INSULATORS

1.0 Scope

This Specification covers design, engineering, manufacture, assembly, stage testing, inspection & testing before supply and delivery at site for the 33kV, 11kV, LT (disc, pin, shackle, guy and post) insulator alongwith fittings for 33kV, 11 kV, LT lines and 33/11 kV substations. "Composite" Insulators as per REC Specification No. 76/2006 are also allowed.

1.1 STANDARDS

The material shall conform in all respect to the relevant Indian and International standards with latest amendments indicated below.

Indian Standards	Title
ISS: 731	Porcelain insulators for overhead power lines with a nominal voltage greater than 1000 V
ISS: 2486 (Part-1 to Part-4)	Metal fittings of insulators for overhead power lines with nominal voltage greater than 1000 V
IS: 1445	LT insulators
IS: 5300	Guy insulators
IS:2486-(Part-III)/ IEC:372	Security clips
IS : 2544 and IS : 5350 Part-III	Post insulators

In the event of the supply of insulators & fittings conforming to standards other than specified, the Bidder shall confirm in his bid that these standards are equivalent to those specified. In case of award, salient features of comparison between the standards proposed by the Contractor and those specified in this document will be provided by the Contractor to establish their equivalence.

1.2 ATMOSPHERIC CONDITIONS

The material offered shall be suitable for operation under the climatic conditions indicated below:

a)	Maximum temperature of air in shade	43°C
b)	Minimum temperature of air in shade	40°C
c)	Maximum temperature of air in sun	60°C
d)	Maximum humidity	100%
e)	Average number of thunderstorm Per annum days	50
f)	Average number of dust storms per annum	20
g)	Maximum Rainfall per annum mm	1750
h)	Average rainfall per annum mm	1270
i)	Limits of ambient temperature over a period of 24 hours	32°C
j)	Wind Pressure	100Kg/m2
k)	Attitude above MSL	not exceeding 1000

1.2.1 Reference atmospheric conditions at which Post Insulator or Post Insulator units characteristics shall be expressed for the purpose of comparison shall be as given below :

1.2.2

Ambient temperature	20^0 C
Barometric Pressure	1013 mille bar
Absolute humidity	11 g of water per cubic metric corresponding to 63 % relative humidity at 20 degree C.

1.2.3 Test for the purpose of this standard shall preferably be carried out under conditions of temperature and humidity specified in IS : 196 i.e. a temperature of 27 ± 2^0 C and relative humidity of 65±2 % and at the prevailing atmospheric pressure. When this is not possible test may be carried out under conditions naturally obtaining at the time of test. The barometric pressure, air temp. and humidity shall be recorded for the purpose of correction. Correction of test voltage for atmospheric conditions is given in Appendix-A of IS: 731, 2544, 1445 and 5300.

1.3 GENERAL REQUIREMENTS

1.3.1 All insulators for 11kV and 33kV shall conform to Type B of latest version of IS: 731.

1.3.2 Pin insulator shall consist of a single piece of porcelain, intended to be mounted rigidly on a supporting structure by a pin, which passes up inside the insulator. The pin type insulator shall have a top groove and shall have a lead thimble cemented to it which shall be threaded to take mild steel pins. The profile of threads shall be as per IS: 1445.

1.3.3 The strain insulators shall be of Ball and Socket type or Tongue or Clevis type, as specified.

1.3.4 The string insulators for 33kV line shall only be of Ball and Socket type. 33 kV string will consists of 3 nos of disc insulators.

1.3.5 Post Insulators are required to provide rigid supports for bus bars, part of Isolators, AB Switches and other equipments/conductors in the sub-station.

1.3.6 **Post Insulators**: A Post Insulator consists of Post Insulator unit or an assembly of such units and is intended to rigid support to a live part which is insulated from earth or from another live part.

1.3.7 **Mechanical Strength**: The Post Insulators shall be suitable for the minimum failing loads specified as under:

Sl. No	Designation as per IS: 5350 Part-III	Highest System voltage	Failing Loads(Min.)			
			Up-right Bending(N)	Torsion(Nm)	Tension(N)	Compression(N)
1	E22	12 KV	9000	340	20000	40000
2	E32(stack of two unit)	36 KV	4500	680	30000	40000

1.3.8 Following type of guy strain insulators shall be used on guy wires of overhead lines of different voltage levels:

Power Line Voltage	**Designation of Insulators (as per IS: 5300)**
11kV	C
33kV	C (2 insulators to be used in series)

1.4 MATERIALS

1.4.1 PORCELAIN

The porcelain used in the manufacture of shells shall be sound, free from defects thoroughly vitrified and smoothly glazed.

1.4.2 GLAZE

The finished porcelain shall be glazed in brown colour. The glaze shall cover all exposed parts of the insulator and shall have a smooth surface and good performance under the extreme weather conditions of a tropical climate. It shall not crack or chip by ageing under normal service conditions.

1.4.3 CEMENT

Cement used in the manufacture of the insulator shall not cause fracture by expansion or loosening by contraction. The cement shall not give rise to chemical reaction with metal fittings and its thickness shall be as small and uniform as possible. Proper care shall be taken to correctly centre and locate individual parts during cementing.

1.5 CREEPAGE DISTANCE

The creepage distance shall be as per enclosed table-I

1.6 DISC INSULATORS

1.6.1 PIN AND CAP

1.6.1.1 Pins and Caps shall be made of drop forged steel and malleable cast iron/ spheroidal graphite iron/drop forged steel respectively, duly hot dip galvanised and shall not be made by jointing, welding, shrink fitting or any other process from more than one piece of material.

1.6.1.2 Pin and Cap shall be designed to transmit the mechanical stresses to the shell by compression and develop uniform mechanical strength in the insulator. The cap shall be circular with the inner and outer surfaces concentric and of such design that it will not yield or distort under load conditions.

1.6.1.3 The pin ball shall move freely in the cap socket but without danger of accidental uncoupling during erection or in position. The design of the disc should be such that stresses due to expansion or

contraction in any part of the insulator shall not lead to deterioration.

1.6.2 SECURITY CLIP

1.6.2.1 Security clip for use with ball and socket coupling shall be of R-shaped hump type which shall provide positive locking of the coupling as per IS:2486-(Part-III)/ IEC:372. The legs of the security clips shall be spread after installation to prevent complete withdrawal from the socket. The locking device should be resilient, corrosion resistant and of suitable mechanical strength. There shall be no risk of the locking device being displaced accidentally or being rotated when in position under no circumstances shall locking device allow separation of insulator units or fittings.

1.6.2.2 Security clips shall be made of good quality stainless steel or phosphor bronze as per IS:1385-1968. 2.5% extra Security clip shall be provided.

1.6.3 BALL AND SOCKET DESIGNATION

The dimensions of the balls and sockets shall be of 16 mm designation in accordance with the standard dimensions stated in IS:2486 - (Part - II).

1.7 PIN INSULATORS

1.7.1 General requirement of Pin insulator shall be as per clause 1.3.2

1.7.2 The mild steelpins shall be of single piece obtained by the process of forging. They will not be made by any process using more than one piece of material. The pin will have good finish, free from flaws and other defects. The finish of the collar shall be such that a sharp angle between the collar & the shank is avoided. All ferrous pins, nuts and washers, except those made of stainless steel, shall be galvanized. The threads of nuts, and taped holes, when cut after galvanization shall be well oiled or greased.

1.7.3 HELICALLY FORMED PIN INSULATOR TIES

These shall be used to hold conductor on the pin insulator and shall be made of aluminium alloy or aluminized steel or aluminium clad steel wires and shall conform to IS 12048.

1.7.3.1 The ties shall be suitable for the AAAC equivalent to ACSR conductors.

1.7.3.2 Elastometer pad for insulator shall be used with the ties to avoid abrasion of the conductor.

1.8 INTERCHANGEABILITY

The disc, pin, shackle guy and post insulators inclusive of fittings shall be of standard design suitable for use with the hardware fittings of any make conforming to relevant Indian/International Standards.

1.9 MAINTENANCE

The insulators offered shall be suitable for employment of hot line maintenance techniques so that the usual hot line operations can be carried out with ease, speed and safety.

1.10 WORKMANSHIP

1.10.1 All the material shall be of the latest design and conform to the best modern practices adopted in the distribution voltage field. Contractors shall offer only such insulators as are guaranteed by him to be satisfactory and suitable for specified voltage level lines and will give continued good service.

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

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

1.10.4 In disc insulators, metal caps shall be free from cracks, seams, shrinks, air holes, burrs and rough edges. All surfaces of the metal parts shall be perfectly smooth with no projecting points or irregularities. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly.

1.10.5 All ferrous parts shall be hot dip galvanised to give a minimum average coating of Zinc equivalent to 600 gm/sq.m. and shall be in accordance with the requirement of IS:2629 and shall satisfy the tests mentioned in IS:2633 The zinc used for galvanising shall be of Grade Zn 99.95 as per IS:209. 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 galvanised metal parts shall be guaranteed to withstand at least six successive dips each lasting for one (1) minute duration under the standard preece test.

1.10.6 Before ball fittings are galvanised, all die flashing on the shank surface of the ball shall be carefully removed without reducing the dimensions below the design requirements.

1.10.7 In disc insulators, the design of the insulators shall be such that the shell shall not engage directly with hard metal. The design shall also be such that when units are coupled together there is no contact between the shell of one unit and metal of the next adjacent unit. The design of the shell ribs shall be such that the security clip of the insulator can be engaged and disengaged easily with hot stick without damaging the shell ribs.

1.10.8 Insulator units after assembly shall be concentric and co-axial within limits as permitted by the relevant Indian Standards.

1.11 EQUIPMENT MARKING

1.11.1 Each insulator shall be legibly and indelibly marked with the trademark of the manufacturer and month & year of manufacture. The guaranteed combined mechanical and electrical strength shall be indicated in kilo Newton followed by the word ‘kN’ to facilitate easy identification and to ensure proper use.

1.11.2 The marking shall be on porcelain, and shall be printed, not impressed and shall be applied before firing.

1.12 BID DRAWINGS

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

1.12.2 The Bidder shall furnish along with the bid the outline drawing (6 copies) of each insulator unit including a cross sectional view of the

insulator shell. The drawing shall include but not limited to the following information:

(a) Dimensions with manufacturing tolerances

(b) Minimum Creepage distance with positive tolerance

(c) Protected creepage distance

(d) Eccentricity of the disc

(i) Axial run out

(ii) Radial run out

(e) Unit mechanical and electrical characteristics

(f) Size and weight of Pin Ball Shank / ball and socket parts

(g) Weight of unit insulator disc

(h) Materials

(i) Identification mark

(j) Manufacturer's catalogue number

1.12.3 After placement of award, the Contractor shall submit fully dimensioned insulator drawings containing all the details as given in Clause No. 1.12.2 above, in four (4) copies to Owner for approval. After getting approval from Owner and successful completion of all the type tests, the Contractor shall submit 20 more copies of the same drawing to the Owner for further distribution and field use at Owner's end.

1.13 TESTS AND STANDARDS

1.13.1 TESTS

The following type, acceptance, routine tests and tests during manufacture shall be carried out on the insulator individually and along with hardware fittings. For the purpose of this clause :

1.13.2 Type tests shall mean those tests which are to be carried out to prove the design process of manufacture and general conformity of the material to this specification. These tests shall be carried out on

samples prior to commencement of commercial production against the specification. The Bidder shall indicate this schedule for carrying out these tests in the activity schedule.

1.13.3 Acceptance tests shall mean those tests which are to be carried out on samples taken from each lot offered for pre-despatch inspection for the purpose of acceptance of that lot.

1.13.4 Routine tests shall mean those tests, which are to be carried out on each insulator/hardware fitting to check requirements which are likely to vary during production.

1.13.5 Tests during manufacture shall mean those tests which are to be carried out during the process of manufacture and end inspection by the Supplier to ensure the desired quality of the end product to be supplied by him.

1.13.6 The norms and procedure of sampling for these tests will be as per the Quality Assurance Programme to be mutually agreed to by the Supplier and Owner.

1.13.7 The standards and norms to which these tests will be carried out are listed against them. Where a particular test is a specific requirement of this specification, the norms and procedure of these shall be as specified in Annexure-A of this Section or as mutually agreed to between the Supplier and the Owner in the Quality Assurance Programme.

1.13.8 For all types and accpetance tests, the acceptance values shall be the values guaranteed by the Bidder in the Guaranteed Technical Particulars of this proposal or the acceptance value specified in this specification whichever is more stringent for that particular test.

1.13.9 For all type and acceptance tests, the Bidder shall guarantee only minimum values in the Guaranteed Technical Particulars. Bidder shall be required to achieve the same or higher values, as guaranteed, during testing for all type and acceptance tests.

1.14 TESTS ON PIN AND DISC INSULATORS

1.14.1 TYPE TESTS

The following type tests shall be conducted on a suitable number of individual insulator unit, components, materials or complete strings:

(a) Verification of dimensions

(b) Power frequency voltage withstand and flashover test (i) dry (ii) wet

(c) Impulse voltage withstand and flashover test (dry)

(d) Visible Discharge test (dry)

(e) Mechanical failing Load Test (for pin insulator only)

(f) 24 hr mechanical strength test (for strain / string insulator only)

1.14.2 ACCEPTANCE TESTS

(a) Visual examination

(b) Verification of dimensions

(c) Temperature cycle test

(d) Galvanising test

(e) Mechanical performance test

(f) Test on locking device (for ball and socket coupling)

(g) Eccentricity test (for ball and socket coupling)

(h) Metallurgical Test

(i)	Grain size	)	
		)	
(ii)	Inclusion rating	)	For Metal fittings
		)	only
(iii)	Chemical analysis	)	(in Black condition)
(iv)	Microstructure	)	

(i) Mechanical Failing Load test (for Pin Insulator only)

(j) Electro-mechanical strength test (for Strain Insulator only)

(k) Porosity test

(l) Puncture test (for Strain Insulator only)

1.14.3 **ROUTINE TESTS**

(a) Visual Inspection

(b) Mechanical routine text (for Strain Insulator only)

(c) Electrical routine test (for disc strain, pin & post insulator only)

1.14.4 **TESTS DURING MANUFACTURE**

On all components as applicable

(a)	Chemical analysis of zinc used for galvanising	)Annexure – A
(b)	Chemical analysis, mechanical, metallographic test and magnetic particle inspection for malleable castings.	)
(c)	Chemical analysis hardness tests and magnetic particle inspection for forgings	) Annexure – A
(d)	Hydraulic Internal Pressure tests on disc insulator shells	)

1.14.5 Tests on mild steel pins The pins shall be tested as per IS 2486 (part-I)

1.14.5.1 Type Test:

a) Checking of Threads on Heads

b) Galvanizing Test

c) Visual Examination

d) Mechanical Test

1.14.5.2 Acceptance Tests:

e) Checking of Threads on Heads

f) Galvanizing Test

g) Mechanical Test

1.14.5.3 Routine Test:

h) Visual Examination

1.14.6 Test on ties: Ties shall be tested as per IS 12048.

1.14.7 Tests on LT insulators – LT insulators shall be tested as per IS 1445

1.14.8 Tests on Guy insulators – Guy insulators shall be tested as per IS 5300

1.14.9 TEST VOLTAGES

1.14.9.1 The test voltages of insulators shall be as under :

Highest System Voltage	Visible Discharge Test	Wet Power Frequency withstand Test	Power Frequency puncture withstand test		Impulse voltage withstand Test
			Pin Insulator	Strain/string Insulators	
KV(rms)	Kv(rms)	KV(rms)	Kv(rms)	kV(rms)	Kvp
12	9	35	105	1.3 times the actural dry flash over voltage of the insulator	75
36	27	75	180	1.3 times the actural dry flash over voltage of	170

			the insulator	

1.14.9.2 The withstand and flashover voltages are referred to the 'Reference Atmospheric Conditions' as per Indian Standards.

1.15 FAILING LOAD

1.15.1 MECHANICAL FAILING LOAD (FOR PIN INSULATORS ONLY)

The insulators shall be suitable for a minimum failing load of 10KN (for 33kV) and 5 KN (for 11kV) applied in transverse direction.

Shackle insulators shall be suitable for a minimum failing load of 11.5KN for type 1 insulator and 16.0KN for type 2 insulator.

Guy strain insulator type A shall be suitable for a minimum failing load of 44KN whereas, type C shall be suitable for a minimum failing load of 88KN.

1.15.2 ELECTRO-MECHANICAL FAILING LOAD (FOR STRAIN INSULATORS/ STRING INSULATOR UNITS)

The insulators shall be suitable for a minimum failing load of 45 KN (for 11kV lines) & 70kN (for 33kV lines) applied axially.

1.16 TESTING EXPENSES

1.16.1 Testing charges for the type test specified shall be indicated separately in the prescribed schedule.

1.16.2 Bidder shall indicate unit type test charges for all type tests covered under this specification separately, in the relevant schedule of Prices as applicable.

1.16.3 In case of failure of any type test, the Contractor is either required to modify design of the material and successfully carryout all the type tests as has been detailed out in this specification or to repeat that particular type test at least three times successfully at his own expenses.

1.16.4 Contractor shall indicate the laboratories in which they propose to conduct the type tests. They shall ensure that adequate facilities are available in the laboratory and the tests can be completed in

these laboratories within the time schedule guaranteed by them in the appropriate schedule.

1.16.5 The entire cost of testing for acceptance and routine tests and tests during manufacture specified herein shall be treated as included in the quoted Ex-works Price.

1.16.6 In case of failure in any type test, if repeat type tests are required to be conducted, then all the expenses for deputation of Inspector / Owner's representative shall be deducted from the contract price. Also if on receipt of the Contractor's notice of testing, the Owner's representative does not find 'PLANT' to be ready for testing the expenses incurred by the Owner for re-deputation shall be deducted from contract price.

1.16.7 The Contractor shall intimate the Owner about carrying out of the type tests along with detailed testing programme at least 3 weeks in advance of the scheduled date of testing during which the Owner will arrange to depute his representative to be present at the time of carrying out the tests.

1.17 SAMPLE BATCH FOR TYPE TESTING

1.17.1 The Contractor shall offer material for sample selection for type testing only after getting Quality Assurance Programme approved by the Owner. The Contractor shall offer at least three times the quantity of materials required for conducting all the type tests for sample selection. The sample for type testing will be manufactured strictly in accordance with the Quality Assurance Programme approved by the Owner.

1.17.2 Before sample selection for type testing, the Contractor shall be required to conduct all the acceptance tests successfully in presence of Owner’s representative.

1.18 SCHEDULE OF TESTING AND ADDITIONAL TESTS

1.18.1 The Bidder has to indicate the schedule of following activities in their bids

(a) Submission of drawings for approval.

(b) Submission of Quality Assurance programme for approval.

(c) Offering of material for sample selection for type tests.

(d) Type testing.

1.18.2 ADDITIONAL TESTS

1.18.2.1 The Owner reserves the right of having at his own expense any other test(s) of reasonable nature carried out at Contractor'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.

1.18.2.2 The Owner also reserves the right to conduct all the tests mentioned in this specification at his own expense on the samples drawn from the site at Contractor's premises or at any other test centre. In case of evidence of non compliance, it shall be binding on the part of the Contractor 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.

1.18.3 CO-ORDINATION FOR TESTING

The Contractor shall have to co-ordinate testing of insulators with hardware fittings to be supplied by other Contractor and shall have to also guarantee overall satisfactory performance of the insulators with the hardware fittings.

1.18.4 GUARANTEE

The Contractor of insulators shall guarantee overall satisfactory performance of the insulators with the hardware fittings.

1.19 TEST REPORTS

1.19.1 Copies of type test reports shall be furnished in at least six (6) copies along with one original. One copy shall be returned duly certified by the Owner only after which the commercial production of the concerned material shall start.

1.19.2 Copies of acceptance test reports shall be furnished in at least six (6) copies. One copy shall be returned duly certified by the Owner, only after which the material shall be despatched.

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

1.19.4 Test certificates of test during manufacture shall be maintained by the Contractor. These shall be produced for verification as and when desired by the Owner.

1.20 INSPECTION

1.20.1 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 Contractor's and sub-Contractor's works, raw materials, manufacture of the material and for conducting necessary test as detailed herein.

1.20.2 The material for final inspection shall be offered by the Contractor only under packed condition as detailed in the specification. The Owner shall select samples at random from the packed lot for carrying out acceptance tests. Insulators shall normally be offered for inspection in lots not exceeding 5000 nos. The lot should be homogeneous and should contain insulators manufactured in the span of not more than 3-4 consecutive weeks.

1.20.3 The Contractor 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.

1.20.4 No material shall be despatched from its point of manufacture before it has been satisfactorily inspected and tested unless the inspection is waived off by the Owner in writing. In the latter case also the material shall be despatched only after satisfactory testing for all tests specified herein have been completed.

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

1.21 PACKING AND MARKING

1.21.1 All insulators shall be packed in strong seasoned wooden crates. The gross weight of the crates alongwith the material shall not normally exceed 200 kg to avoid handling problem. For marine transportation, crates shall be paletted.

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

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

1.21.4 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 despatched 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.

1.22 33 KV AND 11 KV POST INSULATOR

1.22.1 GENERAL REQUIREMENTS

1.22.1.1 The porcelain shall be sound and free from defects, thoroughly vitrified and smoothly glazed.

1.22.1.2 Unless otherwise specified the glaze shall be brown in colour. The glaze shall cover all the expose porcelain part of the insulator except those area which serve as support or required to be left un-glazed.

1.22.1.3 Precaution shall be taken during design and manufacture to avoid the following :

a) Stress due to expansion and contraction which may lead to deterioration .

b) Stress concentration due to direct engagement of the porcelain with the metal fittings.

c) Retention of water in the recesses of metal fitting and

d) Shapes which do not facilitate easy cleaning by normal methods.

1.22.1.4 Cement used in the construction of the post insulator shall not cause fracture by expansion or loosening by contraction and proper care shall be taken to locate the individual parts correctly during cementing. Further, the cement shall not give rise to chemical

reaction with metal fittings and its thickness shall be as uniform as possible.

1.22.1.5 All ferrous metal parts except those of stainless steel, shall be hot dip galvanized and the uniformity of zinc coating shall satisfy the requirements of IS : 2633. The parts shall be galvanized after mechanising . The finished galvanized surface shall be smooth.

1.22.1.6 The threads of the tapped holes in the post insulators metal fittings shall be cut after giving anti- corrosion protection and shall be protected against rest by greasing or by other similar means. All other threads shall be cut before giving anti-corrosion protection. The tapped holes shall be suitable for bolts with threads having anti - corrosion protection and shall confirm to IS : 4218(Part-I to VI). The effective length of thread shall not be less than the nominal diameter of the bolt.

1.22.1.7 The post insulator unit shall be assembled in a suitable jig to ensure the correct positioning of the top and bottom metal fitting relative to one another. The faces of the metal fittings shall be parallel and at right angles to the axis of the insulator and the corresponding holes in the top and bottom metal fittings shall be in a vertical plan containing the axis of insulator.

1.22.2 CLASSIFICATION

The post insulators shall be of type'B' according to their construction, which is defined here under :

A post insulator or a post insulator unit in which the length of the shortest puncture path through solid insulating material is less than half the length of the shortest flash over path through air outside the insulator.

1.22.3 Standard insulation levels :

1.22.3.1 The standard insulator levels of the post insulator or post insulator unit shall be as under :

Highest system voltage	Visible discharge test	Dry one minute power frequency withstand test.	Wet one minute power frequency withstand test.	Power frequency puncture withstand test.	Impulse voltage withstand test.
12 KV (rms)	9 KV(rms)	35 KV(rms)	35 KV(rms)	1.3 times the actual dry flash over voltage of the unit(KVrms)	75 KV peak
36 KV (rms)	27 KV(rms)	75 KV(rms)	75 KV(rms)	1.3 times the actual dry flash over voltage of the unit(KVrms)	170 KV peak

1.22.3.2 In this standard ,power frequency voltage are expressed as peak values divided by √2. The impulse voltage are expressed as peak values.

1.22.3.3 The withstand and flashover voltage are referred to the atmospheric condition.

1.22.4 **TESTS**

1.22.4.1 The insulators shall comply with the following constitute the type tests :

a) Visual examination.

b) Verification of dimensions.

c) Visible discharge test.

d) Impulse voltage withstand test.

e) Dry power frequency voltage withstand test.

f) Wet power frequency voltage withstand test.

g) Temperature cycle tests.

h) Mechanical strength tests.

i) Puncture test.

j) Porosity test.

k) Galvanising test.

Type test certificates for the tests carried out on prototype of same specifications shall be enclosed with the tender and shall be subjected to the following acceptance test in the order indicated below.

Acceptance test : The test samples after having withstood routine test shall be subjected to the at least following acceptance test in the order indicated below :

a) Verification of dimensions.

b) Temperature cycle tests.

c) Mechanical strength tests.

d) Puncture test.

e) Porosity test.

f) Galvanising test.

1.22.4.2 Routine tests: The following shall must be covered under routine tests on each post insulator or post insulator unit.

a) Visual examination as per Cl. No.- 9.12 of IS : 2544/1973

b) Mechanical routine test as per Cl. No.- 9.14 of IS : 2544/1973

c) Electrical routine test as per Cl. No.- 9.13 of IS : 2544/1973

1.22.5 MARKING

1.22.5.1 Each post insulator shall be legibly and indelibly marked to show the following.

a) Name or trade mark of the manufacturer.

b) Month & year of manufacture.

c) Country of manufacture.

1.22.5.2 Marking on porcelain shall be printed and shall be applied before firing.

1.22.5.3 Post insulator or post insulator units may also be mark with I.S.I. certification mark.

1.22.6 PACKING

All post insulators shall be pack in wooden crates suitable for easy but rough handling and acceptable for rail, transport. Where more than one insulator is packed in a crate wooden separators shall be fixed between the insulators to keep individual insulator in position without movement within the crate.

Table-I

Highest System Voltage in kV	Minimum Creepage distance in mm			
	Pin Insulator	Strain Insulator	String insulator	Post insulator
12	320	320	-	320
36	900	960	960	900

ANNEXURE – A

1 **Hydraulic Internal Pressure Test on Shells (if applicable)**

The test shall be carried out on 100% disc strain insulator shells before assembly. The details regarding test will be as discussed and mutually agreed to by the Contractor and Owner in Quality Assurance Programme.

2 **Thermal Mechanical Performance Test**

Thermal Mechanical Performance Test shall be performed in accordance with IEC-383-1-1993 Clause 20 with the following modifications :

(1) The applied mechanical load during this test shall be 70% of the rated electromechanical or mechanical value.

(2) The acceptance criteria shall be

(a) X greater than or equal to R + 3S.

Where

X Mean value of the individual mechanical failing load.

R Rated electro-mechanical / mechanical failing load.

S Standard deviation.

(b) The minimum sample size shall be taken as 20 for disc insulator units.

(c) The individual electromechanical failing load shall be at least equal to the rated value. Also puncture shall not occur before the ultimate fracture.

3 **Electromechanical/Mechanical Failing Load Test.**

This test shall be performed in accordance with clause 18 and 19 of IEC 383 with the following acceptance

(i) X greater than or equal to R + 3S

Where

X Mean value of the electro-mechanical/mechanical/ failing load.

R Rated electro-mechanical / mechanical failing load.

S Standard deviation.

(ii) The minimum sample size shall be taken as 20 for disc insulators units. However, for larger lot size, IEC 591 shall be applicable.

(iii) The individual electro-mechanical/mechanical failing load shall be at least equal to the rated value. Also electrical puncture shall not occur before the ultimate fracture.

4 **Chemical Analysis of Zinc used for Galvanizing**

Samples taken from the zinc ingot shall be chemically analysed as per IS:209. The purity of zinc shall not be less than 99.95%.

5 **Tests for Forgings**

The chemical analysis, hardness tests and magnetic particle inclusion test for forgings, will be as per the internationally

recognised procedures for these tests. The sampling will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Contractor and Owner in Quality Assurance Programme.

6 Tests on Castings

The chemical analysis, mechanical and metallographic tests and magnetic particle inclusion for castings will be as per the internationally recognised procedures for these tests. The samplings will be based on heat number and heat treatment batch. The details regarding test will be as discussed and mutually agreed to by the Contractor and Owner in Quality Assurance Programme.