**Annexure – ‘A’**

1. **SCOPE:**

This specification covers the design, manufacture, testing and supply of 11KV, 45 KN /70 KN Composite Polymer Disc Insulators with hardware fittings shall be of the following type:

* 1. **Long rod insulators ball and socket type** for ACSR conductors in **tension application** at dead end/angle/cut point.
  2. The Bidder should be original manufacturer of the composite insulators and shall have all the facilities to manufacturing and in house testing or their product.

##### This will be pre-qualifying requirement as a “Bidder”.

1. **SERVICECONDITIONS**

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

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

##### SYSTEMPARTICULARS

|  |  |  |
| --- | --- | --- |
| 1 | Nominal system voltage | 11 KV (rms) |
| 2 | Highest System voltage | 12 KV (rms) |
| 3 | Visible discharge test voltage | 9 KV (rms) |
| 4 | Frequency | 50 HZ with ± 3 % tolerance |
| 5 | Neutral Earthing | Effectively Grounded |
| 6 | Number of phases | 3 |

1. **STANDARDS:**

Following Indian/International Standards, which shall mean latest revision, with amendments/changes adopted and published, unless specifically stated otherwise in the Specification, shall be referred while accessing conformity of Insulators with these specifications.

|  |  |  |  |
| --- | --- | --- | --- |
| Sr.  No. | Indian Standard | T  it | 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 Insulators units. | IEC:60575 |
| 6 | IS: 13134 | Guide for the selection of insulators in respect of polluted condition |  |
| 7 |  | Characteristics of string insulator units of the long rod type |  |
| 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 C 29.13-2000 |
| 12 | IS:4759 | Hot dip zinc coatings on structural steel & other allied products. | ISO:1459 |
| 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:2178 |
| 16 | IS:2633 | Testing of Uniformity of coating of zinc coated articles. |  |
| 17 | - | Standard specification for glass fiber standards. | ASTM D 578-05 |
| 18 | - | Standard specification for compositional analysis by Thermo-gravimetery. | ASTM E 1131-03 |
| 19 | IS:4699 | Specification for refined secondary zinc |  |

##### GENERAL REQUIREMENTS

* 1. The Composite insulators will be used on lines on which the conductor will be ACSR of size up to 200 S q . m m and ACSR of any size up to panther (0.2 sq. inch copper equivalent). The insulators should withstand the conductor tension, the reversible wind load as well as the high frequency vibrations due to wind.
  2. Insulator shall be suitable for 3-ph 50 Hz effectively earthed 11KV Overhead distribution system in a moderately/heavily polluted atmosphere. **Long road insulators shall be of ball & socket type as specified.**
  3. Bidder must be an indigenous manufacturer and supplier of composite insulators of rating 11KV or above OR must have developed proven in house technology and manufacturing process for composite insulators of above rating OR possess technical collaboration /association with a manufacturer of composite insulators of rating 11KV or above. The Bidder shall furnish necessary evidence in support of the above along with the bid, which can be in the form of certification from the utilities concerned, or any other documents to the satisfaction of the

owner.

* 1. Insulator shall be suitable for the strain type of load & shall be of Ball & Socket type for long Rod Type. The diameter of Composite Insulator shall be less than 200mm. The center-to- center distance between Ball &socket shall be max. 300mm for 11KV composite insulator.
  2. 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.
  3. The type/size of composite insulator, minimum Creepage distance and mechanical strength along with hardware fittings shall be as follows

|  |  |  |
| --- | --- | --- |
| 1 | Type of Composite insulators | B&S Type long Rod Insulators |
| 2 | Nominal system voltage | 11 KV (rms) |
| 3 | Highest System voltage | 12 KV (rms) |
| 4 | Visible discharge test voltage | 9 KV (rms) |
| 5 | Mechanical characteristic | Min. failing load:45KN/70KN |
| 6 | Minimum Creepage distance (mm) | 320mm |
| 7 | Wet power frequency withstand voltage | 45 KV(rms) |
| 8 | Dry lighting Impulse withstand voltage | 1. Positive 110KV 2. Negative: 110KV |
| 9 | Pin Ball shank diameter | 16mm |

* 1. 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 IEC61109: ± {0.04d+1.5) mm when d<300 mm,

± (0.025d+6J 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.

##### Interchangeability:

The composite insulators including the end fitting connection shall be of standard design suitable for use with the hardware fittings of any other indigenous make conforming to relevant IEC/IS standards.

##### Corona and Rl 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.

1. **TECHNICAL DESCRIPTION OF COMPOSITE INSULATORS**
   1. Composite Insulators shall be designed to meet the light quality, safety and reliability and are capable of withstanding a wide range of environmental conditions.

##### Core- the internal insulating part

* + 1. **Housing – the external insulating part.**
    2. **Metal and fittings – for attaching to hardware to support conductor.**
  1. **CORE**

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

##### HOUSING (Sheath)

The FRP rod shall be covered by a seamless sheath of a silicone elastometric compound or silicone alloy compound of a thickness of 3 mm minimum. It shall be one-piece housing using injection Molding Principle to cover the core. The elastomer housing shall be designed to provide the necessary creepage distance and

protection against environmental influences, external pollution and humidity. Housing shall conform to the requirement of IEC

61109/92-93 with latest amendments.

It shall be extruded or directly molded 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 filings). 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.

##### WEATHERSHEDS

The composite polymer Weathersheds made of silicone elastometric compound or silicon alloy shall be firmly bonded to the sheath, vulcanized to the sheath or molded as part of the sheath and shall be free from imperfections. The weathersheds should have silicon content of minimum 43% by weight. The strength of the weathershed 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.

##### METAL AND FITTINGS:

End fittings transmit the mechanical load to the core. They shall be made of S G Iron or malleable cast iron or forged steel, Metal end fittings shall be suitable for Ball and socket type hardware of respective specified mechanical load and shall be hot dip galvanized 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 fibers or crack the core.The gap between fittings and sheath shall be sealed by flexible silicone elastometric 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 ball and socket insulator shall be in accordance with the standard shown at Sr. No.4.0. No joints in ball and socket or pin will be allowed. Outer portion of ball or socket should be Zinc Sleeved with minimum 99.95% purity of electrolytic high grade Zinc.

The finished surface shall be smooth and shall have a good performance. The surface shall not crack or get chipped due to ageing effect under normal and abnormal service conditions or while handling during transit or erection.

The design of the fittings and the insulators shall be such that there is no local corona formation or discharges likely to cause the interference to either should or vision transmission.

The insulators shall have “W” type phosphors Bronze or R type Stainless steel security clips for ball sockets portion of insulators confirming to IS-2486.

* 1. WORKMANSHIP**:**
  2. 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.
  3. 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.
  4. 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.
  5. The core shall be sound and free of cracks and voids that may adversely affect the Insulators.
  6. 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. End fittings shall be free from cracks, seams, shrinks, air holes and rough edges. End fittings should be effectively sealed to prevent moisture ingress; effectiveness of sealing system must be supported by test documents. All surfaces of the metal parts shall be perfectly smooth with out projecting points or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.
  8. All ferrous parts shall be hot dip galvanized to give a minimum average coating of zinc equivalent to 610 gm/Sq.m, or 87µ m 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 H) minute duration under the standard preece test. The galvanizing shall be carried out only after any machining.

##### TEST 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 03 years old.**

##### 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 subjected to the design tests, the result shall be considered valid for the whole class of insulators, which are represented by the one tested and having the following characteristics:

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

The tested composite insulators shall be identified by a drawing giving all the dimensions with the manufacturing tolerances.

Manufacturer should submit test reports for Design Tests as per IEC-61109 (clause- 5) along with the bid. **Additionally following tests shall be carried out or reports for the tests shall be submitted after award of contract**:UV test: the test shall be carried out in line with clause 7.2 of ANSI C29.13.

##### 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. Following type test shall be conducted on a suitable number of individual insulator units, components, materials or complete strings.

|  |  |  |
| --- | --- | --- |
| SN | Description of type test | Ten procedure/standard |
| 1. | Dry lightning impulse withstand voltage test | As per IEC 61109 (clause 6.1) |
| 2. | Wet power frequency test | As per IEC 61 109 (clause 6,2) |
| 3. | Mechanical failing load test | As per IS:731 (Clause-10.8.2) |
| 4. | Radio interference test | As per IEC 61109 (clause 6.4) |
| 5. | Recovery of Hydrophobicity test | Annexure-B  This test may be repealed every 3 yrs by the manufacturer |
| 6. | Chemical composition test for silicon content | Annexure-B  Or any other test method acceptable to the owner |
| 7. | Brittle fracture resistance test | Annexure - B |

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

##### ACCEPTANCE(SAMPLE)TESTS:

The test samples after having withstood the routine test shall be subjected to the following acceptance tests:

|  |  |  |
| --- | --- | --- |
| a. | Verification of dimensions | Clause 7.2 IEC: 61109 |
| b. | Verification of the locking system (if applicable) | Clause 7.3 IEC: 61 109 |
| c. | Galvanizing test | IS:2633/IS:6745 |
| d. | Verification of the specified mechanical load | Clause 7.4 IEC: 611 09 /  IS:731 |

##### ROUTINE TESTS:

|  |  |  |
| --- | --- | --- |
| SN | Description | Standard |
| 1. | Identification of marking | As per IEC: 61 109 Clause 8.1 |
| 2. | Visual Inspection | As per IEC 61 109 Clause 8.2 |
| 3. | Mechanical routine test | As per IEC:61109 Clause 8.3 |

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

##### TESTS DURING MANUFACTURING

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

* + 1. Chemical analysis of zinc used for galvanizing
    2. Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.
    3. Chemical analysis, hardness tests and magnetic particle inspection for forgings.

##### ADDITIONALTESTS:

The Purchaser reserves the right of getting done any other test(s) of reasonable nature carried out at

Purchaser’s premises, at site, or in any other place in addition to the aforesaid type, acceptance and routine tests to satisfy himself that the material comply with the specifications. In such case all the expenses will be to Suppliers account.

##### AUDIT TESTING:

* + 1. The testing for lot may be carried out at NABL approved laboratory over & above tests carried out at firm’s works. Minimum 8 nos. samples from each lot offered will be tested for type tests/acceptance tests.
    2. The necessary charges will be borne by the company. In the event of failure of Sample, charges will be borne by supplier.

##### PROTOTYPE

The successful tenderer shall have to offer 3 No. Prototype insulator for carrying out tests mentioned at specification clause no.8.3 at their works in presence of company’s representative. All the testing expenditure of prototype sample testing will be borne by the firm. After obtaining the written approval from the competent authority of company for prototype insulator and drawing approval, the firm can commence bulk manufacturing of the ordered insulators. **The expenses towards prototype testing including visit of our Engineers (2 Nos.) to your works shall be borne by the bidder**.

##### 9. QUALITY ASSURANCE PLAN:

1. The successful bidder shall submit following information along with the bid.
   1. Test certificates of the raw materials and bought out accessories.
   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 representative.
   3. List of manufacturing facilities available.
   4. Level of automation achieved and lists of areas where manual processing exists.
   5. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
   6. List of testing equipments available with the bidder for final testing of equipments along with valid calibration reports.
   7. The manufacturer shall submit Manufacturing Quality Assurance Plan (QAP) for approval and the same shall be followed during manufacture and testing.
2. The successful bidder shall submit the routine test certificates of bought outraw materials/accessories and central excise passes for raw material at the time of inspection.
3. The owner’s representative shall 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 representative 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 here in.
4. The material for final inspection shall be offered by the Supplier only under packed condition. The owner shall select samples at random from the packed lot for carrying out acceptance tests. The lot offered for inspection shall be homogeneous and shall contain insulators manufactured in 3-4 consecutive weeks. 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.
5. No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived of by the owner in writing in the later case also the material shall be dispatched only after satisfactory testing specified herein has been completed.
6. The acceptance of any quantity of material shall in no way relieve the supplier at 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.

##### TEST CERTIFICATE:

The tenderer shall furnish detailed type test reports of the offered composite Insulators as per clause 8.2 of the Technical Specifications from the NABL laboratory to prove that the composite Insulators offered meet the requirements of the specification. **These type Tests should have been carried out within three years prior to the date of opening of this tender.**

* 1. The offered composite Insulators are already fully type tested at approved Laboratory within five years prior to the date of opening of this tender.
  2. There is no change in the design of type-tested composite Insulators and those offers against this tender.

##### TESTING FACILITIES :

The following additional facilities shall be available at Supplier’s works:

1. The tenderer must clearly indicate what testing facilities are available in the works of the manufacturer and whether facilities are adequate to carryout all Routine & acceptance Tests. These facilities should be available to JBVNL’s Engineers if deputed or carry out or witness the tests in the manufacturer works. If any test cannot be carried out at the manufacturer’s work, the reasons should be clearly stated in the tender.
2. The insulators shall be tested in accordance with the procedure detailed in IEC 61109/92-93 with latest amendments.
3. Calibration Reports from Government approved testing laboratory of various testing and measuring equipment including tensile testing machine, resistance measurement facilities, burelle, thermometer, barometer etc.
4. Finished insulator shall be checked for dimension verification and surface finish separately. Manufacturers of foreign origin shall, in addition to the above, also have arrangements in India, either at works of their authorized representative/ licenses or in the NABL laboratory for conducting sampling test in accordance with IEC 81109/92-93 with latest amendments.

##### DRAWINGS:

The schematic drawing of the composite long rod (B&S) insulator is attached herewith for reference, the bidder has to submit their own drawing as under:

* 1. The Bidder shall furnish full description and illustration of the material offered.
  2. The Bidder shall furnish along with the bid the outline drawing (3 copies) of each insulator unit including a cross sectional view of the long rod insulator unit. The drawing shall include but not be limited to the following information.
     1. Long rod diameter with manufacturing tolerances.
     2. Minimum Creepage distance with positive tolerance.
     3. Protected creepage distance.
     4. Eccentricity of the long rod
        1. Axial run out.
        2. Radial run out
     5. Unit mechanical and electrical characteristics.
     6. Size and weight of ball and socket.
     7. Weight of composite long rod units.
     8. Materials
     9. Identification mark.

(ii) Manufacturer’s catalogue number

* 1. After placement of awards, the Supplier shall submit full dimensioned manufacturing insulator drawings containing all the details in four (4) copies to owner for approval. After getting

approval from owner and successful completion of all the type tests, the supplier shall submit 10 more copies of the drawing to the owner for further distribution and field use.

* 1. After placement of order, the Supplier shall also submit fully dimensioned insulator crate drawing for different type of insulators for approval of the owner.

##### RETEST AND REJECTION:

* 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 purchaser’s representative from the lost 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 Insulators 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 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.

* 1. 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.

* 1. Verification of the locking system (E2)

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

* 1. Verification of tightness of the interface between end fittings and insulator housing (E2).

One insulator selected randomly from the sample E2, shall be subjected to crack indication by due 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 metal and including an additional area, sufficiently extended beyond the end of the metal part.

The indication shall be performed in the following way.

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

Some housing materials may be penetrated by the penetrant, In such cases evidence shall be provided to validate the interpretation of the results. After the 1 min, test at 70% of the SML, if any crack 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.

* 1. 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 graduallyincreased 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 1 min withstand test at the SML).

These 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.

##### GALVANIZINGTEST:

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

##### MARKINGS:

Each insulator unit shall be legibly and indelibly marked with the following details as per IEC-61109.

1. Name or trademark of the manufacture.
2. Voltage & Type
3. Month and Year of manufacturing.
4. Guaranteed mechanical strength in kilo Newton followed by the word ‘KN’ to facilitate easy identification.
5. Country of Manufacturer.
6. Name of purchaser

##### PACKING:

* 1. **All insulators shall be packed in strong 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.

* 1. The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
  2. Suitable cushioning, protective padding of dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.
  3. 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 shall have all the markings stenciled on it in indelible ink.
  4. The bidder shall provide instructions regarding handling and storage precautions to be taken at site.

##### GUARANTEE:

If the material found defective due to bad design or workmanship the same should be repaired or replaced by you free of charge if reported within 36 months from the date of supply of material.

The bidder will be responsible for the proper performance of the equipments/material for the respective guarantee period.

#### SPECIFICATION FOR HARDWARE FITTINGS SUITABLE FOR TENSION STRING TO BE

**USED FOR 11KV ( 03 Bolt Type)**

All the hardware fittings shall be confirm IS 2486(Part II) -1989 and shall be ball and socket type

1. one pair of mild steel cross arm straps having size 152 mm length x35 mm width x6mm thickness confirming to IS 2486(Part II) -1989 and REC specification No.3/1971(Rev-1993).
2. One hexagonal headed bolt with length 145 mm & 16 mm dia, with 1 No. nut, one No. flat washer of 16mm dia. and 3 mm thickness and 1 No. Split pin of 4 mm dia. conforming to IS 1363(Part-1)1992.
3. One No. forged steel ball eye 16mm suitable for attaching the socket end of the strain insulator to the cross arm strap. Forgings shall be made of steel as per IS 2004-1991. The ball eye shall also be conforming to REC specification No.3/1971(Rev.1993) with this. One no. MS Pin (rivet) of 55mm length 16mm dia along with one no. Spring washer of 3 mm thickness and 1 no. Split pin of 4 mm dia. is to be supplied.
4. One No. aluminium alloy socket made out of permanent mould cast, high strength aluminium alloy for attaching to the strain insulator on one end and for accommodating the helically formed dead-end fittings at the other end in its smooth internal contour. The socket shall be attached to the strain insulator with the help of ‘w’ clip as per IS 2486 (Part II) 1989.
5. 1 No. U bolt with dimension 62mmx12mm with 2 Nos. 12 mm nuts, 2 Nos. flat washer of 2 mm thickness and, 2 Nos. spring washers of 2.5mm thickness and one No. keeper piece of aluminium alloy suitable to U bolt
6. The minimum breaking strength of alloy socket shall be 4500/7000 KG.
7. Strain clamp shall confirm IS 2486(Part II) -1989 **3 Bolt aluminium alloy** “**type A**” and as per Drawing given.

#### Ball & Socket type Hardware fittings (Conversional) for B & S type Strain Insulators

The hardware fittings (Ball and Socket type) shall be suitable for fixing on 100 mm x 50 mm channel cross arms and for accommodation of 55 mm² / 100 mm²/232 mm² Conductor. The set shall complete with following components.

* + 1. Cross-arms straps with Bolts & Nuts, Brass split and Spring Washer.
    2. Two numbers forged cotter pins, Brass split pins, Plain washer.
    3. One number Ball Eye of malleable cast iron
    4. One number of socket eye complete with security clips made of Phosphor bronze made cut of aluminium alloys-A/6.
    5. Helically formed Dead and Conductor grip having a Pre-fabricate loop to fit into

the proved contour of the thimbles on one end and for application over the conductor at the other end for 55

mm²/100mm² conductors.

* + 1. Strain clamps shall be suitable for above ACSR / AAAC. The ultimate strength of clamp should not be less than 4500Kg/7000kg and Slipping strength shall not be less than 90% of these figures. The aluminium socket shall be embossed / casted with

trade name for identification of manufacturer and -word "JBVNL ",

1. All ferrous parts shall be hot dip galvanised as per ISS-2633/1986. However spring washer shall be electro- galvanised.
2. Chemical composition of aluminium alloy for socket ended strain clamp shall be as specified here under,

|  |  |  |
| --- | --- | --- |
| 1 | Copper : | 0.1% Max. |
| 2 | Magnesium : | 0.1% Max |
| 3 | Silicon : | 11 to 13% |
| 4 | Iron : | 0.6% Max |
| 5 | Manganese : | 0.5% Max |
| 6 | Nickel : | 0.1% Max |
| 7 | Zinc : | 0.1% Max |
| 8 | Lead : | 0.1% Max |
| 9 | Tin : | 0.05% Maximum |
| 10 | Titanium : | 0.2 % Maximum |
| 11 | Aluminium : | Remainder |

IX ROUTINE TEST

The following routine tests shall be carried out on each insulator fitting by the manufacturer.

1. Visual examination.
2. Mechanical routine test.

The supplier shall maintain the record of such tests carried out on each fitting and shall submit the records to Inspector, whenever required by him.

IX **PACKING**

The hardware fittings shall be packed in double gunny bags in 25 sets. Gunny bags should withstand the weight of the hardware fittings and should not become loose or torn out during transportation. Further on each gunny bag, supplier shall make arrangement for providing suitable seal wire to enable the JBVNL Inspector to fix identification seal for the inspected lot. Unless the materials are inspected and accepted by the Inspector and/ or waival of the testing or delivery instructions are received in writing material, shall not be dispatched by the supplier.