



SUPPLY CHAIN MANAGEMENT THIRUVANANTHAPURAM

SPECIFICATION

11kV 45kN COMPOSITE POLYMERIC DISC INSULATOR

APPLICABLE TO KSEBL

Rev#0

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Technical Specification and Evaluation Committee for Transmission Materials



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

11kV 45kN Composite Polymeric Disc Insulator

Doc. #: SCM-SPEC/XM/DISC

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(i) Document Approval & Control Status

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(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 **11kV 45kN Composite Polymeric Disc insulator** 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 **11kV 45kN Composite Polymeric Disc insulator** used in field by KSEBL.

3. RESPONSIBILITY

Executive Engineer(M), 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 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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TECHNICAL SPECIFICATION FOR 11kV 45kN COMPOSITE POLYMERIC DISC INSULATOR

- 1) SCOPE:-** This specification covers the design, manufacture, testing and supply of 11kV Composite Polymeric Disc insulators. The composite insulators shall be suitable to use as Long rod insulators for conductors in tension application at angle / cut points the insulators shall be of Tongue & Clevis type.
- 2) SERVICE:-** 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 | 50 |
| (Isoceraunic level) | |
| 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.



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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) | - | Hydrophobic 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 Specification for refined secondary Zinc | ASTM E 1131-03 |

5) COMPOSITE INSULATORS LONG ROD TYPE FOR TENSION LOCATIONS:-

5.1. The insulators shall be suitable for three phase, 50 Hz, effectively earthed 11kV O/H distribution system in a moderately polluted Atmosphere. 45kN Long rod Insulators shall be of Tongue & Clevis type.

5.2. Bidder must be an indigenous manufacturer and supplier of composite insulators of rating 11kV and 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 11kV and 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.

5.3. 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.

i) The size of Composite insulator, minimum creepage distance and Mechanical strength along with hardware fittings shall be as follows: -

| Sl. No. | Type of composite Insulator | 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 (peak) | Minimum creepage distance (mm) | Min. failing load kN | Pin ball shank diameter (mm) |
|---------|-----------------------------|---------------------------------|---------------------------------|--|--|-------------------------------------|--------------------------------|----------------------|------------------------------|
| 1) | Long Rod Disc insulator | 11 | 12 | 9 | 35 | 75 | 320 | 45 | 16 |

Note:- Creepage distances have been considered in line with IS-13134 (which specifies **25mm/kV for moderately polluted environment**).

5.4. 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:

- a) $(0,04d+1.5)$ mm when <300 mm,
- b) $(0.025d+6)$ 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.

5.5. INTERCHANGEABLY:- The composite Insulators including the end fitting connection shall be of standard design suitable for use with the hardware fittings of any make conforming to relevant IEC/IS standards.

5.6. 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.

5.7. MAINTENANCE:- The composite Insulators offered shall be suitable for use of hot line maintenance technique so that usual hot line operation can be carried out with ease, speed and safety.

6) BASIC FEATURES:-

6.1. Design and construction: - The composite insulator shall have a core, housing & weather shed of insulating material and steel / aluminum alloy hardware components for attaching it to the support / conductor.

6.2. Core:- It shall be a glass-fiber reinforced epoxy resin rod of high strength (FRP rod) manufactured in house. 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 and minimum glass content should be 80%. For 11 KV Disc Insulator the diameter of the FRP rod should be minimum **16 mm**.

6.3. Housing (Sheath): - The FRP rod shall be covered by a seamless sheath of a silicone electrometric compound or silicone alloy compound of a thickness of 3mm minimum. It should protect the FRP rod against environmental influences, external pollution and humidity. It shall be directly molded by PLC controlled automatic Rubber Injection moulding machine on the 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 shall be free from voids.

6.4. Weather sheds:- The composite polymer weather sheds made of silicone electrometric compound or silicon alloy shall be firmly bonded to the sheath, vulcanized to the sheath or



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molded as part of the sheath and shall be free from imperfections. 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.

6.5. **End Fittings:-** End fittings transmit the mechanical load to the core. They shall be made of spheroidal graphite cast Iron or forged steel. They shall be connected to the rod by means of a controlled compression technique. System of attachment of end fitting to the rod shall provide superior sealing performance between housing, i.e. seamless sheath and metal connections. The sealing must be moisture proof. The dimensions of end fittings of insulators shall be in accordance with the standard dimensions stated in IS;2486 /IEC:60120. The end fittings shall be crimped first and over moulded insulator for avoiding water entry.

7) **WORKMANSHIP:-** 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.

7.1. 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.

7.2. 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.

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

7.4. 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.

7.5. End fittings shall be free from cracks, seams, shrinks, air holes and rough edge. 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 smooth and uniform so as to distribute the loading stresses uniformly.

7.6. All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/ sq.mm, or 87 m thickness and shall be in accordance with the requirement of ISL4759. 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 minute duration under the standard preece test. The galvanizing shall be carried out only after any machining. **Electro-Plated metal end parts will not be accepted.**

8) **EQUIPMENT MARKING:-** Each insulator unit shall be legibly and indelibly marked with the following details as per IEC-61109:

a) Month &Year of manufacture.

- b) Min. failing Load/guaranteed mechanical strength in kilo Newton followed by the word 'kN' to facilitate easy identification.
- c) Manufacturer's name/Trade mark on silicone core.
- d) Voltage & Type

9) BID DRAWINGS:- The Bidder shall furnish full description and illustration of the material offered.

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: -

- i) Long rod shed diameter with manufacturing tolerances.
- ii) Minimum Creepage distance.
- iii) Eccentricity of the long rod unit
 - i) Axial run out
 - ii) Radial run out
- iv) Unit mechanical and electrical characteristics
- v) Size and weight ball & socket
- vi) Weight of composite long rod unit.
- vii) Materials.
- viii) Identification mark.
- ix) Manufacturer's catalogue number

The bidder shall submit full dimensioned manufacturing insulator drawings containing all the details in four (4) copies along with copies of all the type tests.

At the time of placement of award the Supplier shall also submit fully dimensioned insulator crate drawing for different type of Insulators for approval of the owner.

10) TESTS AND STANDARDS:- Insulators offered shall be manufactured with the same configuration and raw materials as used in the Insulators for which design and 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 05 years old.

10.1. **Design tests:** - Manufacturer should submit test reports for Design Tests as per IEC - 61109 (clause - 9.1) along with the bid. Additionally following tests shall be carried out and reports also for the tests shall be submitted along with the bid: + UV test: The test shall be carried out in line with clause 7.2 of ANSI C29.13.

10.2. **Type Tests:-** The tenderer shall furnish detailed type test report of the offered composite insulators as per Clause-8.2 of the technical specification at Govt.of India approved lab includes CPRI/ ERDA to prove that the composite insulators offered meet the requirements of the specifications. This type test should have been carried out within 5years prior to the date of opening of this tender. The following type tests shall be conducted on a suitable

number of individual insulator units, components, materials or complete strings and the test reports should invariably be submitted with the bid:

| 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 61 109 |
| 3 | Mechanical load-time test | As per IEC 61 109 |
| 4 | Radio interference test | As per IEC 60437 |
| 5 | Recovery of Hydrophobicity test | Annexure-B |
| 6 | Chemical composition test for Silicon content | Annexure-B Or any other test method acceptable to the owner |
| 7 | Brittle fracture resistance test | Annexure - A |

NOTE:- The purchaser may like to conduct any other test(s) in addition to above at bidder's cost to establish the performance of the material as per the system requirement.

10.3. All the type test given in Clause No. 8.2 in addition to routine & acceptance test shall be carried out on insulator along with hardware fittings wherever required.

10.4. ACCEPTANCE (SAMPLE) TESTS:-

10.4.1. For Composite Insulators: -

| | | | |
|-----|---|---|---|
| (a) | Verification of dimensions | : | Clause 12 IEC: 61109 |
| (b) | Verification of the locking system (if applicable) | : | Clause 12 IEC: 61109 |
| (c) | Galvanizing test | : | IS: 2633 / IS: 6745 |
| (d) | Verification of the specified mechanical load | : | Clause 12 IEC: 61109 |
| (e) | Verification of tightness of the interface between end fitting and silicone rubber. | : | Clause 12 IEC:61109 amendment 1 of 1995 |

10.4.2. **ROUTINE TESTS:-**

| Sl. No. | Description | Standard |
|---------|---------------------------|--------------------------------|
| 1 | Identification of marking | As per IEC: 61 109 Clause 13.2 |
| 2 | Visual Inspection | As per IEC 61 109 Clause 13.2 |
| 3 | Mechanical routine test | As per IEC: 61 109 Clause 13.1 |

10.4.3. **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.

10.4.4. **SAMPLE BATCH FOR TYPE TESTING:-** The bidder shall offer material for sample selection for type testing only after getting Quality Assurance Programme approved by the Owner. The bidder shall offer at least three times the quantity of materials required for conducting all the type tests for sample section. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Programme approved by the Owner.

10.4.5. **ADDITIONAL TESTS:-** The owner also reserves the right to conduct all the tests mentioned in this specification at his expense on the sample drawn from the site at Supplier's premises or at any other test center. In case of evidence of non compliance, it shall be binding on the part of the Supplier to prove the compliance, of the items to the technical specifications by repeat tests or correction of deficiencies or replacement of defective items, all without any extra cost to the Owner.

10.4.6. **QUALITY ASSURANCE PLAN:-** The successful bidder shall submit following information to the owner:

- 10.4.6.1. Test certificates of the raw materials and bought out accessories.
- 10.4.6.2. Statement giving list of important raw materials, 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 representatives.
- 10.4.6.3. List of manufacturing facilities available.
- 10.4.6.4. Level of automation achieved and lists of areas where manual processing exists.
- 10.4.6.5. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- 10.4.6.6. List of testing equipments available with the bidder for final testing of equipment along with valid calibration reports.
- 10.4.6.7. The manufacturer shall submit Manufacturing Quality Plan (MQP) for approval & the same shall be followed during manufacture and testing.
- 10.4.6.8. The successful bidder shall submit the routine test certificates of bought out raw materials / accessories and central excise passes for raw materials at the time of inspection.

11) GUARANTEE:- The supplier of insulators shall guarantee overall satisfactory performance of the insulators for the period of 36 months from the date of acceptance by the consignee or 30 months from commissioning whichever is earlier.



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12) TEST REPORTS:-

12.1. At least three copies of type test reports shall be furnished. One copy shall be returned duly certified by the owner, only after which the commercial production of the concerned material shall start

12.2. Copies of acceptance test reports shall be furnished in at least three [3] copies. One copy shall be returned duly certified by the Owner, only after which the material shall be dispatched.

12.3. Record of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the Owner's representative.

12.4. Test Certificates of test during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Owner.

13) INSPECTION:-

13.1. 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.

13.2. 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.

13.3. 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.

13.4. No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is only after satisfactory testing specified herein has been completed.

13.5. 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.

14) PACKING:-

14.1. All Insulators shall be packed in strong corrugated box of min, 5 ply. The gross weight of the crates along with the material shall not normally exceed 30 Kg to avoid handling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.

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

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



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14.4. 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.

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

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 10 kV for 11 KV class insulators respectively under dry condition. The test procedure shall be in accordance with IS: 8263/ IEC: 60437/ CISPR: 18-2
2. **BRITTLE FRACTURE RESISTANCE TEST:** - Brittle fracture test shall be carried out on naked rod along with end fittings by applying "1 n HNO₃ acid" (63 g cone, 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:- 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 only at CPRI or ERDA

15) RETEST AND REJECTION:-

15.1. 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 |
|--------------|-------------|
|--------------|-------------|



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| | E1 |
|------------------|----------------------|
| N < 300 | Subject to agreement |
| 300 < N < 2000 | 4 |
| 2000 < N < 5000 | 8 |
| 5000 < N < 10000 | 12 |

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 Employer'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 (E2) end fittings & Insulator housing

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 KSEB Limited.

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 em-

bracing 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.

- a. the surface shall be properly pre-cleaned with the cleaner ;
- b. the penetrant, which shall act during 20 minutes, shall be applied on the cleaned surface;
- c. 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;
- d. the surface shall be cleaned with the excess penetrant removed, and dried;
- e. the developer shall be applied if necessary;
- f. 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.

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.

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

16) MARKINGS:-

16.1. 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



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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) KSEB Ltd'. Marking

16.2. 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 polymeric composite Pin insulators : Orange

17) PACKING:-

17.1. 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 hackling problem. The crates shall be suitable for outdoor storage under wet climate during rainy season.

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

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

17.4. 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.

17.5. The Manufacturer shall provide instructions regarding handling and storage precautions to be taken at site.

The manufacturer shall furnish in Annexure -II the guaranteed technical particulars.

Sd/-

Chief Engineer (SCM)



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GUARANTEED TECHNICAL PARTICULARS

| Sl. No. | Description | Board's Requirement | To be furnished by Firm |
|---------|--|--|-------------------------|
| 1) | Manufacturer | | |
| 2) | Country of Origin | | |
| 3) | Type of insulator | 11kV 45kN Composite Polymeric Disc Insulator | |
| 4) | Standard according to which the insulators manufactured and tested | IEC 61109 | |
| 5) | Name of material used in manufacture of the insulator with class/grade | | |
| 6) a) | Material of core (FRP rod) | | |



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| | | | |
|------|---|---|--|
| i) | E-glass or ECR-glass | | |
| ii) | Boron content | | |
| b) | Material of housing & weather sheds (Silicon content by weight) | Silicon Min. 30% Silicon content by weight | |
| c) | Material of end fittings | | |
| d) | Sealing compound for end fitting | | |
| e) | Colour | | |
| 7) | Electrical characteristics | | |
| 7.1. | Nominal system voltage KV (rms) | 11 | |



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| | | | |
|------|--|----|--|
| 7.2. | Highest system voltage KV (rms) | 12 | |
| 7.3. | Dry Power frequency withstand voltage KV (rms) | | |
| 7.4. | Wet Power frequency withstand voltage KV (rms) | | |
| 7.5. | Dry flashover voltage KV (rms) | | |
| 7.6. | Wet flash over voltage KV (rms) | | |
| 7.7. | i. Dry lighting impulse withstand voltage Positive kV (peak) | | |
| | ii. Negative KV (peak) | | |
| 7.8. | Dry lighting impulse flashover voltage | | |



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| | | | |
|----------|---|-----------------------------|--|
| I) | Positive KV (peak) | | |
| ii) | Negative KV (peak) | | |
| 7.9. | RIV at 1 MHz when energized at 10 kV/ 30 kV (rms) under dry condition | | |
| 7. 10 | Creepage distance (Min.) | 320mm | |
| 8) i) | Center to center distance between tongue & clevis | 290 ± 15 mm | |
| ii) | Shed diameter (mm) | Type tested model dimension | |
| iii) | Mechanical characteristics:KN | 45kN | |

| | | | |
|------|--------------------------------|------|--|
| iv) | Minimum failing load | 45kN | |
| 9) | Dimensions of insulator | | |
| 9.1. | Weight (Kg) | | |
| 9.2. | Dia. of FRP rod (mm) | | |
| 9.3. | Length of FRP rod (mm) | | |
| 9.4. | Dia. of weather sheds (mm) | | |
| 9.5. | Thickness of housing (mm) | | |
| 9.6. | Dry arc distance (mm) | | |



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| | | | |
|-------|---|-------------------------------|--|
| 9.7. | Dimensioned drawings of insulator (including weight with tolerances in weight) enclosed. | (To be submitted by the firm) | |
| 9.8. | Method of fixing of sheds to housing (Specify): Single mould or Modular construction (Injection molding / compression molding) | (To be specified by the firm) | |
| 9.9. | No of weather sheds | | |
| 9.10. | Type of sheds | | |
| 9.11. | Aerodynamic Please specify (Yes/No) | (To be specified by the firm) | |
| 9.12. | With under ribs Please specify (Yes/No) | (To be specified by the firm) | |
| 10. | Packing details | | |



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| | | | |
|-------|---|-------------------------------|--|
| 10.1. | Type of packing | | |
| 10.2 | No. of insulators in each pack | | |
| 10.3. | Gross weight of package | | |
| 11. | Design Test Report, Type Test Report of insulator enclosed. | (To be submitted by the firm) | |
| 12. | Any other particulars which the Manufacturer may like to give (State end fitting crimped first and over moulded type) | | |

Sd/-

Chief Engineer (SCM)