



SUPPLY CHAIN MANAGEMENT

THIRUVANANTHAPURAM

SPECIFICATION

11 kV , 5kN Composite Polymeric Pin Insulators with Pin set

APPLICABLE TO KSEBL	Rev#0	DOC. NO.: SCM-SPEC/XH/11kV Polymeric Pin Insulator EFF. DATE: 15/12/2021
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Technical Specification and Evaluation Committee for Distribution Material

(i) Document Approval & Control Status



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Date	10/12/2021	13/12/2021	15/12/2021
Signature	Sd/-	Sd/-	Sd/-

(ii) Amendments and History

Sec. #	Rev. #	Date	History of Change



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1. PURPOSE:

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **11 kV , 5kN Composite Polymeric Pin Insulators with Pin set** in a professional manner

2. SCOPE:

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL, Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of **11 kV , 5kN Composite Polymeric Pin Insulators with Pin set** used in field by KSEBL

3. RESPONSIBILITY:

The Executive Engineer (H), Office of Chief Engineer, Supply Chain Management shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions

4. PROCEDURE FOR REVISION:

Modifications if any, in the technical specification will be incorporated as **Revisions**. Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev. No.0.1, 0.2 etc.**

A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev. No.1.0, 2.0 etc.**

All the details of regarding the revisions (both minor and major) will be incorporated in **“(ii)- Amendments and history”** above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by **Chief Engineer (SCM)**. Those who notice any discrepancy or have any suggestion regarding revision, may bring the matter to the attention of Chief Engineer (SCM) in writing or through e-mail id: **cescm@kseb.in**



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- 1) **SCOPE:-** This specification covers the design, manufacture, testing and supply of 11KV Composite polymeric Pin insulators with pin. The composite insulators shall be suitable to use as Line post insulators or pin insulators at straight line locations. The Pin and insulator portion shall be an integrated moulded unit.
- 2) **SERVICE CONDITIONS:-** The insulators to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

Maximum Annual Rainfall (mm)	5000
Average Annual Rainfall (mm)	3107
Maximum temperature of air in shade	50°C
Minimum temperature of air in shade	10°C
Relative humidity(%)	50-99
Maximum Barometric pressure	1013
Average no. of thunderstorm days/annum (Isoceraunic level)	50
Average number of dust storm days per annum	5
Average number of rainy days per annum	120-140
No. of months during which tropical monsoon conditions prevail	5
Maximum wind pressure(kg/m ²)	150
Maximum wind velocity(km/ hour)	120
Seismic Zone	3
Maximum Altitude above M.S.L. (in meters)	1000
Moderately hot and humid climate conducive to rust and fungus growth.	

3) **SYSTEM PARTICULARS:-**

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

- 4) **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'.

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5) GENERAL REQUIREMENTS:-

- i) The composite insulators shall generally conform to latest Standards as listed in Annexure A'.
- ii) The Composite Insulators will be used on lines with ACSR conductors of and below Raccoon. The insulators should withstand the conductor tension, the reversible wind load as well as the high frequency vibrations due to wind.
- iii) Insulator shall be suitable for strain type of load. The diameter of Composite Insulator shall be less than 200 mm. The center-to-center distance between top & Bottom fittings shall be max. 300 mm for 11 kV composite Insulator. Length of the pin should be 150mm +/- 2mm. The Pin should be full threaded with one nut, one plane and spring washers.
- iv) 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.
- v) The size of Composite insulator, minimum creepage distance and mechanical strength along with hardware fittings shall be as follows:

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 top & Bottom fittings (mm)	Min. Failing Load kN	Shed Diameter (mm) (min.)
Post/ Pin Insulator	11	12	9	35	75	320	300	5	100

- vi) 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 $d \leq 300$ mm.

(0.025d+6) mm when $d > 300$ mm.

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

- vii) **Interchangeability:** The composite insulators including the end fitting connection shall be standard design suitable for use with the hardware fittings of any make conforming to relevant IEC/IS standards.
- viii) **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.

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6) TECHNICAL DESCRIPTION OF COMPOSITE INSULATOR:-

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.
- i) 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.
 - ii) HOUSING;- The FRP rod shall be covered by a seamless sheath of a silicone elastomeric compound or silicone alloy compound of a thickness of 3mm minimum. It shall be one-piece housing using Injection Moulding 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.
 - iii) WEATHERSHEDS:- The composite polymer weather sheds made of a silicone elastomeric compound or silicone alloy compound shall be firmly bonded to the sheath, vulcanized to the sheath or moulded 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.
 - iv) METAL END FITTINGS:- End fitting transmit the mechanical load to the core. They shall be made of spheroidal graphite cast iron, forged steel or aluminium alloy. They shall be connected to the rod by means of a controlled compression technique. Metal end fittings shall be suitable for Pin type composite insulator 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.

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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. Manufacturers 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 without projecting points or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.
- 7.7. All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/sq.m. or 87 micron 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;

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- 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). 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:

Sl. No	Description of type test	Test procedure / standard
1	Dry lightning impulse withstand voltage test	As per IEC 61109
2	Wet power frequency test	As per IEC 61109
3	Mechanical failing load test	As per IEC 61109
4	Radio interference test	As per IEC 61109
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 KSEB Limited
7	Brittle fracture resistance test	Annexure - B

The Manufacturer shall submit type test reports as per IEC 61109. 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:



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(a)	Verification of dimensions	IEC: 61109
(b)	Verification of tightness of the interface Between end fittings & Insulator housing.	IEC: 61109 amendment 1 of 1995
(c)	Verification of the specified mechanical load	IEC: 61109 amendment 1 of 1995
(d)	Galvanizing test	IS:2633/IS:6745

8.4 ROUTINE TESTS:-

Sl.No.	Description	Standard
1	Identification of marking	As per IEC: 61109
2	Visual Inspection	As per IEC: 61109
3	Mechanical routine test	As per IEC: 61109

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

- Chemical analysis of zinc used for galvanizing
- Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.
- Chemical analysis, hardness tests and magnetic particle inspection for forgings.

8.6 SAMPLE BATCH FOR TYPE TESTING:-

The Manufacturer shall offer material for sample selection for type testing only after getting Quality Assurance Plan approved by KSEB Ltd. The sample for type testing will be manufactured strictly in accordance with the approved Quality Assurance Plan. KSEB Limited reserves the right to type test the samples.

9.0) QUALITY ASSURANCE PLAN:

9.1. The Manufacturer shall submit following information:

- Test certificates of the raw materials and bought out accessories.
- Statement giving list of important raw material, their grades along with names of sub-Manufacturers 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 Manufacturer's representative.
- List of manufacturing facilities available.
- Level of automation achieved and lists of areas where manual processing exists.



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- 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 equipments available with the Manufacturer for final testing of equipment along with valid calibration reports.
- vii) The manufacturer shall submit Manufacturing Quality Assurance Plan (QAP) for approval & the same shall be followed during manufacture and testing.

9.2. The Manufacturer 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 KSEB Limited'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 Manufacturer's and sub-Manufacturer's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.

9.4. Routine Test Certificate as per Clause-8.4 for shall be furnished while offering inspection. The material for final inspection shall be offered by the Manufacturer only under packed condition. The Employer 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 Manufacturer shall keep the KSEB Limited 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 KSEB Limited 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 Manufacturer 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 manufacturer shall furnish detailed type test reports of the offered composite Insulators as per clause 8.2 of the Technical Specifications at the CPRI/ ERDA/ GOVT approved NABL 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 bid. The KSEB Ltd reserves right to demand repetition of some or all the Type Test in presence of KSEB Ltd's representative. In case the unit fails in the Type Tests, the complete supply shall be rejected.

11) TESTING FACILITIES: The manufacturer 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 KSEB Ltd's Engineers if deputed or carry out or witness the tests in the manufacturer works. The insulators shall be tested in accordance with the procedure detailed in IEC 61109 / 92-93 with latest amendments.



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12) DRAWINGS:-

- (i) The Manufacturer shall furnish full description and illustration of the material offered.
- (ii) The Manufacturer shall furnish 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:
 - Long rod diameter with manufacturing tolerances
 - Minimum Creepage distance with positive tolerance
 - Protected creepage distance
 - Eccentricity of the long rod unit
 - Axial run out
 - Radial run out
 - Unit mechanical and electrical characteristics
 - Size and weight of ball and socket
 - Weight of composite long rod units
 - Materials Identification mark
 - Manufacturer's catalogue number
- (iii) After placement of award the Manufacturer shall submit fully dimensioned insulator crate drawing for 11KV polymeric composite pin insulator with pin for approval of the KSEB Ltd.

.13) 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, E1 and 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 KSEB Limited'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)



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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 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.

- (i) the surface shall be properly pre-cleaned with the cleaner;
- (ii) the penetrant, which shall act during 20 minutes, shall be applied on the cleaned surface;
- (iii) within 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;
- (iv) the surface shall be cleaned with the excess penetrant removed, and dried;
- (v) the developer shall be applied if necessary;
- (vi) the surface shall be inspected.



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

After the 1 min. test at 70 % of the SML, if any cracks occur, the housing and, if necessary, the metal fittings 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.

- 13.4. **Verification of the specified mechanical load SML:-** The insulators of the sample E1 shall be subjected at ambient temperature to a tensile load, applied between the couplings. The tensile load shall be increased rapidly but smoothly from zero to approximately 75 % of the SML, and then 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.

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

14) MARKINGS:

- 14.1. Each insulator shall be legibly and indelibly marked by embossing in Malayalam with the following details as per IEC- 61109:

- Name or trademark of the manufacturer.
- Voltage & Type
- Month and year of manufacturing.
- Min. failing load/guaranteed mechanical strength in kilo Newton followed by the word KN' to facilitate easy identification.
- KSEBL

- 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 5 KN polymeric composite Pin insulator : Yellow

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15) PACKING:-

- 15.1. All insulators shall be packed in strong corrugated box of min. 7 ply duly palletted 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 stencilled on it in indelible ink.
- 15.5. The Manufacturer shall provide instructions regarding handling and storage precautions to be taken at site.

- 16) GUARANTEE:-** The Manufacturer of insulators shall guarantee overall satisfactory performance of the insulators for 36 months. The manufacturer shall furnish in the form attached (Schedule 'A') all the guaranteed technical particulars.

Sd/-

Chief Engineer (SCM)



SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

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Polymeric Pin Insulator**

Rev.#: 0

Effective Date **15/12/2021**

ANNEXURE 'A'

STANDARDS TO BE ADOPTED FOR COMPOSITE INSULATORS

Sl. 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



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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	



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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 & 30kV for 11kV & 33kV 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.

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- 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/ ERDA/ GOVT approved NABL accredited laboratory.

All dimensions are in mm

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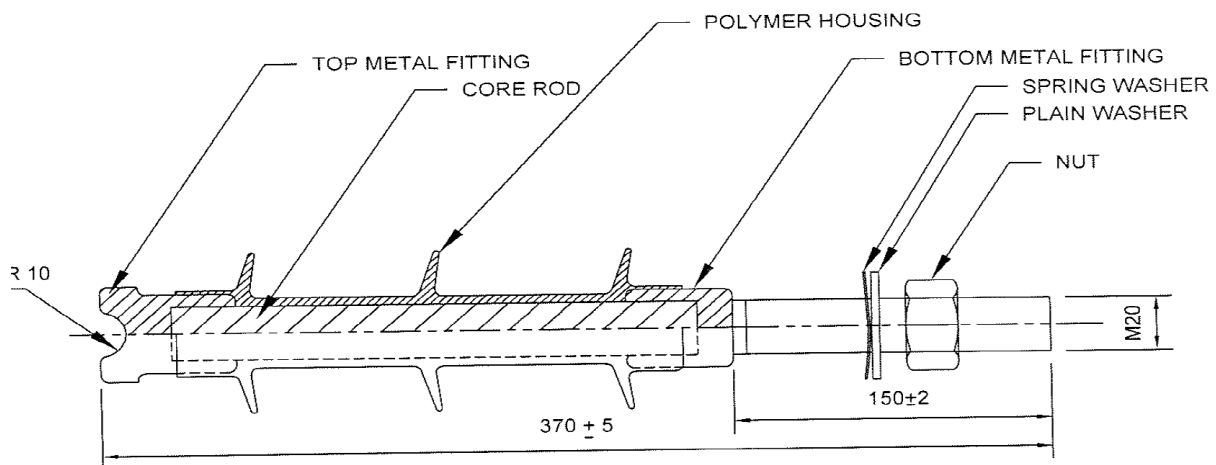
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11kV-5kN COMPOSITE POLYMERIC PIN INSULATOR



Diameter of FRP rod - 24 mm (minimum)
Arcing distance - 165 mm (minimum)

All dimensions are in mm

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Schedule - A

GUARANTEED TECHNICAL PARTICULARS, 11KV,5KN, PIN INSULATOR

(to be filled separately for each type mentioned above)

Sl. No	Parameter Name	Board's Requirement	Supplier's offer
1.	Type of insulator	11kV Composite Polymeric Pin Insulator with Pin	
2	Standard according to which the insulators manufactured and tested	IEC:61109	
3.	Name of material used in manufacture of the insulator with class/grade	As per Specification	
3.1	Material of core (FRP rod) i) E-glass or ECR-glass ii) Boron content	Boron free	
3.2	Material of housing & weather sheds (Silicon content by weight)	Min.30% silicon content by weight	
3.3	Material of end fittings	Hot Dip Galvanized Spheroidal Graphite Cast Iron/ Forged Steel/ Aluminium Alloy	
3.4	Sealing compound for end fitting	As per Specification	
4.0	Colour	Grey/ Red epoxy	

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5.0	Electrical characteristics		
5.1.	Nominal system voltageKV (rms)	11kV	
5.2	Highest system voltage KV (rms)	12kV	
5.3	Dry Power frequency withstand voltage KV (rms)	28 kV	
5.4	Wet Power frequency withstand voltage KV (rms)	$\geq 35kV$	
5.5	Dry flashover voltage kV (rms)	$\geq 55kV$	
5.6	Wet flash over voltage kV (rms)	$\geq 35kV$	
5.7	Dry lighting impulse withstand voltage Positive KV (peak) Negative KV (peak)	$\geq 75kV$ $\geq 75kV$	
5.8	Dry lighting impulse flashover voltage a) Positive KV (peak) b) Negative KV (peak)	$\geq 75kV$ $\geq 75kV$	
5.9	RIV at 1 MHz when energized at 10 kV/ 30 kV (rms) under dry condition Micro volts	100Micro Volts	
6.0	Creepage distance (Min.) (320mm)(mm)	$\geq 320mm$	
6.1	Center to center distance between top & bottom fittings) (300mm) (mm)	$\geq 300mm$	



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6.2	Shed diameter (100mm) (mm)	100mm	
7.	Mechanical characteristics: KN Minimum failing load	5kN	
8.0	Dimensions of insulator		
8.1	Weight (Kg)	1kg (Approx.)	
8.2	Dia. of FRP rod: mm (Minimum)	>24mm	
8.3	Length of FRP rod (mm)	>138+/-2mm	
8.4	Dia. of weather sheds (100mm)	>100mm	
8.5	Thickness of housing (mm)	3mm	
8.6	Dry arc distance (mm) (Minimum)	>165mm	
8.7	Dimensioned drawings of insulator (including weight with tolerances in weight)	enclosed	
9.0.	Method of fixing of sheds to housing (Specify): Single mould or Modular construction (Injection moulding / compression moulding)	Injection moulding	
10.0	No of weather sheds	≥3	
11.0	Type of sheds		
11.1	Aerodynamic	Aerodynamic	
11.2	With under ribs	No	
12.0	Packing details	As per Specification	



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12.1	Type of packing	Corrugated Box	
12.2	No. of insulators in each pack	<50 Nos.	
12.3	Gross weight of package	Approx. 50kg	
13.0	Design Test Report, Type Test Report of insulator.	Enclosed	
14.0	Binding Groove depth	6mm	
15	Collar Diameter	45mm	
16	Dia. Of head of top end fittings	30mm	
17	Any other particulars which the Manufacturer may like to give		

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