

Technical Specifications of 33KV Pin Insulator

1. Scope of Work:-

This Specification covers design, engineering, manufacture, assembly, stage testing, inspection & testing before supply and delivery at site of the 33KV Pin & Disc Insulator.

2. APPLICABLE STANDARDS:-

Unless otherwise stipulated in this specification, the insulators shall comply with the Indian standard specification IS: 731-1971 and the insulator fittings with IS:2486(Pt.-I)-1971 and IS:2486(Pt . II)-1974 or the latest version thereof.

3. INSULATORS:-

3.1 General Requirements

- 3.1.1 The Porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed.
- 3.1.2 Unless otherwise specified, the glaze shall be brown in colour. The glaze shall cover all the porcelain parts of the insulator except those areas which serve as supports during firing or are left unglazed for the purpose of assembly.
- 3.1.3 The design of the insulator shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. The porcelain shall not engage directly with hard metal.
- 3.1.4 Cement used in the construction of the 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. The cement shall not give rise to chemical reaction with metal fittings, and its thickness shall be as uniform as possible.

3.2 Creepage Distance

The minimum creepage distance shall be as under:

Highest System Voltage	Normal & moderately polluted atmospheres (total)	Heavily polluted atmospheres (total)
(1)	(2)	(3)
36KV	580mm	840mm

Note: For insulator used in an approximately vertical position the values given in col.(2) or (3) shall apply. For insulators used in an approximately horizontal position, the value given in col. (2) shall apply but the value in Col.(3) may be reduced by as much as 20%.

3.3 Tests:

The insulators shall comply with the following tests as per IS:731-1971.

3.3.1 Type tests

- a) Visual examination
- b) Verification of dimensions
- c) Visible discharge test
- d) Impulse voltage withstand test.
- e) Wet power-frequency voltage withstand test.
- f) Temperature cycle test.
- g) Electro-mechanical failing load test.
- h) Mechanical failing load test (for those of type B string insulator units to which electro mechanical failing load test (g) is not applicable.
- i) Twenty four hours mechanical strength test (for string insulators only when specified by the purchaser).
- j) Puncture test
- k) Porosity test and
- l) Galvanising test.

3.3.2 Acceptance Tests

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

- a) Verification of dimensions.
- b) Temperature cycle test.
- c) Twenty four hours mechanical strength test (for string insulator units only when specified by the purchaser)
- d) Electro-Mechanical failing load test.
- e) Puncture test
- f) Porosity test and
- g) Galvanizing test.

3.3.3 Routine Test

- a) Visual examination.
- b) Mechanical routine test (for string insulator units only) and
- c) Electrical routine test (for string insulator units only)

3.4 Marking

3.4.1 Each Insulator shall be legibly and indelibly marked to show the following.

- a) Name and trade mark of the manufacturer.
- b) Month and year of manufacture
- c) Minimum failing load in kN.
- d) ISI Certification mark, if any.
- e) Property of WESCO
- f) Specific Parameters & Layout Conditions.

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

4. Packing

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

GURANTEED TECHNICAL PARTICULARS OF 33KV PIN INSULATOR

(To be submitted along with offer)

Sl. No.	Description	Requirement	Bidder's offer
1	Name & Address of the Manufacture Name		
2	Normal working voltage	33KV(rms)	
4	High system voltage	36KV(rms)	
5	Visible Discharge Voltage dry PF	27KV(rms)	
6	Dry Power frequency 1 Minute withstand voltage	95KV(rms)	
7	Wet Power frequency 1 Minute withstand voltage	75KV(rms)	
8	Power Frequency puncture withstand voltage	180KV(rms)	
9	Impulse withstand voltage	170 KV	
11	Minimum failing load	10KN	
12	Minimum creepage distance	580mm	
13	Colour of glaze	Brown	
14	Weight per unit	To be submitted by bidder	
15	Size of Insulator		

(a)	Height	To be submitted by bidder	
(b)	Diameter	To be submitted by bidder	
16	Material of thimble	Lead	
17	Steel head	Large head	
18	Standard	IS: 731/1971	
19	Tolerance	Tolerance will be allowed as per IS:731/1971 or latest amendments if any.	
20	Drawing & Sample	To be submitted by bidder	

PACKING: All insulators shall be packed in wooden crates suitable for easy but rough handling & acceptable for road transport. Where more than one insulator are packed in a crate, Separator shall be fixed between the insulators to keep individual insulator in position without movement in the crate.

Technical Specification of 33KV 120kN (B&S type) Disc Insulator

1. **SCOPE:-** This specification provides for design, manufacture, engineering, inspection and testing before dispatch packing and delivery FOR (destination) of disc. Insulators as per technical requirements furnished in this specification.

These insulators are to be used in suspension and tension insulators strings for the suspension and anchoring of the bus-bar conductors.

2. **STANDARDS:-**

Except as modified in this specification, the disc insulators shall conform to the following Indian Standards, which shall mean latest revisions and amendments. Equivalent International and Internally recognized standards to which some of these standards generally correspond are also listed below.

Sl. No.	Indian Standard	Description of Test	International Standard
1.	IS: 206	Method for Chemical Analysis of Slab Zinc.	
2.	IS: 209	Specification for Zinc.	BS: 3436
3.	IS: 731	Porcelain insulators for overhead power lines with a normal voltage greater than 1000V	BS: 137(I&II); IEC 274 IEC 383
4.	IS: 2071 Part-(I) Part-(II)	Method of High Voltage Testing.	
5.	IS: 2121	Specification of Conductors and Earth wire Accessories for Overhead Power lines. Armour Rods, Binding wires and tapes for conductor.	
6.	IS: 2486	Specification for Insulator fittings for overhead power lines with 1000V	
	Part – I	General Requirement and Tests.	BS: 3288
	Part – II	Dimensional Requirements.	IEC: 120
	Part – III	Locking devices.	IEC: 372
7.	IS: 2629	Recommended practice for Hot Dip. Galvanisation for iron and steel.	
8.	IS: 2633	Testing for Uniformity of Coating of Zinc coated articles.	
9.	IS: 3138	Hexagonal Bolts & Nuts.	ISO/R 947 & ISO/R272
10.	IS: 3188	Dimensions for Disc Insulators.	IEC: 305
11.	IS: 4218	Metric Screw Threads	ISO/R 681969 R 261963, R 262-1969 & R965-1969
12.	IS: 6745	Determination of weight of zinc coating on zinc coated iron and steel articles.	
13.	IS: 8263	Methods of RIV Test of HV insulators.	IEC 437 NEMA Publication No.107/1964 CISPR
14.	IS: 8269	Methods for switching impulse test on HV insulators	IEC: 506
15.		Thermal mechanical performance test and mechanical performance test on string insulator units.	IEC: 575
16.	IEC	Long Rod Insulators	IEC-433

The standards mentioned above are available from:

Reference.	Abbreviation	Name & Address:
BS		British Standards, British Standards Institution, 101, Pentonville Road, N-19
IEC/ CISPR		International Electro technical commission Electro Technique International. 1, Rue de verembe
IS		Bureau of Indian Standards, Manak Bhavan, 9 Bahadurshah Zafar Marg, New Delhi
ISO		International Organisation for Standardization. Danish Board of Standardization Dansk Standardizing Sraat Aurehoegvej-12 DK-2900 Helleprup
NEMA		National Electric Manufacturers Association, 1`55, East 44 th . Street New York, NY 10017

3. **PRINCIPAL PARAMETERS. DETAILS OF DISC INSULATORS:-**

The Insulator strings shall consist of standard discs for use in three phases, 50 Hz 33/11KV S/s of WESCO in a moderately polluted atmosphere. The discs shall be cap and pin, ball and socket type, radio interference and have characteristics as shown in Table-I and all ferrous parts shall be hot dip galvanized as per the latest edition of IS: 2629. The zinc to be used for making sleeves shall be 99.95 % pure.

4. **SPECIFICATION DRAWINGS:-**

The specification in respect of the disc insulators are described. This specification for information and guidance of the Bidder only. The drawings to be furnished by the supplier shall be as per his own design and manufacture and in line with the specification.

5. **GENERAL TECHNICAL REQUIREMENTS:-**

5.1 **Porcelain:**

The porcelain used in the manufacture of the shells shall be ivory white nonporous of high dielectric, mechanical and thermal strength, free from internal stresses blisters, laminations, voids, forgone matter imperfections or other defects which might render it in any way unusable for insulator shells. Porcelain shall remain unaffected by climatic conditions ozone, acid, alkalis, zinc or dust. The manufacturing shall be by the wet process and impervious character obtained by through verification.

The insulator shall be made of highest grade, dense, homogeneous, wet-process porcelain, completely and uniformly vitrified throughout to produce uniform mechanical and electrical strength and long life service. The porcelain shall be free from warping, roughness, cracks, blisters, laminations, projecting points foreign particles and other defects, except those within the limits of standard accepted practice. Surfaces and grooves shall be shaped for easy cleaning. Shells shall be substantially symmetrical.

5.2 **Porcelain glaze:**

Surface to come in contact with cement shall be made rough by stand glazing. All other exposed surfaces shall be glazed with ceramic materials having the same temperature coefficient of expansion as that of the insulator shell. The thickness of the glaze shall be uniform throughout and the colour of the glaze shall be down. The Glaze shall have a visible luster and smooth on surface and be capable of satisfactory performance under extreme tropical climatic weather conditions and prevent ageing of the porcelain. The glaze shall remain under compression on the porcelain body throughout the working temperature range.

5.3 **METAL PARTS:**

(i) Cap and Ball Pins:

Ball pins shall be made with drop forged steel caps with malleable cast iron. They

shall be in one single piece and duly hot dip galvanized. They shall not contain parts or pieces joined together welded, shrink fitted or by any other process from more than one piece of materials. The pins shall be of high tensile steel, drop forged and heat-treated. The caps shall be cast with good quality black heart malleable cast iron and annealed. Galvanizing shall be by the hot dip process with a heavy coating of zinc of very high purity. The bidder shall specify the grade composition and mechanical properties of steel used for caps and pins. The cap and pin shall be of such design that it will not yield or distort under the specified mechanical load in such a manner as to change the relative spacing of the insulators or add other stresses to the shells. The insulator caps shall be of the socket type provided with nonferrous metal or stainless steel cotter pins and shall provide positive locking of the coupling.

(ii) Security Clips:

The security clips shall be made of phosphor bronze or of stainless steel.

5.4 FILLER MATERIAL:

Cement to be used, as a filler material is quick setting, fast curing Portland cement. It shall not cause fracture by expansion or loosening by contraction. Cement shall not react chemically with metal parts in contact with it and its thickness shall be as small and as uniform as possible.

6. MATERIALS DESIGN AND WORKMANSHIP:

6.1 GENERAL:

All raw materials to be used in the manufacture of these insulators shall be subject to strict raw material quality control and to stage testing/ quality control during manufacturing stage to ensure the quality of the final end product. Manufacturing shall conform to the best engineering practices adopted in the field of extra high voltage transmission. Bidders shall therefore offer insulators as are guaranteed by them for satisfactory performance on Transmission lines.

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

6.2 INSULATOR SHELL:

The design of the insulator shells shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. Shells with cracks shall be eliminated by temperature cycle test followed by mallet test. Shells shall be dried under controlled conditions of humidity and temperature.

6.3 METAL PARTS:

- i. The twin ball pin and cap shall be designed to transmit the mechanical stress 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 loaded conditions. The head portion of the pinball shall be suitably designed so that when the insulator is under tension the stresses are uniformly distributed over the pinhole portion of the shell. The pinball shall move freely in the cap socket either during assembly of a string or during erection of a string or when a string is placed in position.
- ii. Metal caps shall be free from cracks, seams, shrinks, air holes, blowholes and rough edges. All metal surfaces shall be perfectly smooth with no projecting part or irregularities, which may cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stress uniformly. Pins shall not show any microscopically visible cracks, inclusions and voids.

6.4 GALVANIZING:

All ferrous parts, shall be hot dip galvanized in accordance with IS: 2629. The zinc to be used for galvanizing shall conform to grade Zn 99.5 as per IS: 209. The zinc coating shall be uniform, smoothly adherent, reasonably light, continuous and free from impurities such as flux, ash, rust stains, bulky white deposits and blisters. Before ball fittings are galvanized, all die flashing on the shank and on the bearing surface of the ball shall be carefully removed without reducing the designed dimensional requirements.

6.5 CEMENTING:

The insulator design shall be such that the insulating medium shall not directly engaged with hard metal. The surface of porcelain and coated with resilient paint to offset the effect of difference in thermal expansions of these materials. High quality Portland cement shall be used for cementing the porcelain to the cap & pin.

6.6 SECURITY CLIPS (LOCKING DEVICES)

The security clips to be used as locking device for ball and socket coupling shall be "R"-shaped hump type to provide for positive locking of the coupling as per IS: 2486 (Part-IV). The legs of the security clips shall allow for spreading after installation to prevent complete withdrawal from the socket. The locking device shall resilient corrosion resistant and of sufficient mechanical strength. There shall be no possibility of the locking device to be displaced or be capable of rotation, which placed in position, and under no circumstances shall it allow separation of insulator units and fittings. "W"-type security clips are also acceptable. The hole for the security clip shall be counter sunk and the clip shall be of such design that the eye of the clip may be engaged by a hot line clip puller to provide for disengagement under energized conditions. The force required for pulling the clip into its unlocked positions shall not be less than 50 N (5 kg.) or more than 500 N (50 kgs.).

6.7 MARKING:

Each insulator shall have the rated combined mechanical and electrical strength marked clearly on the porcelain surface. Each insulator shall also bear symbols identifying the manufacturer, month, and year of manufacture. Marking on porcelain shall be printed, not impressed, and shall be applied before firing.

6.8 BALL AND SOCKET DESIGNATION:

The dimensions of the ball and sockets for 120KN discs shall be of 20 mm designation in accordance with the standard dimensions stated in IS:2486 (Part-II).

7. INTERCHANGEABILITY:

The insulators inclusive of the ball and socket fittings shall be of standard design suitable for use with hardware fittings of any make conforming to relevant Indian Standards.

8. FREEDOM FROM DEFECTS:

Insulators shall have none of the following defects:

- 1) Ball pin shake.
- 2) Cementing defects near the pin like small blow holes, small hair cracks lumps etc.
- 3) Sand fall defects on the surface of the insulator.

9. INSULATOR STRINGS:

9.1 TYPE AND RATING:

The insulator strings shall be formed with standard discs described in this specification for use on 3-phases, 33KV, 50Hz effectively earthed systems in an atmosphere with pollution level as indicated in project synopsis. Tension insulator strings for use with Anchor / Tension towers are to be fitted with discs of 120KN KN EMS level rating.

9.2 STRING SIZE:

The sizes of the disc insulator, the number to be used in different types of strings, their electro-

mechanical strength and minimum nominal creep age distance shall be as given in this specification. Insulator units after assembly shall be concentric and coaxial within limits as permitted by Indian Standards. The strings design shall be such that when units are coupled together there shall be contact between the shell of one unit and metal of the adjacent unit.

9.3 DIMENSIONAL TOLERANCE OF INSULATORS DISCS

It shall be ensured that the dimensions of the long rod insulators are within the limits as per relevant IEC/ISS.

10. TESTS (FOR DISC INSULATORS) :

The following tests shall be carried out on the insulator string and disc insulators.

10.1 TYPE TEST:

This shall mean those tests, which are to be carried out to prove the design, process of manufacture and general conformity of the material and product with the intents of this specification. These tests shall be conducted on a representative number of samples prior to commencement of commercial production. The Bidder shall indicate his schedule for carrying out these tests.

10.2 ACCEPTANCE TESTS:

This shall mean these tests, which are to be carried out on samples taken from each lot offered for pre-dispatch inspection for the purpose of acceptance of the lot.

10.3 ROUTINE TESTS:

This shall mean those tests, which are to be carried out on each insulator to check the requirements, which are likely to vary during production.

10.4 TESTS DURING MANUFACTURE:

Stage tests during manufacture shall mean those tests, which are to be carried out during the process of manufacture to ensure quality control such that the end product is of the designed quality conforming to the intent of this specification.

11. TEST PROCEDURE AND SAMPLING NORMS:

The norms and procedure of sampling for the above tests shall be as per the relevant Indian Standard or the internationally accepted standards. This will be discussed and mutually agreed to between the supplier and purchaser before placement of order. The standards and normal according to which these tests are to be carried out are listed against each test. Where a particular test is a specific requirement of this specification, the norms and procedure for the same shall be as mutually agreed between the supplier and the purchaser in the quality assurance programme.

11.1 TYPE TESTS:

The following type test shall be conducted on a suitable number of individual unit components, materials or complete strings.

- | | Standard: |
|--|--------------------------|
| i) On complete insulator string with hardware fittings | |
| a) Power frequency voltage withstand test with corona control rings and under wet condition. | BS: 137(Part-I) IEC:383 |
| b) Impulse voltage withstand test under dry condition | |
| c) Mechanical strength test | As per the Specification |
| ii) On Insulators | |
| a) Verification of dimensions. | IS: 731 |
| b) Thermal mechanical performance test: | IEC:575 |
| c) Power frequency voltage withstand and flashover | BS:173 |
| (i) dry (ii) wet. | |

- d) Impulse voltage withstand flashover test (dry) IEC:383
Visible discharge test (dry)
- e) All the type tests given under clause No.5.14 above shall be conducted on single suspension and Double Tension insulator string along with hardware fittings IS:731

11.2 ACCEPTANCE TESTS: For insulator:

- a) Visual examination : IS:731
- b) Verification of dimensions : IS: 731
- c) Temperature cycle test : IS: 731
- d) Galvanizing test : IS: 731
- e) Mechanical performance test : IEC:575
- f) Test on locking device for ball and socket coupling : IEC: 372
- g) Eccentricity test
- h) Electro-mechanical strength test : As per the specification
- i) Puncture test : IS: 731
- j) Porosity test : IS: 731

11.3 ROUTINE TESTS: For insulators:

- a) Visual inspection : IS: 731
- b) Mechanical routine test
- c) Electrical routine test : IEC:383

11.4 ADDITIONAL TESTS:

The purchaser reserves the right for carrying out any other tests of a reasonable nature at the works of the supplier/ laboratory or at any other recognized laboratory/ research institute in addition to the above mentioned type, acceptance and routine tests at the cost of the purchaser to satisfy that the material complies with the intent of this specification.

12. IDENTIFICATION MARKING:

- a) Each unit of insulator shall be legibly and indelibly marked with the trade mark of the supplier, the year of manufacture, the guaranteed combined mechanical and electrical strength in kilo-Newton abbreviated by 'KN' to facilitate easy identification and proper use.
- b) The marking shall be on porcelain for porcelain insulators. The marking shall be printed and not impressed and the same shall be applied before firing.

13. QUALITY ASSURANCE PLAN:

The bidder here under shall invariably furnish following information along with his offer, failing which the offer shall be liable for rejection.

- a. Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw material are tested, list of tests normally carried out on raw materials in presence of bidder's representative, copies of test certificates.
- b. Information and copies of test certificates as in (i) above in respect of bought out materials.
- c. List of manufacturing facilities available.
- d. Level of automation achieved and lists of area where manual processing exists.
- e. List of areas in manufacturing process, where stage inspections are normally carried out in quality control and details of such tests and inspection.

- f. Special features provided in the equipment to make it maintenance free.
- g. List of testing equipping available with the bidder for final testing of equipment specified and test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in schedule of deviations from specified test requirements.

14. CHEMICAL ANALYSIS OF ZINC USED FOR GALVANIZING.

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

15. TESTS FOR FORGINGS:

The chemical analysis hardness tests and magnetic particle inspection for forgings will be as per the internationally recognized 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 supplier and purchaser in quality assurance programme.

16. TESTS ON CASTING:

The chemical analysis mechanical and metallographic tests and magnetic particle inspection for castings will be as per the internationally recognized 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 supplier and purchaser in quality assurance programme.

17. HYDRAULIC INTERNAL PRESSURE TEST ON SHELLS:

The test shall be earned out on 100% shells before assembly. The details regarding test will be as discussed and mutually agreed to by the suppliers and purchaser in Quality Assurance Programme.

18. THERMAL MECHANICAL PERFORMANCE TEST:

The thermal mechanical performance test shall be carried out on minimum 15 number of disc insulators units as per the procedure given in IEC 575. The performance of the insulator unit shall be determined by the same standard.

19. ECCENTRICITY TEST:

The insulator shall be vertically mounted on a future using dummy pin and socket. A vertical scale with horizontal slider shall be used for the axial run out. The pointer shall be positioned in contact with the bottom of the outermost petticoat of the disc. The disc insulators shall be rotated with reference to the fixture and the slider shall be allowed to move up and down on the scale but always maintaining contact with the bottom of the outer most petticoats. After one full rotation of the disc the maximum and minimum position the slider has reached on the scale can be found out. Difference between the above two readings shall satisfy the guaranteed value for axial run out.

Similarly using a horizontal scale with veridical slider the radial run out shall be measured. The slider shall be positioned on the scale to establish contact with the circumstance of the disc insulator and disc insulator rotated on its future always maintaining the contact. After one full rotation of the disc the maximum and minimum position the slider has reached on the scale can be found out. Difference between the above two readings shall satisfy the guaranteed value for axial run out.

20. CRACK DETECTION TEST:

Crack detection test shall be carried out on each ball and pin before assembly of disc unit. The supplier shall maintain complete record of having conducted such tests on each and every piece of ball pin the bidder shall furnish full details of the equipment available with him for crack test and also indicate the test procedure in detail.

GUARANTEED TECHNICAL PARTICULARS OF 33KV 1 2 0 k N DISC INSULATOR (B&S TYPE)

(To be submitted along with offer)

Sl. No.	Description	Unit	Requirement	Bidder's
1	Disc Diameter	mm		
2	Disc spacing	mm		
3	Creepage distance			
	(a) Total	mm		
	(b) Protected	mm		
4	Combined electromechanical strength.	Kgs.	120kN	
5	Dry one minute power frequency withstand	KV	75	
6	Wet one minute power frequency withstand.	KV		
7	Dry power frequency flashover.	KV		
8	Wet power frequency flashover.	KV		
9	Dry impulse withstand positive & negative.	KV (Peak)	170	
10	Impulse flashover 1 x 50 microsecond (Positive)	KV (Peak)		
11	Impulse flashover 1 x 50 microsecond (Negative)	KV(Peak)		
12	Power frequency puncture voltage	Kv	1.3 times the actual drive flashover	
13	High system voltage.	KV	36	
14	Visible Discharge voltage.	KV	27	
15	Weight/Unit.	Kg.		
16	Marking :--	Each insulator will be legibly marked to show the		
		(a) Name of the Purchaser :-- WESCO		
		(a) Name or trademark :--		
		(c) Month & year of Manufacturing :--		
		(d) Minimum failing load.		
	PACKING:- All insulators shall be packed suitably for easy but rough handling & acceptable for road transport. Where more than one insulator is packed in a crate, separator shall be fixed between the insulators to keep individual insulator in position without movement in the crate.			

Technical Specification of 11KV Insulator

1. 11KV Pin Insulator:- Confirming to IS:731/71 & 77 with latest amendments
2. 11KV (70kN) Disc Insulator (B&S type):- Confirming to IS 731/71 (Reaffirmed 2001), with latest amendments, Ball & Socket type, EMS- 70kN
3. 11KV (45kN) Disc Insulator (T&C type):- Confirming to IS:731-1971 with latest amendments

1. Scope:-

This specification covers manufacturing, testing and supply of 11KV Pin Insulator, 11KV (70kN) Disc Insulator (B&S type) and 11KV (45kN) Disc Insulator (T&C type) confirming to IS with latest amendment.

2. PORCELAIN GLAZE:-

Surfaces to come in contact with cement shall be made rough by sand glazing. All other exposed surfaces shall be glazed with ceramic materials having the same temperature coefficient of expansion as that of the insulator shell. The thickness of the glaze shall be uniform throughout and the colour of the glaze shall be brown. The glaze shall have a visible luster and smooth on surface and be capable of satisfactory performance under extreme tropical climatic weather conditions and prevent ageing of the porcelain. The glaze shall remain under compression on the porcelain body throughout the working temperature range.

3. METAL PARTS:-

Cap and Ball Pins:-

Twin Ball pins shall be made with drop forged steel and caps with malleable cast iron. They shall be in one single piece and duly hot dip galvanized. They shall not contain parts or pieces joined together, welded, shrink fitted or by any other process from more than one piece of material. The pins shall be of high tensile steel, drop forged and heat malleable cast iron and annealed. Galvanizing shall be by the hot dip process with a heavy coating of zinc of very high purity with minimum of 6 dips. The bidder shall specify the grade, composition and mechanical properties of steel used for caps and pins.

4. SECURITY CLIPS:-

The security clips shall be made of phosphor bronze or of stainless steel.

5. FILLER MATERIAL:-

Cement to be used as a filler material shall be quick setting, for curing Portland cement. It shall not cause fracture by expansion or loosening by contraction. Cement shall not react chemically with metal parts in contact with it and its thickness shall be as small and as uniform as possible.

6. Tests:-

Suitable number of individual units and complete string shall be subject to the following tests in accordance with IS:731/1971 with its latest amendments.

6.1. Type Tests:

Following Type test shall be carried out on porcelain insulators as specified in IS:731 /971 amended up to date.

1. Visual Examination.
2. Verification of dimensions.
3. Visible Discharge Test.
4. Impulse voltage withstand test.
5. Impulse voltage flashover test.
6. Wet one Minute Power Frequency withstand test and Wet Flashover test.
7. Temperature Cycle test.
8. Electromechanical failing load test.
9. Power frequency puncture withstand test.
10. Porosity test.

11. Galvanizing test.

6.2. Acceptance Tests:

The test samples after having withstood the routine test shall be subject to the following acceptance tests in order indicated below:

1. Verification of dimensions.
2. Temperature Cycle test.
3. Twenty four hour mechanical test.
4. Electromechanical failing load test.
5. Power Frequency puncture withstand test.
6. Porosity test.
7. Galvanizing test.

6.3. Routine Tests:

1. Visual Examination
2. Mechanical test
3. Electrical test
4. Twenty four hours mechanical test
5. Electro mechanical failing load test

7. Testing Facilities :-

The bidder must clearly indicate what testing facilities are available in the works of the manufacturer and whether facilities are adequate to carry out all Routine & acceptance Tests. These facilities should be available to Board'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. The insulators shall be tested in accordance with the procedure detailed in IS-731/1971 amended up to date.

8. MATERIAL DESIGN AND WORKMANSHIP:-

- i) All raw materials to be used in the manufacture of these insulators shall be subject to strict raw materials quality control and to stage testing quality control during manufacturing stage to ensure the quality of the final end product. Manufacturing shall conform to the best engineering practices adopted in the field of extra high voltage transmission. Bidders shall therefore offer insulators as are guaranteed by them for satisfactory performance on Transmission lines.
- ii) The design, manufacturing process and material control at various stages be such as to give maximum working load, highest mobility, best resistance to corrosion good finish, elimination of sharp edges and corners to limit corona and radio interference voltage.

9. INSULATOR SHELL:-

The design of the insulator shell shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. Shells with cracks shall be eliminated by temperature cycle test followed by temperature cycle test followed by mallet test. Shells shall be dried under controlled conditions of humidity and temperature.

10. METAL PARTS:-

- a) The twin ball 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 loaded conditions. The head portion of the insulator or is under tension the stresses are uniformly distributed over the pinhole portion of the shell. The pinball shall move freely in the cap socket either during assembly of a string or during erection of a string or when a string is placed in position.
- b) Metal caps shall be free from cracks, seams, shrinks, air holes, blowholes and rough edges. All metal surfaces shall be perfectly smooth with no projecting parts or irregularities which may

cause corona. All load bearing surfaces shall be smooth and uniform so as to distribute the loading stresses uniformly. Pins shall not show any macroscopically visible cracks, insulations and voids.

11. GALVANIZING:-

All ferrous parts shall be hot dip galvanized six times in accordance with IS: 2629. The zinc to be used for galvanizing shall conform to grade Zn 99.5 as per IS: 209. The zinc coating shall be uniform, smoothly adherent, reasonably light, continuous and free from impurities such as flux ash, rust stains, bulky white deposits and blisters. Before ball fittings are galvanized, all die flashing on the shank and on the bearing surface of the ball shall be carefully removed without reducing the designed dimensional requirements.

12. CEMENTING:-

The insulator design shall be such that the insulating medium shall not directly engage with hard metal. The surfaces of porcelain and coated with resilient paint to offset the effect of difference in thermal expansions of these materials.

13. Markings:

13.1 Each insulator shall be legibly and indelibly marked to show the following :

- (a) Name or trade mark of the manufacturer.
- (b) Voltage Type
- (c) Month and year of manufacturing.
- (d) Electromechanical strength in KN
- (e) Property of WESCO.

13.2 The “W” clip shall be marked with/punched with the ball and socket sizes for which it is meant. e.g.16B,20 etc.

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

14. Packing :

All insulators shall be packed in crates or boxes suitable for rough handling. Packing shall be marked with the strength and KV rating.

Guaranteed Technical Particulars of 11 KV Pin Insulator

(To be submitted along with offer)

Sl. No.	Description	Bidder's Offer
1	Name & Address of manufacturer	
2	Applicable standard	
3	Type of insulator	
4	Dry impulse withstand voltage	
5	Wet power frequency, 1 minute withstand voltage	
6	Dry Critical Impulse Flashover Voltage	
7	Dry power frequency, Critical Flashover Voltage	
8	Wet power frequency, Critical Flashover Voltage	
9	Power frequency Puncture Voltage	
10	Safe Working Load	
11	Minimum Failing Load	
12	Creepage Distance	
13	Protected Creepage Distance	
14	Type and Grade of Materials : Insulator	
15	Type and Grade of Materials : Thimble	
16	Type and Grade of Materials : Cement	
17	Type of semi conducting Glaze	
18	Radius of conductor Groove	

19	Colour of Insulator	
20	Weight of Insulator	
21	Whether drawing showing dimensional details have been furnished along with Bid	
22	Whether Type Test Certificate have been furnished	
23	Other particulars (if any)	

Date:

Seal & Signature of Tenderer

Guaranteed Technical Particulars of 11 KV Disc Insulator

(To be submitted along with offer)

Sl. No.	Description	Bidder's Offer	
		70kN (B&S type)	45kN (T&C type)
1	Name & Address of manufacturer		
2	Applicable standard		
3	Type of insulator		
4	Nominal System Voltage		
5	Highest System Voltage		
6	Dry impulse withstand voltage		
7	Wet power frequency, 1 minute withstand voltage		
8	Dry Critical Impulse Flashover Voltage		
9	Dry power frequency, Critical Flashover Voltage		
10	Wet power frequency, Critical Flashover Voltage		
11	Power frequency Puncture Voltage		
12	Mechanical Routine Test Load		
13	Mechanical Impact Strength		
14	Shattered Strength (Glass)		
15	Electromechanical Failing Load		
16	Safe Working Load		
17	Minimum Failing Load		
18	Creepage Distance		
19	Protected Creepage Distance		
20	Type and Grade of Materials : Insulator		
21	Type and Grade of Materials : Cap		
22	Type and Grade of Materials : Pin		
23	Type and Grade of Materials : Locking Pin		
24	Type and Grade of Materials : Cement		
25	Type of semi conducting Glaze		
26	Colour of Insulator		
27	Weight of Insulator		
28	Whether drawing showing dimensional details have been furnished along with Bid		
29	Whether Type Test Certificate have been furnished		
30	Other particulars (if any)		

Date:

Seal & Signature of Tenderer

Technical Specification of HT & LT Stay Insulator

1. 11KV HT Stay Insulator (Type-C):- Confirming to IS:5300, Minimum mechanical failing load- 88kN, Minimum creepage distance- 57mm
2. LT Stay Insulator:- Confirming to IS: 5300, Minimum mechanical failing load- 53kN, Minimum creepage distance- 48mm

1. General requirement for Stay Insulators:-

These insulators shall generally comply with latest version of IS: 1445, REC Specification No.4/1972 and fittings with IS: 7935-1975 or the latest version thereof. Guy strain insulators shall conform to designation 'C' for H.T. & 'B' for L.T. as per IS: 5300.

2. Insulator Materials:-

2.1 Porcelain:-

The porcelain used in the manufacture of shells shall be sound, free from defects thoroughly vitrified and smoothly glazed. It should not engage directly with hard metal.

2.2 Glaze:-

The finished porcelain shall be glazed in brown colour. The glaze shall cover all exposed parts of the insulator and shall have a good luster, smooth surface and good performance under the extreme weather conditions of a tropical climate. It shall not crack or chip by ageing under the normal service conditions. The glaze shall have the same co-efficient of expansion as if the porcelain body throughout the working temperature range. The insulator shall be so designed that the stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.

2.3 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.

3. QUALITY ASSURANCE AND TESTING:-

2.1 Type Tests:-

Reports of the following type tests conducted in any NABL accredited laboratory, shall have to be submitted along with the bid.

- i. Visual examination
- ii. Verification of dimensions
- iii. Visible Discharge test (dry)
- iv. Impulse voltage withstand and flashover test(dry)
- v. Power frequency voltage withstands and flashover test (dry)
- vi. Power frequency voltage withstands and flashover test (wet)
- vii. Temperature Cycle test
- viii. 24 hour Mechanical Strength Test for Strain Insulator
- ix. Puncture Test
- x. Porosity Test
- xi. Galvanizing Test
- xii. Electro-mechanical failing test
- xiii. Thermal mechanical performance test

Note: Type test reports shall be submitted for acceptance which should not be more than five (05) years old as on date of bid opening.

2.2 Acceptance Tests:-

The following tests shall be conducted at the works of the manufacturer on a suitable number of individual insulators.

- i. Verification of dimensions
- ii. Temperature cycle test
- iii. Electro-mechanical failing test
- iv. Puncture Test
- v. Porosity Test
- vi. Galvanizing Test

2.3 Routine Test:-

The manufacturer should have facilities to conduct following routine tests at their works.

- i. Visual Inspection
- ii. Mechanical routine test
- iii. Electrical routine test
- iv. Hydraulic Internal Pressure on shells

The bidder shall have to submit the list testing and measuring equipments along with bid documents.

2.4 Test during Manufacture:-

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

2.5 Thermal Mechanical Performance Test (if applicable)

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

- i. The applied mechanical load during this test shall be 70% of the rated electromechanical or mechanical value.
- ii. 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.

2.6 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 per 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.

Note: The purchaser had right to waive any type/special test if the supplier produces the test report for such tests conducted on identical Insulators.

3. Packing and Marking

- a) Each insulator shall be visibly and indelibly marked as following :

- (i) Name and Trademark of manufacturer
 - (ii) Month / Year of manufacturer
 - (iii) Minimum failing load in KN
(Marking on porcelain shall be printed / engraved and shall be applied before firing)
- b) All insulators shall be packed in strong seasoned wooden crates. The gross weight of the crates along with the material shall not normally exceed 200 Kg to avoid handling problem
- c) The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
- d) Suitable cushioning, protective padding or spacers shall be provided to prevent damage or deformation during transit and handling.

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.

Guaranteed Technical Particulars of Stay Insulator

(To be submitted along with offer)

Sl. No.	Description of Materials	Bidder's Offer	
		HT Stay Insulator	LT Stay Insulator
1	Name & Address of the manufacturer		
2	Applicable standard & type		
3	Type of insulator		
4	Dry impulse withstand voltage		
5	Wet power frequency 1 minute, withstand voltage		
6	Dry Critical Impulse Flashover Voltage		
7	Dry power frequency, Critical Flashover Voltage		
8	Wet power frequency, Critical Flashover Voltage		
9	Power frequency Puncture Voltage		
10	Safe Working Load		
11	Minimum Failing Load		
12	Creepage Distance		
13	Protected Creepage Distance		
14	Type and Grade of Materials : Insulator		
15	Colour of Insulator		
16	Weight of Insulator		
17	Type of semi-conducting glaze		
18	Minimum dia of Stay wire hole		
19	Whether drawing showing dimensional details have been furnished along with bid		
20	Whether Type Test Certificates have been furnished		
21	Other particulars (if any)		

Date:

Seal & Signature of Tenderer