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# SUPPLY CHAIN MANAGEMENT THIRUVANANTHAPURAM

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## SPECIFICATION

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33 kV ,10kN Composite Polymeric Pin Insulators with Pin set

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<b>APPLICABLE TO KSEBL</b>	<b>Rev#0</b>	DOC. NO.: <b>SCM-SPEC/XH/33kV Polymeric Pin Insulator</b>
		EFF. DATE: <b>15/12/2021</b>

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Number of Pages: 25

**Technical Specification and Evaluation Committee for Distribution Material**

**(i) Document Approval & Control Status**



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Doc. #: **SCM-SPEC/XH/33kV  
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Rev.#: 0

Effective Date **15/12/2021**

	<b>Compiled by</b>	<b>Verified by</b>	<b>Approved by</b>
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Signature	Sd/-	Sd/-	Sd/-

### (ii) Amendments and History

<b>Sec. #</b>	<b>Rev. #</b>	<b>Date</b>	<b>History of Change</b>

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#### 1. PURPOSE:

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **33 kV , 10kN 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 **33 kV , 10kN 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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#### Annexure - I

#### TECHNICAL SPECIFICATION FOR 33 kV, 10kN COMPOSITE POLYMERIC PIN INSULATOR WITH PIN SET

- 1) **Scope:-**This specification cover the design, manufacturing, testing at manufacturers works, transport to site, insurance, unloading & storage of 33 KV Polymer Pin Insulator with Pin set and complete accessories suitable for use in 33 kV Overhead Lines situated in any part of under jurisdiction of KSEBL Utility.
- 2) **General Requirements:-**
  - i) The Composite insulators will be used on lines on which the conductor will be size up to 232 Sq. mm. The insulators should withstand the conductor tension, the reversible wind load as well as the high frequency vibrations due to wind.
  - ii) Insulator shall be suitable for 3 Phase, 50 Hz, 33kV Impedance Grounded distribution systems in a moderately/heavily polluted atmosphere.
  - iii) Bidder must be an indigenous manufacturer and supplier of composite insulators of rating 33kV or above or must have developed proven in house technology and manufacturing process for composite insulators of above rating. 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.
  - 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 commendation of IEC- 60815/ IS: 13134.
  - v) The tolerances on all dimensions e.g. diameter, length and creepage distance shall be allowed as follows in line with-IEC 61109:  $\pm (0.04d + 1.5)$  mm when  $d = 300$ mm  $\pm (0.025d+6)$  mm when  $d >300$  mm Where, d being the dimensions in millimetres for diameter, length or creepage distance as the case may be. However, no negative tolerance shall be applicable to creepage distance.
  - vi) The composite insulators including the end fitting connection shall be standard design suitable for use of any make conforming to relevant IEC/IS standards.
  - viii) 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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- 3) **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 <sup>0</sup> C
Minimum temperature of air in shade	10 <sup>0</sup> 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 <sup>2</sup> )	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.	

- 4) **System Parameters:-**

- a) Nominal system voltage : 33 kV.
- b) Highest system voltage : 36 kV
- c) Power frequency : 50 Hz.
- d) Number of Phases : Three.
- e) System earthing : 33 KV Impedance earth.

- 5) **Standard:-** The following Indian / International Standards with latest revisions and amendments shall be referred while accessing conformity of insulators with this specification. Unless otherwise specified elsewhere in the specifications insulators shall

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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'.

6) **Technical Requirement:-** Composite Insulators shall be designed to meet the high quality, safety and reliability and are capable of withstanding a wide range of environmental conditions.

- a) Core : The internal insulating part
- b) Housing : The external insulating part.
- c) Metal end fittings : For attaching to hardware to support conductor.

i) **Core:-** It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod Diameter minimum 33 mm for achieving cantilever strength of 10KN). 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 shall be manufactured through Pultrusion process. The FRP rod shall be void free. All rods must pass electric leakage current test of 170V/mm. The leakage current shall not exceed 0.05mA. The vendor should have facility to measure such a low leakage current & should furnish record of 100% testing of leakage current test at incoming inspection

ii) **Housing (Sheath):-** The FRP rod shall be covered by a seamless sheath of a silicone elastomeric compound or Silicone alloy compound of a thickness of 3 mm 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, external Pollution and humidity. Housing shall conform to the requirement of IEC 61109/92-93 with latest amendments.

It shall be extruded or directly moulded on core and shall have chemical bonding with the FRP rod. The strength of the bond shall be greater than the tearing strength of the polymer. Sheath material in the bulk as well as in the sealing / bonding area shall be free from voids.

Manufacturer should furnish a description of its quality assurance programme including fabrication; testing and inspection for any material (i.e rubber) Components (i.e rod) or hardware (i.e. end fittings). The manufacturer has had fabricated by others should also be included. Manufacturing methods and material composition documentation will be a part of Technical Bid to be submitted along with offer.

iii) **WEATHER SHEDS:-** The composite polymer Weather sheds made of silicone elastomeric compound or silicon alloy shall be firmly bonded to the sheath, vulcanized to the sheath or moulded as part of the sheath and shall be free from imperfections. The weather sheds should have silicon content of minimum 30% by

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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. Housing and weather shed materials shall have tensile strength of 10 MPa with 300% elongation minimum and tear strength of 20N/mm. The sheath and weather shed should be modified simultaneously through injection moulding process only.

- iv) **METAL END FITTINGS:-** End fittings transmit the mechanical load to the core. They shall be made of spheroidal graphite cast iron, malleable cast iron or forged steel or aluminium alloy. The end fittings should be crimped first & then over moulded with silicone rubber. 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.

They 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. Hardware of respective specified mechanical load and shall be hot dip galvanized in Zinc coated with minimum 99.95 % purity of electrolytic high grade Zinc in accordance with IS 2629. The material used in fittings shall be corrosion resistant.

Metal end fittings shall be uniform and without sharp edges or corners and shall be free of cracks, flakes, silvers, slag, blow-holes shrinkages defects and localized porosity. They shall be connected to the rod by means of a controlled compression technique. As the main duty of the end fittings is the transfer of mechanical loads to the core the fittings should be property attached to the core by a coaxial or hexagonal compression process and should not damage the individual fibres or crack the core. The gap between fittings and sheath shall be sealed by flexible silicone elastomeric compound or silicone alloy compound sealant. System of attached 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.

Nominal dimensions of the pin insulator shall be in accordance with the Specific Technical Particulars. No joints in pin will be allowed. Outer portion of Pin should be Zinc coated 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 should or vision transmission. Bottom end metal fitting (Shank) of Pin Insulator should be as per IS: 2486. Length of



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thread on shank should be minimum 120 mm for 33 KV Pin insulator. Shank diameter is >33 mm for 33 KV Pin insulators. Minimum Collar diameter should be 40 mm and its minimum thickness should be of 5 mm. Two number nuts as per IS 1363 (P-III) and 4 mm thick Spring Washer shall be as per IS 3063 with latest amendments if any, Nuts and spring washer shall be hot dip galvanized.

#### 7) **Workmanship:**

- a) 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.
- b) 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.
- c) 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.
- d) The core shall be sound and free of cracks and voids that may adversely affect the insulators.
- e) Weather sheds shall be uniform in quality. They shall be clean, sound and smooth and shall be free from defects and excessive flashing at parting lines.
- f) 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.
- g) All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/sq.m. or 87microns thickness and shall be in accordance with the requirement of IS:4579. 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) **Drawing:-** The bidder shall furnish the outline drawing of each insulator unit including a cross sectional view of the long rod insulator unit along with the bid. The drawing shall include but not be limited to the following information:

- a) Long rod diameter with manufacturing tolerances

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- 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) Weight of composite long rod units
  - g) Identification mark
  - h) Manufacturer's catalogue number
- 9) **Marking:** Each insulator shall be legibly and indelibly marked (embossing/engraved) to show the following:
- a) Name & Trade mark of the manufacturer
  - b) Month & Year of manufacturing
  - c) Voltage & Type
  - d) Minimum Failling Load ( in KN)
  - e) Utility marking " KSEBL"

**N.B: Marking with sticker/written by Ink is not acceptable.**

10) **TESTS:-**

**(A) Type Test:-** The following Type Test shall have to be conducted on insulator unit, components, materials or complete strings; All the Type tests to be Carried out and submitted only from the CPRI/ ERDA/ GOVT owned NABL approved LAB only).

SI. No.	Description of type test	Test produced Standard
a)	Dry Positive & Negative Lightning Impulse voltage withstand test	IEC:61109
b)	Dry Positive & Negative Lightning Impulse Flashover voltage test	IEC:61109
c)	Dry & Wet Power Frequency Voltage withstand test	IEC:61109
d)	Dry & Wet Power Frequency Voltage Flashover	IEC:61109

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	test	
e)	Mechanical Failing Load test.	IEC:61109
f)	Radio Interference test	IEC:61109 & Annexure - B
g)	Recovery of Hydrophobicity test	Annexure - B
h)	Dye Penetration Test.	
i)	Water Diffusion Test	
j)	Chemical composition test for Silicon content	Annexure - B
k)	Brittle fracture resistance test.	Annexure - B
l)	Salt fog test on insulation for 1000 hr	As per IEC.

#### (B) Routine Test:-

- a) Identification of marking - As per IEC:61109
- b) Visual inspection - As per IEC:61109
- c) Mechanical routine test - As per IEC:61109

#### (C) Acceptance Test:- The following test will be carried out at manufacturers works during inspection of the offered insulators before delivery :

- a) Visual examination - As per IEC:61109
- b) Verification of dimension - As per IEC:61109
- c) Galvanizing test - As per IS:2633/IS:6745
- d) Mechanical performance test - As per IEC:61109
- e) Mechanical Failing Load test - As per IEC:61109

- 11) **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.

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- 12) **Tests on the material used in manufacture of the insulator:-** The bidder shall furnish following test reports conducted on the raw materials (i.e., silicon rubber or EVA) for confirming following properties along with their bid.

Sl. No	Property	Standard
1)	Tensile Strength (MPa)	ISO37/ASTM D 638
2)	Elongation (%)	ISO37/ASTM D 638
3)	Tear Strength (N/mm)	ASTM D624B
4)	TERT (4.5KV 360min)	ASTM D2303/IEC507
5)	Volume Resistivity (Ohm -cm)	ASTM D257/IEC93
6)	Dielectric constant	IEC 250/ ASTM D150
7)	Dielectric Strength (kv/mm)	ASTM D149/IEC93
8)	Density	ISO 1183A
9)	Hardness (shore A)	ISO868
10)	Accelerated aging	ISO188/ ASTM G53
11)	Arc Resistance	IEC61621

- 13) The following characteristics shall be met by FRP rods used in manufacture of the insulator:

- 1) Tensile strength : 760 MPa min
- 2) Tensile modulus : 41 GPA min
- 3) Glass content (%) : 75% min
- 4) Tg by DSC : 110 Deg C min
- 5) Dye penetration : No dye rise on 10 sample of 10 mm thick > 15 min.
- 6) Water diffusion & Voltage tests - 100 hours - 12kv for 1 min, no puncture or flash over on the FRP & current shall not exceed 1 mA
- 7) Hardness > 51 Barcol No
- 8) ECR glass - Boron/alkali content not more than 0.8%.

- 14) **Inspection:-** All Acceptance tests shall be carried out at manufacturer's works in presence of the KSEBL's and manufacturers' representatives. In addition to above, all routine tests are also to be carried on the insulator as per relevant IS / IEC. The entire cost of acceptance and routine test that to be carried out as per relevant IS / IEC shall be treated as included in the quoted price of Insulator. The manufacturer shall give at least 20 (twenty one) days advance notice intimating the actual date of Inspection and details of all tests that are to be carried out from the date when the tests will be carried out. Routine tests on all insulators shall be

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carried out as per IEC / IS and test reports shall be submitted along with respective inspection offer to CE (SCM), KSEBL, TVM.

#### 15) **Sampling & Rejection during inspection:-**

15.1. The sampling and rejection procedure for Acceptance Test shall be as per IEC 61109.

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)
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

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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.

**15.2. 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.

**15.3. 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.

**15.4. 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.

- (i) the surface shall be properly per-cleaned with the cleaner;
- (ii) the penetration, 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.

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.

**15.5. 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.

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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 15.4 & 15.5 above if:

a) 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 or during the 1 min.100 % withstand test .

b) No cracks are indicated after the dye penetration method described in 15.4 above.

The investigation of the halves described in 15.4 above shows clearly that the cracks do not reach the core.

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

16) **Packing:-**

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

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

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

d) Each wooden case / crate / corrugated box shall have all the markings stencilled on it in indelible ink.

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

17) **Guarantee:-** In the event of any defect in the equipment / materials arising out of faulty design, materials, workmanship within a period of 36 (Thirty six) months from the date of last despatch the supplier shall guarantee to replace or repair the same to the satisfaction of the purchaser. If the supplier fail to do so within a reasonable time, KSEBL reserves the right to effect repair or replacement by any other agency and recover charges for repair or replacement from the supplier.

18) **Quality Assurance Plan:**

1) The successful bidder shall submit following information along with the bid.

a) Test certificates of the raw materials and bought out accessories.

b) 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 supplier's representative.

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- c) List of manufacturing facilities available.
  - d) Level of automation achieved and lists of areas where manual processing exists.
  - e) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
  - f) List of testing equipment's available with the bidder for final testing equipment along with valid calibration reports.
- 2) The manufacturer shall submit Manufacturing Quality Assurance Plan (QAP) for approval & the same shall be followed during manufacture and testing.
  - 3) 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.
  - 4) The KSEBL'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.
  - 5) Routine test certificate as per IEC shall be furnished along with the offer.
  - 6) 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.
  - 7) 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.
  - 8) 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 latter case also the material shall be dispatched only after satisfactory testing specified herein has been completed.
  - 9) 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 materials are later found to be defective.

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### 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
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	

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		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

### Test 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 50Hz voltage of 10 kV & 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 fittings by applying "1n HNO3 acid" (63 g conc. HNO3 added to 937 g water) to the rod. The rod should be held at 80% of SML for the duration of the test. The rod should not fail within the 96 Hour test duration. Test arrangement should ensure continuous wetting of the rod with Nitric acid.
- 3) Recovery of Hydrophobicity & Corona Test:
  - 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 (Extract enclosed at Annexure-D) 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 1 mm above the sample surface. Tentative arrangement shall be as shown in Annexure- E.  
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 ERDA only.

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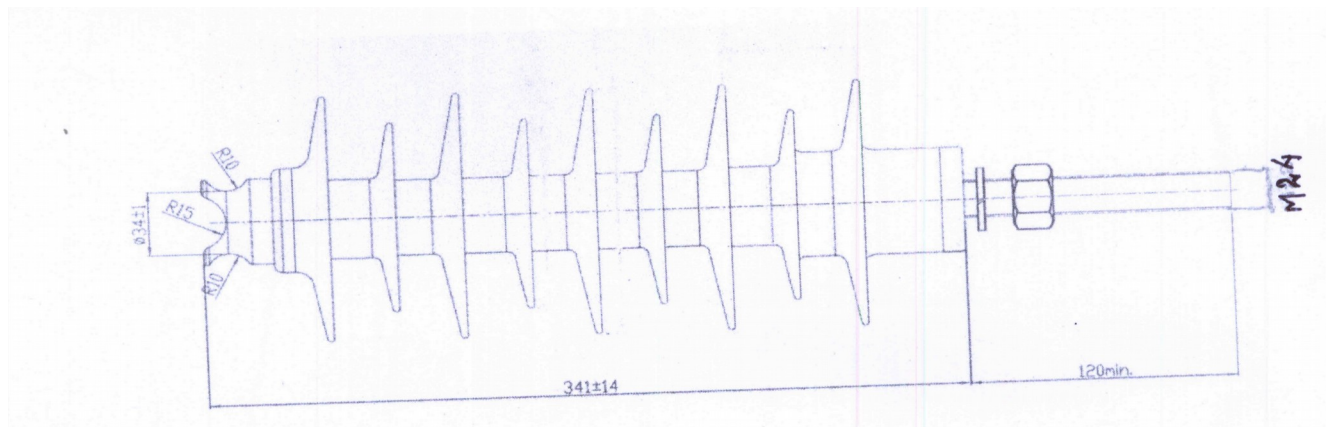


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### ANNEXURE- C



### KSEBL TENDER DRAWING FOR 33KV PIN WITH INSULATOR

#### Physical Properties

- 1) Normal Creepage Distance = 900 mm (No Negative Tolerance)
- 2) Nominal Dry Arcing Distance =  $\geq 335$  mm
- 3) Wet Power frequency withstand voltage =  $> 75$  kV
- 4) Impulse withstand voltage =  $> 180$  kV
- 5) Impulse Flash over Voltage =  $> 220$  kV (Negative)
- 6) Minimum Cantilever Load = 10 kN
- 7) Number of housing = Suitable to meet the above requirements
- 8) Diameter of FRP rod  $> 33$  mm
- 9) Tolerance as per IEC standard formula

The accessories required to fix the insulator in cross arms is also under the scope of the Supplier (Bidder shall furnish the drawing)

#### Materials

- Core Materials - ECR Glass Reinforced Plastic.  
Housing - Silicon Rubber  
End Fitting - Galvanized Steel/ Forged Steel

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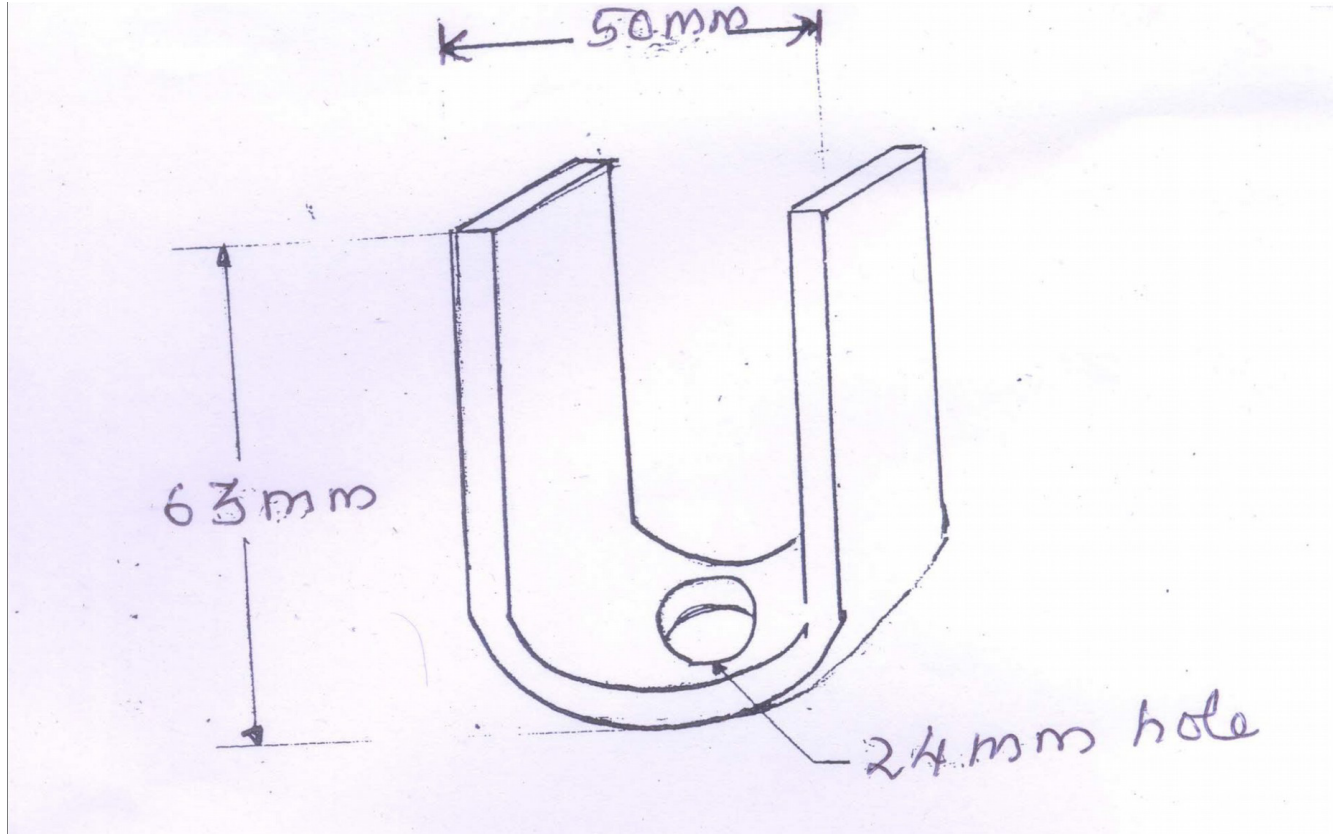
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### ANNEXURE- D Packing Clamp 40 x 6 MSF galvanised.



**For fitting 33kV Pin Insulator in V Cross arm and 'F' top bracket, U clamp with nut, bolt and Washers for M24 shall be provided.**

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### ANNEXURE - E

#### Guaranteed Technical Particulars for 33kV Pin Insulator

**(To be filled by the Bidder)**

(to be filled separately for each type mentioned above)

Sl. No	Parameter Name	33kV Pin Insulator
1.0.	Type of insulator	Polymeric
2.0.	Standard according to which the insulators manufactured and tested	IEC 61109
3.0.	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	i) ECR glass-fiber ii) Boron free
3.2	Material of housing & weather sheds (Silicon content by weight)	>30%
3.3	Material of Top end fittings	HDG Spheroidal graphite cast iron/ forged steel/ forged aluminium alloy.
3.4.	Material of Bottom end fittings	HDG Spheroidal graphite cast iron/ forged steel/ forged aluminium alloy.
3.5	Material of sealing compound for end fittings	RTV silicon
4.0	Colour of Sheds	Grey

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5.0	<b>Electrical characteristics</b>	
5.1.	Rated voltage KV (rms)	33kV
5.2	Highest voltage KV (rms)	36kV
5.3	Dry Power frequency withstand voltage KV (rms)	95kV
5.4	Wet Power frequency withstand voltage KV (rms)	>75kV
5.5	Dry Power frequency flashover voltage kV (rms)	130kV
5.6	Wet Power frequency flash over voltage kV (rms)	90kV
5.7	Dry lighting impulse withstand voltage 1) Positive KV (peak) 2) Negative KV (peak)	1) >180kV 2) >180kV
5.8	Dry lighting impulse flashover voltage 1) Positive KV (peak) 2) Negative KV (peak)	1) >220kV 2) >220kV
5.9	RIV at 1 MHz when energized at 10 kV/ 30 kV (rms) under dry condition Micro volts	<70 $\mu$ Volts
6.0	Creepage distance (Min.) (900mm) (mm)	900mm
6.1	Mechanical characteristics: Minimum failing load (10 kN)	10kN

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7.0.	<b>Dimensions of insulator</b>	
7.1	Weight (Kg)	20Kg (Approx.)
7.2	Dia. of FRP rod: mm (Minimum)	>33mm
7.3	Length of FRP rod (341mm) (minimum)	341mm (Minimum)
7.4	Dia. of weather sheds	110mm
7.5	Thickness of housing	3 mm
7.6	Dry arc distance	335mm Minimum
7.7	Method of fixing of sheds to housing (Specify): Single mould or Modular construction (Injection moulding)	Injection moulding.
8.0.	Visible discharge voltage (PF) (27kV)	27kV
9.0.	No of weather sheds	Minimum 8
10.0.	Type of sheds	
10.1	Aerodynamic	Aerodynamic
10.2	Diameter of Bottom end fittings	24mm
11.0.	Thread length of Bottom end fittings	120 mm Minimum
11.1	Details of accessories	U clamp as per Annexure D
11.2	Type of packing	Wooden / Corrugated boxes



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11.3	No. of insulators in each pack	20
12.0.	Gross weight of package	
13.0.	Design Test Report, Type Test Report of insulator	To be enclosed.
14.0.	Any other particulars which the Manufacturer may like to give	

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