MAHAVITARAN

Maharashtra State Electricity Distribution Co. Ltd.

Maharashtra State Electricity Distribution Co. Ltd.

SPECIFICATION NO. MSEDCL/ DIST: MM-III/07/2007/R1/181209

SPECIFICATION

FOR

11 KV/22 KV/33 KV

COMPOSITE INSULATORS

TECHNICAL SPECIFICATION FOR 11 KV/22 KV/33 KV COMPOSITE INSULATORS

SPECIFICATION NO.MM-III/Composite Ins.: 07/2007/R1/181209

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TECHNICAL SPECIFICATION 11 KV/22 KV/33 KV COMPOSITE INSULATORS SPECIFICATION NO. MM-III/Composite Ins : 07/2007/R1/181209

1.0 SCOPE :

This specification covers the design, manufacture, testing and supply of 11KV / 22KV / 33 KV Composite Insulators. The composite insulators shall be of the following type:

i) Long rod insulators for conductors in tension application at angle / cut points the insulators shall be of tongue & clevis type.
ii) Line post insulators or pin insulators for straight line locations

2.0 SERVICE CONDITIONS :

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

2.1.1	Maximum ambient temperature (Degree C)	…	50
2.1.2	Minimum ambient temperature (Degree C)	…	3.5
2.1.3	Relative Humidity (%)	…	10 to 100
2.1.4	Maximum Annual Rainfall (mm)	…	1450
2.1.5.	Maximum Wind pressure (kg/m.sq.)	…	150
2.1.6	Maximum wind velocity (km/hour)	…	45
2.1.7	Maximum altitude above mean sea level (meter)	…	1000
2.1.8	Isoceraunic level (days/year)	…	50
2.1.9	Seismic level (Horizontal acceleration)	…	0.3 g
2.1.10	Moderately hot and humid tropical climate Conductive to rust and fungus growth		

3.0 SYSTEM PARTICULARS:

a) Nominal System Voltage	11 kV	22 kV	33 kV
b) Corresponding highest system Voltage	12 kV	24kV	36 kV
c) Frequency	50 Hz with 3% tolerance		
d) Number of phase	3	3	3
e) Neutral earthing	effectively grounded.		

4.0 STANDARDS :

Unless otherwise specified elsewhere in the specifications insulators shall confirm to the latest revisions of all relevant standards available at the time of placement of the order. The standards are listed in Annexure ‘A’.

5.0 GENERAL REQUIREMENTS

5.1 The composite insulators shall generally conform to latest Standards as listed in Annexure 'A'

5.2 The Composite Insulators will be used on lines on which the conductors will be A.A.A. Conductor of size up to 200 sq. mm. and ACSR of any size up to Panther (0.2 sq. inch copper equivalent). The insulators should withstand the conductor tension, the reversible wind load as well as the high frequency vibrations due to wind.

5.3 Bidder must be an indigenous manufacturer and supplier of composite insulators of rating 33 kV or above OR must have developed proven in house technology and manufacturing process for composite insulators of above rating OR possess technical collaboration /association with a manufacturer of composite insulators of rating 33kV or above. The Bidder shall furnish necessary evidence in support of the above along with the bid, which can be in the form of certification from the utilities concerned, or any other documents to the satisfaction of the owner.

5.4 Insulator shall be suitable for both the suspension and strain type of load & shall be of tongue & clevis type. The diameter of Composite Insulator shall be less than 200 mm. The center-to-center distance between tongue & clevis shall be max. 300 mm for 11 kV, 450 mm for 22 kV & 550 mm for 33 kV composite Insulator.

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

5.6 The size of Composite insulator, minimum creepage distance and mechanical strength along with hardware fittings shall be as follows:

Sr. No.	Type of composite insulators	Nominal System voltage kV (rms)	Highest System voltage kV(rms)	Visible discharge test voltage kV(rms)	Wet Power Frequency Withstand voltage kV(rms)	Impulse Withstand voltage kV(rms)	Minimum Creepage Distance (mm) (Heavily polluted 25mm/kV)	Center to center distance between Tongue & Clevis (mm)	Min. failing load kN	Shed Diameter (mm) (min)
i.	Long rod insulator	11	12	9	35	75	320	300	45	100
		22	24	18	55	125	600	450	70	100
		33	36	27	75	170	900	550	70	100
ii.	Post/Pin Insulator	11	12	9	35	75	320		5	
		22	24	18	55	125	560		10	
		33	36	27	75	170	900		10	

5.7 Dimensional Tolerance of Composite Insulators

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

± (0.04d+1.5) mm when d≤300mm.
± (0.025d+6) mm when d>300 mm.
Where, d being the dimensions in millimeters for diameter, length or creepage distance as the case may be. However no negative tolerance shall be applicable to creepage distance.

5.8 Interchangeability:

The composite insulator together with the tongue & clevis fittings shall be of standard design suitable for use with the hardware of any other indigenous make conforming to relevant standards referred above.

5.9 Corona and RI Performance

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

6.0 TECHNICAL DESCRIPTION OF COMPOSITE INSULATORS

Polymeric Insulators shall be designed to meet the high quality, safety and reliability and are capable of withstanding a wide range of environmental conditions.
Polymeric Insulators shall consist of THREE parts, at least two of which are insulating parts:- (a) Core- the internal insulating part (b) Housing- the external insulating part (c) Metal end fittings.

6.1 CORE

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

6.2 HOUSING:

The FRP rod shall be covered by a seamless sheath of a silicone elastometric compound or silicone alloy compound of a thickness of 3mm minimum. It shall be one-piece housing using Injection Molding Principle to cover the core. The elastomer housing shall be designed to provide the necessary creepage distance and protection against environmental influences. Housing shall conform to the requirements of IEC 61109/92-93 with latest amendments

6.3 WEATHERSHEDS

The composite polymer weather sheds made of a silicone elastometric compound or silicone alloy compound shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and shall be free from imperfections It should protect

the FRP rod against environmental influences, external pollution and humidity. The weather sheds should have silicon content of minimum 30% by weight. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The interface, if any, between sheds and sheath (housing) shall be free from voids.

6.4 METAL END FITTINGS:

End fitting transmit the mechanical load to the core. They shall be made of spheroidal graphite cast iron, malleable cast iron or forged steel or aluminum alloy. They shall be connected to the rod by means of a controlled compression technique. Metal end fittings shall be suitable for tongue & clevis hard wares of respective specified mechanical load and shall be hot dip galvanized after, all fittings have been completed. The material used in fittings shall be corrosion resistant. As the main duty of the end fittings is the transfer of mechanical loads to the core the fittings should be properly attached to the core by a coaxial or hexagonal compression process & should not damage the individual fibers or crack the core. The gap between fitting and sheath shall be sealed by a flexible silicone elastomeric compound or silicone alloy compound sealant. System of attachment of end fitting to the rod shall provide superior sealing performance between housing, i.e. seamless sheath and metal connection. The sealing must be moisture proof. The dimensions of end fittings of insulators shall be in accordance with the standard dimensions stated in IEC: 60120/ IS: 2486 - Part-II /1989.

7.0 WORKMANSHIP

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

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

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

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

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

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

All load bearing surfaces shall be sooth and uniform so as to distribute the loading stresses uniformly.

7.7 All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/sq.m. or 87 microm thickness and shall be in accordance with the requirement of IS:4759. the zinc used for galvanizing shall be of purity 99.5% as per IS:4699. The zinc coating shall be uniform, adherent, smooth, reasonably bright continuous and free from imperfections such as flux, ash rust stains, bulky white deposits and blisters. The galvanized metal parts shall be guaranteed to withstand at least four successive dips each lasting for one (1) minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

8.0 TESTS AND STANDARDS

Insulators offered shall be manufactured with the same configuration & raw materials as used in the insulators for which design & type test reports are submitted. The manufacturer shall submit a certificate for the same. The design & type test reports submitted shall not be more than five years old.

8.1 DESIGN TESTS :

For polymeric insulators it is essential to carry out design test as per clause 4.1 of IEC 61109 / 92-93 with latest amendments. The design tests are intended to verify the suitability of the design, materials and method of manufacture (technology). When a composite insulator is submitted to the design tests, the result shall be considered valid for the whole class of insulators, which are represented by the one tested and having the following characteristics:

- Same materials for the core, and sheds and same manufacturing method;
- Same material of the fittings, the same design, the same method of attachment;
- Same or greater layer thickness of the shed material over the core (including a sheath where used);
- Same or smaller ratio of the highest system voltage to insulation length;
- Same or smaller ratio of all mechanical loads to the smallest core diameter between fittings
- Same or greater diameter of the core.

The tested composite insulators shall be identified by a drawing giving all the dimensions with the manufacturing tolerances.
Manufacturer should submit test reports for Design Tests as per IEC – 61109 (clause – 5) along with the bid. Additionally following tests shall be carried out or reports for the tests shall be submitted after award of contract:
UV test: the test shall be carried out in line with clause 7.2 of ANSI C29.13.

8.2 TYPE TESTS :

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

8.2.1 Following Type test shall be conducted on a suitable number of individual insulator units, components, materials or complete strings:

SI. No	Description of type test	Test procedure / standard
1	Dry lightning impulse withstand voltage test	As per IEC 61109(Clause 6.1)
2	Wet power frequency test	As per IEC 61109(Clause 6.2)
3	Mechanical load-time test	As per IEC 61109(Clause 6.4)
4	Radio interference test	As per IEC 61109(Clause 6.5) revised
5	Recovery of Hydrophobicity test	Annexure – B This test may be repeated every 3yrs by the manufacturer
6	Chemical composition test for silicon content	Annexure – B Or any other test method acceptable to the owner
7	Brittle fracture resistance test	Annexure – B

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

8.3 ACCEPTANCE TESTS :

The test samples after having withstood the routine test shall be subject to the following acceptance tests in order indicated below:

(a)	Verification of dimensions	: Clause 7.2 IEC: 61109,
(b)	Verification of the locking system (if applicable)	: Clause 7.3 IEC: 61109,
(c)	Verification of tightness of the interface Between end fittings & Insulator housing	: Clause 7.4 IEC: 61109 amendment 1of 1995
(d)	Verification of the specified mechanical load	: Clause 7.4 IEC: 61109, amendment 1of 1995
(e)	Galvanizing test	: IS:2633/IS:6745

8.4 ROUTINE TESTS:

Sr.No.	Description	Standard
1	Identification of marking	As per IEC: 61109 Clause 8.1
2	Visual Inspection	As per IEC: 61109 Clause 8.2
3	Mechanical routine test	As per IEC: 61109 Clause 8.3

Every polymeric insulator shall withstand mechanical routine test at ambient temperature tensile load at RTL corresponding to at least 50 % of the SML for at least 10 sec.

8.5 TESTS DURING MANUFACTURE:

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

(a)	Chemical analysis of zinc used for galvanizing
(b)	Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.
(c)	Chemical analysis, hardness tests and magnetic particle inspection for forgings.

8.6 SAMPLE BATCH FOR TYPE TESTING :

8.6.1 The bidder shall offer material for sample selection for type testing only after getting Quality Assurance Plan approved by the C.E.(Dist) MSEDCL Mumbai. The bidder shall offer at least three times the quantity of materials required for conducting all the type tests for sample selection. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Plan approved by the C.E. (Dist) MSEDCL Mumbai.

9.0 QUALITY ASSURANCE PLAN :

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

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

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

9.1.3 List of manufacturing facilities available.

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

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

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

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

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

9.3 The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where insulator, and its component parts shall be manufactured and the representatives shall have full facilities for unrestricted inspection of the Supplier's and sub-Supplier's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.

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

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

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

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

10.0 TEST CERTIFICATE :

The tenderer shall furnish detailed type test reports of the offered composite Insulators as per clause 8.2 of the Technical Specifications at the NABL approved laboratories to prove that the composite Insulators offered meet the requirements of the specification. These Type Tests should have been carried out within five years prior to the date of opening of this tender. However, the tenderers who have supplied the composite Insulators to the Board against order from Central Purchase Agency of M.S.E.D.C.L. shall be exempted from submission of Type Test Report against this tender provided.

i) The offered composite Insulators are already fully type tested at approved Laboratory within five years prior to the date of opening of this tender.

ii) There is no change in the design of type-tested composite Insulators and those offers against this tender.

iii) Such tenderers complying (i) and (ii) above shall furnish an undertaking in the format schedule "F" enclosed herewith.

The detailed Type tests along with the relevant certified drawings etc. or undertaking in the format schedule "F" seeking exemption from their submission of the type test reports are to be submitted along with the offer.

The purchaser reserves right to demand repetition of some or all the Type Test in presence of purchaser's representative at purchaser's cost. For this purpose, the tenderer shall quote unit rates for carrying out each Type Test. However, such unit rates will not be considered for evaluation of the offer. In case the unit fails in the Type Tests, the complete supply shall be rejected.

The successful tenderer shall take approval / waival of Type Test from C.E. (Dist.), M.S.E.D.C.L., Prakashgad, Bandra(E), Mumbai prior to the commencement of supply.

11.0 TESTING FACILITIES :

The tenderer must clearly indicate what testing facilities are available in the works of the manufacturer and whether facilities are adequate to carry out all Routine & acceptance Tests. These facilities should be available to MSEDCL's Engineers if deputed or carry out or witness the tests in the manufacturer works. If any test cannot be carried out at the manufacturer's work, the reasons should be clearly stated in the tender. The insulators shall be tested in accordance with the procedure detailed in IEC 61109 / 92-93 with latest amendments.

12.0. DRAWINGS :

12.1 The Bidder shall furnish full description and illustration of the material offered.

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

(a) Long rod diameter with manufacturing tolerances
(b) Minimum Creepage distance with positive tolerance
(c) Protected creepage distance
(d) Eccentricity of the long rod unit
    (i) Axial run out
    (ii) Radial run out
(e) Unit mechanical and electrical characteristics
(f) Size and weight of ball and socket/tongue & clevis

(g) Weight of composite long rod units
(h) Materials
(i) Identification mark
(j) Manufacturer's catalogue number

12.3 After placement of award, the Supplier shall submit three sets of full dimensioned manufacturing insulator drawings containing all the details to The Chief Engineer (Distribution) MSEDCL Mumbai for approval. After getting approval from The Chief Engineer (Distribution) MSEDCL Mumbai bidder shall submit 10 more copies of the drawings & type tests for further distribution and field use.

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

13.0 RETEST AND REJECTION:

13.1 Sample Procedure for testing of insulators shall be as per clause 7.1 to 7.6 of IEC 61109 for Acceptance & Routine Tests.

For the sampling tests, two samples are used, E1and E2. The sizes of these samples are indicated in the table below.

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

If more than 10000 insulators are concerned, they shall be divided into an optimum number of lots comprising between 2000 and 10000 insulators. The results of the tests shall be evaluated separately for each lot.

The insulators shall be selected by the purchaser's representative from the lot at random.

The samples shall be subjected to the applicable sampling tests.

The sampling tests are:

Verification of dimensions	-	(E1 + E2)
Verification of the locking system	-	(E2)
Verification of tightness of the interface between end fittings & Insulator housing	-	(E2)
Verification of the specified mechanical load SML	-	(E1)
Galvanizing test	-	(E2)

In the event of a failure of the sample to satisfy a test, the retesting procedure shall be as follows :

If only one insulator or metal part fails to comply with the sampling tests, a new sample equal to twice the quantity originally submitted to the tests shall be subjected to retesting. The retesting shall comprise the test in which failure occurs. If two or more insulator or metal parts fail to comply with any of the sampling tests or if any failure occurs during the retesting, the complete lot is considered as not complying with this standard and shall be withdrawn by the manufacturer.

Provided the cause of the failure can be clearly identified, the manufacturer may sort the lot to eliminate all the insulators with these defects. The sorted lot then be resubmitted for testing. The number then selected shall be three times the first chosen quantity for tests. If any insulators fail during this retesting, the complete lot is considered as not complying with this standard and shall be withdrawn by the manufacturer.

13.2 Verification of dimensions (E1 + E2)

The dimensions given in the drawings shall be verified. The tolerances given in the drawing are valid. If no tolerances are given in the drawings the values mentioned in this specification shall hold good.

13.3 Verification of the locking system (E2)

This test applies only to the insulators equipped with socket coupling as specified by IEC 120 and is performed according to IEC 383.

13.4 Verification of tightness of the interface between end fittings & Insulator housing (E2)

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

The indication shall be performed in the following way.

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

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

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

13.5 Verification of the specified mechanical load SML

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

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

The insulators have passed the test at 13.4 & 13.5 above if:

- No failure (breakage or complete pull out of the core, or fracture of the metal fitting) occurs either during the 1 min. 70 % withstand test (a) or during the 1 min.100 % withstand test (b).
- No cracks are indicated after the dye penetration method described in 13.4 above.
- The investigation of the halves described in 13.4 above shows clearly that the cracks do not reach the core.

13.6 Galvanizing test

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

14.0 MARKINGS :

14.1 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 & Type
c) Month and year of manufacturing.
d) Min. failing load/guaranteed mechanical strength in kilo Newton followed by the word 'KN' to facilitate easy identification.
e) 'MSEDCL'. Marking

14.2 One 10 mm thick ring or 20 mm thick spot of suitable quality of paint shall be marked on the end fitting of each composite long rod of particular strength for easy identification. The paint shall not have any deteriorating effect on the insulator performance.

Following codes shall be used as identification mark:

For 45 KN long rod units : Blue
For 70 KN long rod units : Red

15.0 PACKING :

15.1 All insulators shall be packed in strong corrugated box of min. 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.

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

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

15.4 All packing cases shall be marked legibly and correctly so as to ensure safe arrival at their destination and to avoid the possibility of goods being lost or wrongly dispatched on account of faulty packing and faulty or illegible markings. Each wooden case /crate /corrugated box shall have all the markings stenciled on it in indelible ink.

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

16.0 GUARANTEE

The Supplier of insulators shall guarantee overall satisfactory performance of the insulators. The tenderer shall furnish in the form attached (Schedule 'A') all the guaranteed technical particulars.

SCHEDULE – A1

GUARANTEED TECHNICAL PARTICULARS.

COMPOSITE INSULATOR UNIT

11KV(45KN) / 11KV(70KN),
(to be filled separately for each type mentioned above)

Sr.No	Parameter Name	Parameter type
1.	Type of insulator	Text
2.	Standard according to which the insulators manufactured and tested	Text
3.	Name of material used in manufacture of the insulator with class/grade	
3.1	Material of core (FRP rod) i) E-glass or ECR-glass ii) Boron content	Text
3.2	Material of housing & weather sheds (Silicon content by weight)	Text
3.3	Material of end fittings	Text
3.4	Sealing compound for end fitting	Text
4.0	Colour	Text
5.	**Electrical characteristics**	
5.1.	Nominal system voltage KV (rms)	Numeric
5.2	Highest system voltage KV (rms)	Numeric
5.3	Dry Power frequency withstand voltage KV (rms)	Numeric
5.4	Wet Power frequency withstand voltage KV (rms)	Numeric
5.5	Dry flashover voltage KV (rms)	Numeric
5.6	Wet flash over voltage KV (rms)	Numeric
5.7	Dry lighting impulse withstand voltage a) Positive KV (peak) b) Negative KV (peak)	Numeric
5.8	Dry lighting impulse flashover voltage c) Positive KV (peak) d) Negative KV (peak)	Numeric
5.9	RIV at 1 MHz when energized at 10 kV/ 30 kV (rms) under dry condition Micro volts	Numeric
6.0	Creepage distance (Min.) (320mm) (mm)	Numeric
6.1	Center to center distance between tongue & clevis) (300mm) (mm)	Numeric
6.2	Shed diameter (100mm) (mm)	Numeric

Sr.No	Parameter Name	Parameter type
7.0	Mechanical characteristics: KN Minimum failing load	Numeric
8.0	**Dimensions of insulator**	
8.1	Weight Kg	Numeric
8.2	Dia. of FRP rod: mm	Numeric
8.3	Length of FRP rod mm	Numeric
8.4	Dia. of weather sheds (100mm) mm	Numeric
8.5	Thickness of housing mm	Numeric
8.6	Dry arc distance mm	Numeric
8.7	Dimensioned drawings of insulator (including weight with tolerances in weight) enclosed.	Boolean
9.0.	Method of fixing of sheds to housing (Specify): Single mould or Modular construction (Injection molding / compression molding)	Text
10.0	No of weather sheds	Text
11.0	**Type of sheds**	
11.1	Aerodynamic	Text
11.2	With underribs	Text
12.	**Packing details**	
12.1	Type of packing	Text
12.2	No. of insulators in each pack	Text
12.3	Gross weight of package	Text
13.0	Design Test Report, Type Test Report of insulator enclosed.	Boolean
14.0	Any other particulars which the bidder may like to give	File

SEAL & SIGNATURE OF THE TENDERER

SCHEDULE – A2

GUARANTEED TECHNICAL PARTICULARS.

COMPOSITE INSULATOR UNIT

22KV (70KN)

Sr.No	Parameter Name	Parameter type
1.	Type of insulator	Text
2.	Standard according to which the insulators manufactured and tested	Text
3.	Name of material used in manufacture of the insulator with class/grade	
3.1	Material of core (FRP rod) iii) E-glass or ECR-glass iv) Boron content	Text
3.2	Material of housing & weather sheds (silicon content by weight)	Text
3.3	Material of end fittings	Text
3.4	Sealing compound for end fitting	Text
4.0	Colour	Text
5.	**Electrical characteristics**	
5.1.	Nominal system voltage KV (rms)	Numeric
5.2	Highest system voltage KV (rms)	Numeric
5.3	Dry Power frequency withstand voltage KV (rms)	Numeric
5.4	Wet Power frequency withstand voltage KV (rms)	Numeric
5.5	Dry flashover voltage KV (rms)	Numeric
5.6	Wet flash over voltage KV (rms)	Numeric
5.7	Dry lighting impulse withstand voltage e) Positive KV (peak) f) Negative KV (peak)	Numeric
5.8	Dry lighting impulse flashover voltage g) Positive KV (peak) h) Negative KV (peak)	Numeric
5.9	RIV at 1 MHz when energized at 10 kV/ 30 kV (rms) under dry condition Micro volts	Numeric
6.0	Creepage distance (Min.) mm	Numeric
6.1	Center to center distance between tongue & clevis (mm)	Numeric
6.2	Shed diameter (mm)	Numeric

Sr.No	Parameter Name		Parameter type
7.0	Mechanical characteristics: Minimum failing load	KN	Numeric
8.0	**Dimensions of insulator**		
8.1	Weight	Kg	Numeric
8.2	Dia. of FRP rod:	mm	Numeric
8.3	Length of FRP rod	mm	Numeric
8.4	Dia. of weather sheds	mm	Numeric
8.5	Thickness of housing	mm	Numeric
8.6	Dry arc distance	mm	Numeric
8.7	Dimensioned drawings of insulator (including weight with tolerances in weight) enclosed.		Boolean
9.0.	Method of fixing of sheds to housing (Specify): Single mould or Modular construction (Injection molding / compression molding)		Text
10.0	No of weather sheds		Text
11.0	**Type of sheds**		
11.1	Aerodynamic		Text
11.2	With underribs		Text
12.	**Packing details**		
12.1	Type of packing		Text
12.2	No. of insulators in each pack		Text
12.3	Gross weight of package		Text
13.0	Design Test Report, Type Test Report of insulator enclosed.		Boolean
14.0	Any other particulars which the bidder may like to give		File

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SCHEDULE – A3

GUARANTEED TECHNICAL PARTICULARS.

COMPOSITE INSULATOR UNIT

33KV (70KN)

Sr.No	Parameter Name	Parameter type
1.	Type of insulator	Text
2.	Standard according to which the insulators manufactured and tested	Text
3.	Name of material used in manufacture of the insulator with class/grade	
3.1	Material of core (FRP rod) v) E-glass or ECR-glass vi) Boron content	Text
3.2	Material of housing & weather sheds (silicon content by weight)	Text
3.3	Material of end fittings	Text
3.4	Sealing compound for end fitting	Text
4.0	Colour	Text
5.	**Electrical characteristics**	
5.1.	Nominal system voltage KV (rms)	Numeric
5.2	Highest system voltage KV (rms)	Numeric
5.3	Dry Power frequency withstand voltage KV (rms)	Numeric
5.4	Wet Power frequency withstand voltage KV (rms)	Numeric
5.5	Dry flashover voltage KV (rms)	Numeric
5.6	Wet flash over voltage KV (rms)	Numeric
5.7	Dry lighting impulse withstand voltage i) Positive KV (peak) j) Negative KV (peak)	Numeric
5.8	Dry lighting impulse flashover voltage k) Positive KV (peak) l) Negative KV (peak)	Numeric
5.9	RIV at 1 MHz when energized at 10 kV/ 30 kV (rms) under dry condition Micro volts	Numeric
6.0	Creepage distance (Min.) mm	Numeric
6.1	Center to center distance between tongue & clevis (mm)	Numeric
6.2	Shed diameter (mm)	Numeric

Sr.No	Parameter Name		Parameter type
7.0	Mechanical characteristics: Minimum failing load	KN	Numeric
8.0	**Dimensions of insulator**		
8.1	Weight	Kg	Numeric
8.2	Dia. of FRP rod:	mm	Numeric
8.3	Length of FRP rod	mm	Numeric
8.4	Dia. of weather sheds	mm	Numeric
8.5	Thickness of housing	mm	Numeric
8.6	Dry arc distance	mm	Numeric
8.7	Dimensioned drawings of insulator (including weight with tolerances in weight) enclosed.		Boolean
9.0.	Method of fixing of sheds to housing (Specify): Single mould or Modular construction (Injection molding / compression molding)		Text
10.0	No of weather sheds		Text
11.0	**Type of sheds**		
11.1	Aerodynamic		Text
11.2	With underribs		Text
12.	**Packing details**		
12.1	Type of packing		Text
12.2	No. of insulators in each pack		Text
12.3	Gross weight of package		Text
13.0	Design Test Report, Type Test Report of insulator enclosed.		Boolean
14.0	Any other particulars which the bidder may like to give		File

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ANNEXURE 'A'

STANDARDS TO BE ADOPTED FOR COMPOSITE INSULATORS

Sr. No.	Indian Standard	Title	International Standard
1	-	Definition, test methods and acceptance criteria for composite insulators for A.C. overhead lines above 1000V	IEC: 61109
2	IS: 731	Porcelain insulators for overhead power lines with a nominal voltage greater than 1000V	IEC: 60383
3	IS: 2071	Methods of High Voltage Testing	IEC: 60060-1
4	IS: 2486	Specification for Insulator fittings for Overhead power Lines with a nominal voltage greater than 1000V General Requirements and Tests Dimensional Requirements Locking Devices	IEC: 60120 IEC: 60372
5.	-	Thermal Mechanical Performance test and mechanical performance test on string insulator units	IEC: 60575
6.	IS: 13134	Guide for the selection of insulators in respect of polluted condition	IEC: 60815
7.	-	Characteristics of string insulator units of the long rod type	IEC: 60433
8.	-	Hydrophobicity Classification Guide	STRI guide 1.92/1
9.	-	Radio interference characteristics of overhead power lines and high-voltage equipment.	CISPR: 18-2 Part 2
10.	IS: 8263	Methods of RI Test of HV insulators	IEC: 60437
11.		Standard for Insulators- Composite-Distribution Dead-end Type	ANSI C29.13-2000
12.	IS: 4759	Hot dip zinc coatings on structural steel & other allied products	ISO: 1459 ISO: 1461
13.	IS: 2629	Recommended Practice for Hot, Dip Galvanization for iron and steel	ISO: 1461 (E)
14.	IS: 6745	Determination of Weight of Zinc Coating on Zinc coated iron and steel articles	ISO: 1460
15.	IS: 3203	Methods of testing of local thickness of electroplated coatings	ISO: 2173
16.	IS: 2633	Testing of Uniformity of Coating of zinc coated articles	
17.	-	Standard specification for glass fiber strands	ASTM D 578-05
18.	-	Standard test method for compositional analysis by Thermogravimetry	ASTM E 1131-03
19.	IS:4699	Specification for refined secondary Zinc	

Annexure-B

Tests on Insulator units

1 RIV Test (Dry)

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

2 Brittle Fracture Resistance Test

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

3 Recovery of Hydrophobicity & Corona test

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

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

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

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

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

4 Chemical composition test for Silicon content

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