the intensity of the corona treatment.

2.3.SILICON 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 Owner & Supplier in Quality Assurance Programme.

3. 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%.

3.1. TESTS FOR FORGINGS:

The chemical analysis hardness tests and magnetic particle inspection for forgings, will be as per the internationally recognised 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 bythe Supplier and Owner in Quality Assurance Programme.

3.2. 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 numberand heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Supplier and Owner in Quality AssuranceProgramme.

4.GRADING DEVICE TEST:

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.

GURANTEED TECHNICAL PARTICULARS OF 70/120/160 KN POLYMER INSULATORS FOR 132/220/400KV TRANSMISSION LINES.
(to be filled in by the Bidder)

Sl no	Particulars	Units	132KV		220KV		400KV		
			70 KN (Sus.)	120 KN (Ten.)	70 KN (Sus.)	120 KN (Ten.)	120 KN (ISus.)	120 KN (V Sus.)	160 KN (D.Ten.)
1	Name and address of Tenderer								
2	Name and address of manufacturer								
3	Voltage level	KV							
4	Weight of single unit	Kg							
5	Size and designation of Ball & Socket assembly	mm							
6	Core diameter	mm							
7	Tolerance on Core diameter	mm							
8	Nominal Length(insulation spacing)	mm							
9	Tolerance on Nominal Length	mm							
10	Dry Arcing distance	mm							
11	Number of Sheds	Nos.							
12	Shed profile(type)	mm							
13	Shed Spacing	mm							
14	Shed profile(Regular/Alternating)	mm							
15	Shed diameter	mm							
16	Tolerance on Shed diameter	mm							
17	Minimum Creepage distance(25mm/KV)	mm							
18	Tolerance on Creepage distance	mm							
19	Guranteed mechanical strenght	KN							

20	Routine mechanical load	KN							
21	Material a)FRP ROD								
	b)weather shed with % contents of Silicon								
	c)Housing								
	d)End fittings								
	e)Grading rings								
22	Min thickness of sheath covering over the core	mm							
23	Power frequency withstand voltage of composite long rod insulator								
	a)Dry	KV (rms)							
	b)wet	KV (rms)							
24	Power frequency flashover voltage of composite long rod insulator								
	a)Dry	KV (rms)							
	b)wet	KV (rms)							
25	Impulse withstand voltage of composite long rod insulator								
	a)positive	KV (peak)							
	b)negative	KV (peak)							
26	Impulse flashover voltage of single unit(Dry)								
	a)positive	KV (peak)							
	b)negative	KV(peak)							
27	Inc used for Galvanising and fittings	%							
28	Number of dips which the end fittings can withstand in standard preece test	Nos.							
29	Visible discharge Voltage	KV							

30	Minimum RIV at 1000 kHZ	Micro Volt							
31	Drawing enclosed.								
32	Packing details								
	a)type of Packing								
	b)no of insulator in the pack								
	c)gross weight of package(kgs)(approx)								

Seal of the Company

Signature:
Name:

Date: Designation: