# POST AND DISC INSULATOR

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*Engineering Department*

WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED
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**Updates for WBSETCL / TECH SPEC / Rev.-3.1**

1. Cluse no: **SPECIFIC TECHNICAL PARTICULARS**

   **Post Insulator**

   **5. Minimum total creepage Distance (mm)** changed to 31mm/kV

## TECHNICAL SPECIFICATION FOR POST & DISC INSULATOR

### 1. SCOPE:

This specification covers design, type testing, manufacture, testing at manufacturer's works, supply, delivery, erection, testing and commissioning of Post Insulators, Anti Fog type Disc Insulators and Disc Insulator Strings suitable for use in heavily polluted atmosphere.

### 2. STANDARD:

The Post and Disc Insulators shall comply in all respect with the provisions of the following Standards as amended up-to-date unless otherwise specified hereinafter and also as per relevant IEC's.

| SL | Standard | Title |
|---|---|---|
| 1 | IS 731 | Specification for porcelain insulators for overhead power lines with nominal voltage greater than 1000 volts. |
| 2 | IS 3188 | Characteristics of String Insulator Units. |
| 3 | IS 2486 | Specification for Insulator fittings for overhead power lines with nominal voltage greater than 1000 volts. |
| 4 | IS 2633 | Method for testing uniformity of coating of Zinc-coated articles. |
| 5 | IS 2544 | Specification for porcelain Post Insulators for system with nominal voltage greater than 1000 Volts. |
| 6 | IS 5350 | Specification for dimensions of indoor and outdoor porcelain Post Insulator and Post Insulator units for system with nominal voltage greater than 1000 Volts. |
| 7 | IEC 383 | Specification for insulator |
| 8 | IEC 60168 | Test on Indoor & Outdoor Post Insulator |
| 9 | IEC 273 | Dimension of Indoor & Outdoor Post Insulator |

### 3. DEVIATIONS:

Normally the offer should be as per Technical Specification without any deviation. But any deviation felt necessary to improve performance, efficiency and quality of the insulator must be mentioned in the Deviation Schedule with reasons duly supported by documentary evidence. Such deviation suggested may or may not be accepted.

### 4. DESIGN CRITERIA & CONSTRUCTION:

#### A. DISC INSULATOR:

(i) The insulator discs shall be cap and ball pin type with Ball and Socket coupling suitable for use in suspension or tension strings. Insulators shall be interchangeable and shall

be suitable for forming either suspension or tension string. Normal type disc insulator with Ball and Socket coupling is not acceptable. Anti fog type disc insulator is to be supplied only.

(ii) The porcelain shall be uniform brown colour, non-porous having high dielectric mechanical and thermal strength, free from internal stresses, blisters, laminations, voids, foreign matters, imperfections or other defects, which might in any way render it unsuitable as insulator shells. Porcelain shall be smoothly glazed to remain unaffected by climatic condition, Ozone, acids, alkalies, zinc or dust.

(iii) The glaze shall have bright Luster, smooth surface, a good performance under extreme weather condition of tropical climate and dust resistant. The glaze shall not crack or chip due to ageing under normal service condition or while handling during transit or erection.

(iv) Cement used in the construction of insulators shall not cause fracture by expansion or loosening by contraction and must have high compressive and shearing strength and free from change in volume due to ageing and temperature change. The cement shall not give rise to chemical reaction with metal fittings. Rapid hardening cement with special sand shall be used for assembly of metal parts.

(v) When operating at normal rated voltage there shall be no electric discharge between insulator and conductor, which would cause corrosion or injury to conductor and insulator by the formation of substance due to chemical action.

(vi) The caps and ball pins of Disc Insulator shall be hot dip galvanised and mechanically strong. The Zn used for galvanising shall be of grade Zn 99.95 as per IS: 209. The ball pins shall move freely in the cap socket, but shall be so designed that they do not disengage while in service. The caps shall be made of heat treated malleable cast iron. These shall be free from cracks, shrinks, air holes, burrs and rough edges. All load bearing surfaces shall be smooth and uniform so as to distribute loading stress evenly.

(vii) The ball pins shall be of forged steel and so designed that they will not yield or distract under loaded conditions. The ball and socket insulators shall be provided with 'R' clip to prevent uncoupling of insulator units from each other. The 'R' clip shall be made of phosphor bronze or stainless steel to safe guard against corrosion.

(viii) The electrical and mechanical characteristic of the Disc Insulator shall conform to specific technical parameters of this specification and relevant Indian Standards.

(ix) The Insulator shall be manufactured with best workmanship. Each Insulator shall have rated strength and Manufacturer's Trade Mark markings on porcelain.

## B. **POST INSULATOR:**

(i) The porcelain used shall be homogeneous, free from lamination, cavities thoroughly verified smoothly glazed and type of post insulator shall be solid core. The glaze shall be of uniform brown in colour. The glaze shall cover the exposed porcelain parts of the insulator. Glazing shall be free from blisters, burrs etc.

(ii) The post insulator shall be designed and manufactured to avoid stresses due to expansion and contraction which may lead to deterioration, stress concentration due to direct engagement of porcelain with metal fittings and shapes which do not facilitate cleaning by normal methods.

(iii) Cement used in the construction of insulators shall not cause fracture by expansion or loosening by contraction and must have high compressive and shearing strength and free from change in volume due to ageing and temperature change. The cement shall

not give rise to chemical reaction with metal fittings. Rapid hardening cement with special sand shall be used for assembly of metal parts. When operating at normal rated voltage there shall be no electric discharge between insulator and conductor, which would cause corrosion or injury to conductor and insulator by the formation of substance due to chemical action.

(iv) All ferrous metal parts except those of stainless steel shall be hot dip galvanised and uniform zinc coating shall satisfy the requirement of IS:2633. The Zinc used for galvanising shall be grade Zn 99.95 as per IS:209. The zinc coating shall be uniform, adherent smooth, reasonably bright, continuous and free from imperfection.

(v) The tapped holes suitable for bolts with threads shall have anti-corrosion protection. The effective length of the thread shall not be less than the nominal diameter of the bolt.

(vi) The electrical and mechanical characteristics of post insulator shall conform to the specific technical parameters of this specification and relevant Indian Standards.

(vii) Post Insulator shall be suitable for upright mounting on steel structures.

(viii) Each Insulator shall have rated strength and Manufacturer's Trade Mark markings.

## 5. GUARANTEE:

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, WBSETCL shall have right to reject the material. Guaranteed Technical Particulars are to be submitted by successful bidder during detailed engineering alongwith submitted drawings/documents.

## 6. CONTRACT DRAWING AND CATALOGUE / MANUAL:

The contractor shall submit six (6) copies of the following drawings and catalogue/manuals for approval:

(i) Dimensional general arrangement drawing showing all fittings and accessories, sectional drawing etc. of individual disc and post insulator with all technical parameters and G.T.P.

(ii) Dimensional general arrangement drawings of insulator string (Tension and Suspension) along with all fittings and accessories, technical parameters of the string.

(iii) Catalogue for individual disc and post insulators including maintenance manual, if any.

(iv) Type test certificates of Post Insulator, Disc Insulator and all type of Insulator string.

## 7. TESTS AND TEST CERTIFICATES:

All routine and acceptance tests of Disc insulator, Post insulator and Disc Insulator string shall be carried out at the works of the manufacturer as per relevant Indian Standards & IEC.

All acceptance tests shall be carried out at the manufacturer's works on every lot offered for inspection as per relevant Indian Standards in presence of the representative of WBSETCL. Selection of samples for acceptance test as well as rejection and re-testing shall be guided

by relevant IS and IEC. The entire cost of acceptance and routine tests that are to be carried out as per relevant IS shall be treated as included in quoted price.

The representative of WBSETCL shall have full facilities for unrestricted inspection of manufacturer's works, the raw materials, manufacture of Disc Insulator and or carrying out necessary tests.

Insulator Disc shall not be dispatched before it has been satisfactorily inspected tested and clearance issued by WBSETCL for dispatch.

Acceptance of any quantity of material shall in no way relieve the contractor of any of its responsibility for meeting all requirements of the Specification and shall not prevent subsequent rejection, if such materials are later found to be defective.

An advance notice shall be given by the contractor to Chief Engineer, Engg. Deptt. intimating the actual date of tests, Routine test reports and details of all inspection that are to be carried out.

Contractor has to co-ordinate among disc insulator manufactures and insulator hardware manufactures for conducting all acceptance test of disc insulator string as per relevant IS &IEC.

Only type tested Insulators are to be offered conforming to our technical specification, and relevant IS and IEC. Offered materials should be similar with ones on which type testing has been carried out. Complete type test reports carried out in Govt. recognized Test House or Laboratory / NABL accredited laboratory shall have to be submitted.

Following Acceptance Test (as applicable) shall be carried out on every Lot offered for inspection.

i) Visual Examinations
ii) Verification of dimension.
iii) Temperature cycle test.
iv) Mechanical strength test.
v) Puncture test.
vi) Porosity test.
vii) Galvanizing test.
viii) Tests on Locking Device for Ball & Socket coupling as per IEC:372
ix) Residual Strength Test as per IEC:797.
x) Eccentricity Test as per IEC:383-1-1993.
xi) Mechanical Performance Test as per IEC:575-1975 cl. 4.0.
xii) Metallurgical Test (Grain size, inclusion rating, chemical analysis, micro structure).
xiii) Electro Mechanical Failing Load Test.
xiv) Steep-wave Front Test (This will be conducted only during first lot of inspection offered for Insulators if not witnessed by WBSETCL Engineers during type test. During this test 10 sample of insulators will be subjected to 5 positive & 5 negative impulses. No puncture should occur. Subsequently each insulator will be subjected to 3 PF flashover under dry condition. The arithmetic means of this dry power frequency voltage flashover values for each insulator should be minimum 95% of declared dry power frequency flashover voltage.

SPECIFIC TECHNICAL PARTICULARS OF ANTI FOG DISC INSULATORS

| **Tension Disc Insulator** | | | | | |
|---|---|---|---|---|---|
| SL NO | DESCRIPTION | TECHNICAL PARAMETERS | | | |
| | | 400KV | 220KV | 132 KV | 33 KV |
| 1 | Rated System Voltage (KV) | 400KV | 220 | 132 | 33 |
| 2 | Highest system Voltage | 420KV | 245 | 145 | 36 |
| 3 | Type | Disc | | | |
| 4 | Insulator material | Porcelain | | | |
| 5 | Diameter of unit (mm) | 280 | 255 | 255 | 255 |
| 6 | Distance between centres of unit (mm) | 170 | 145 | 145 | 145 |
| 7 | Creepage distance of each disc (mm) (minimum and as required to meet total creepage distance) | 430 | 430 | 430 | 430 |
| 8 | Electromechanical strength (KN) | 160 | 120 | 120 | 120 |
| 9 | Method/Attachment between units | Ball and Socket | | | |
| 10 | Ball diameter (mm) | 20 | 20 | 20 | 20 |
| 11 | Nominal Voltage (KV) | 11 | 11 | 11 | 11 |
| 12 | Highest Voltage (KV) | 12 | 12 | 12 | 12 |
| 13 | Wet power frequency withstand voltage (KVrms) | 35 | 35 | 35 | 35 |
| 14 | Power frequency puncture withstand voltage (KV rms) | 1.3 times the actual wet flashover voltage | | | |
| 15 | Impulse withstand Volt (KVp) | 75 | 75 | 75 | 75 |
| 16 | Colour | Glazed Brown | | | |
| 17 | Markings | Markings on porcelain shall be printed and applied before firing | | | |

| | | | | | |
|---|---|---|---|---|---|
| 18 | Min. no. of units in complete string for Sub Station<br><br>For Tr. line | 2x25 / 4X25<br><br>2x23 / 4X23 | 16<br><br>15 | 11<br><br>10 | 3<br><br>3 |
| 19 | 1.2/50 microsecond Impulse withstand voltage of string (KVp) | 1425 | 1050 | 650 | 170 |
| 20 | 250/2500 Switching Impulse withstand voltage of insulator string (KVp) | 1050 | - | - | - |
| 21 | Minimum Corona extinction voltage level of insulator string (KVrms) | 320 | 156 | - | - |
| 22 | Maximum RIV level (in micro volts) at 266KV rms | Not exceeding 1000 | | - | - |
| 23 | One minute power frequency withstand voltage of insulator string (KVrms) | 630 | 460 | 275 | 70 |
| | | | | | |

| **Suspension Disc Insulator** | | | | | |
|---|---|---|---|---|---|
| SL NO | DESCRIPTION | TECHNICAL PARAMETERS | | | |
| | | 400KV | 220KV | 132 KV | 33 KV |
| 1 | Rated System Voltage (KV) | 400KV | 220 | 132 | 33 |
| 2 | Highest system Voltage | 420KV | 245 | 145 | 36 |
| 3 | Type | Disc | | | |
| 4 | Insulator material | Porcelain | | | |
| 5 | Diameter of unit (mm) | 255 | 255 | 255 | 255 |
| 6 | Distance between centres of unit (mm) | 145 | 145 | 145 | 145 |

| | | | | | |
|---|---|---|---|---|---|
| 7 | Creepage distance of each disc (mm) (minimum and as required to meet total creepage distance) | 430 | 430 | 430 | 430 |
| 8 | Electromechanical strength (KN) | 120 | 70 | 70 | 70 |
| 9 | Method/Attachment between units | Ball and Socket | | | |
| 10 | Ball diameter (mm) | 20 | 16 | 16 | 16 |
| 11 | Nominal Voltage (KV) | 11 | 11 | 11 | 11 |
| 12 | Highest Voltage (KV) | 12 | 12 | 12 | 12 |
| 13 | Wet power frequency withstand voltage (KVrms) | 35 | 35 | 35 | 35 |
| 14 | Power frequency puncture withstand voltage (KV rms) | 1.3 times the actual wet flashover voltage | | | |
| 15 | Impulse withstand Volt (KVp) | 75 | 75 | 75 | 75 |
| 16 | Colour | Glazed Brown | | | |
| 17 | Markings | Markings on porcelain shall be printed and applied before firing | | | |
| 18 | Min. no. of units in complete string for Sub Station<br><br>For Tr. line | 24<br><br>23 | 15<br><br>14 | 10<br><br>9 | 3<br><br>3 |
| 19 | 1.2/50 microsecond Impulse withstand voltage of string (KVp) | 1425 | 1050 | 650 | 170 |
| 20 | 250/2500 Switching Impulse withstand voltage of insulator string (KVp) | 1050 | - | - | - |
| 21 | Minimum Corona extinction voltage level of insulator string (KVrms) | 320 | 156 | - | - |
| 22 | Maximum RIV level (in micro volts) at 266KV rms | Not exceeding 1000 | | - | - |

| | | | | | |
|---|---|---|---|---|---|
| 23 | One minute power frequency withstand voltage of insulator string (KVrms) | 630 | 460 | 275 | 70 |
| | | | | | |

| **Post Insulator** | | | | | |
|---|---|---|---|---|---|
| SNO | DESCRIPTION | TECHNICAL PARAMETERS | | | |
| | | 400KV | 220 KV | 132 KV | 33 KV |
| 1 | Rated Voltage (KV) | 400 | 220 | 132 | 33 |
| 2 | Highest System Voltage (KV) | 420 | 245 | 145 | 36 |
| 3 | Type | Solid Core | | | |
| 4 | Insulating material | Brown colour glazed porcelain | | | |
| 5 | Minimum total creepage Distance (mm) (31mm/kV) [R3.1] | ~~10500~~ 13020 | ~~6125~~ 7595 | ~~3625~~ 4495 | ~~900~~ 1116 |
| 6 | Minimum cantilever strength (KN) | 8 | 6 | 4 | 4 |
| 7 | 1.2/50 microsecond Impulse withstand voltage (KVp) | 1425 | 1050 | 650 | 170 |
| 8 | Corona extinction voltage (KV rms) | 320 | 156(min) | 105(min) | N A |
| 9 | Dry & wet One-minute P.F. withstand voltage (KVrms) | 630 | 460 | 275 | 75 |
| | | 400KV | 220 KV | 132 KV | 33 KV |
| 10 | Maxm Radio Interference Voltage (in microvolts) at 305KV (rms) and 156KV (rms) for 400KV & 220KV respectively between phase & ground. | 500 | 500 | 500 | NA |
| 11 | Type of Bus | Tubular Aluminium Pipe | | | |
| 12 | Mounting Position | Upright | | | |
| 13 | Minimum torsoinel moment | As per IEC-273. | | | |
| If corona extinction voltage is achieved with the help of corona ring or any other similar device, the same shall be deemed to be included in the scope of the contractor. | | | | | |

GUARANTEED TECHNICAL PARTICULARS FOR POST AND DISC INSULATORS

(To be filled in and signed by the Bidder)

## I. **SINGLE DISC INSULATORS**

| Sl.no. | Description | 160kN | 120kN | 70kN |
|---|---|---|---|---|
| i) | a) Type of insulators | | | |
| | 1)Ball and socket: | | | |
| | 2)Conventional / Antifog: | | | |
| | b) Size & designation of ball and socket with standard to which it will conform | | | |
| ii) | Maker's Name and Address | | | |
| iii) | Dimensions | | | |
| | a) Porcelain disc diameter (mm) | | | |
| | b) Unit spacing (mm) | | | |
| | c) Creepage distance (mm) of each disc (min.) | | | |
| iv) | Colour of glaze of the finished porcelain insulator | | | |
| v) | Mechanical Values | | | |
| | a) Electro mechanical strength (KN) | | | |
| | b) Mechanical failing load (KN) | | | |
| vi) | Electrical Values | | | |
| | a) Power frequency flashover voltage-dry, KV(RMS) | | | : |
| | b) Power frequency flashover voltage -wet, kV (RMS) | | | : |
| | c) Impulse flashover voltage 1.2/50 microsecond positive wave, KV (Peak) | | | |
| | d) Impulse flashover voltage 1.2/50 microsecond negative wave, KV (Peak) | | | |
| | e) Power frequency withstand voltage-dry, kV (RMS) | | | |
| | f) Power frequency withstand voltage-wet, kV (RMS) | | | |
| | g) Impulse withstand voltage 1.2/50 microsecond positive wave, KV (Peak) | | | |
| | h) Impulse withstand voltage 1.2/50 microsecond negative wave, KV (Peak) | | | |
| | i) Power frequency puncture withstand voltage, kV (RMS) | | | |
| | j) Radio interference voltage at 110% rated voltage (micro volt) | | | |
| vii) | Net wt. of insulator unit (Kg) : | | | |
| viii) | Specification to which insulator will conform: | | | |
| ix) | Type of locking device and its dimensions (IS reference also to be indicated) | | | |
| x) | Reference of Type tests & other test certificates | | | |
| xi) | Whether inter-changeability of the insulators is guaranteed | | | |
| xii) | Packing details | | | |

## II. **INSULATOR STRINGS:**

| Sl. No. | Description | Suspension Insulator String Single/ Double | Tension Insulator String Single/ Double |
|---|---|---|---|
| 1. | Maker's Name & Address | | |
| 2. | Applicable Standard | | |
| 3. | a) Type of insulator units (Ball & socket) | | |
| | b) Size and designation of ball & socket with standard to which it will conform | | |
| | c) No. of Units per Strings | | |
| 4. | Electro-mechanical strength of Complete string (Kgf) | | |
| 5 | a) Power frequency withstand voltage of the complete string with arcing horn/ corona control ring | | |
| | i) Dry (kVrms) | | |
| | ii) Wet (kVrms) | | |
| | b) Power frequency withstand voltage of the complete string without arcing horn/ corona control ring | | |
| | i) Dry (kVrms) | | |
| | ii) Wet (kVrms) | | |
| 6 | a) Power frequency flash over withstand voltage of complete string (suspension as well as tension) without arcing horns/ corona control ring | | |
| | i) Dry (kVrms) | | |
| | ii) Wet (kVrms) | | |
| | b) Power frequency flash over withstand voltage of complete string (suspension as well as tension) with arcing horns/ corona control ring | | |
| | i) Dry (kVrms) | | |
| | ii) Wet (kVrms) | | |
| 7 | Impulse flash over withstand (1.2/50 micro second wave) voltage of complete string (suspension as well as tension) without arcing horns KV (peak) (+ve /-ve) | | |
| 8 | Impulse flashover withstand (1.2/50 micro seconds wave) voltage of complete string (suspension as well as tension) with arcing horns KV (peak), (+ve /-ve) | | |
| 9 | Switching Surge withstand voltage of complete string with corona control (wet) (KVP) of the complete string | | |
| 10 | Visible corona extinction voltage (KVrms) | | |
| | (i) With corona control ring | | |
| | (ii) Without corona control ring | | |
| 11 | Total length of the string without Arcing horn (mm) | | |
| 12 | Total length of the string upto the tip of arcing horn (mm) | | |
| 13 | Weight of complete insulator strings (Kg) | | |
| 14 | Voltage distribution with normal fittings and with and without arcing horns | | |
| 15 | Total creepage distance of complete string (mm) | | |
| 16 | RIV level of complete string at 110% rated voltage | | |
| 17 | Confirm whether string type tested with offered disc insulator as per IS (Yes/No) | | |

III. **POST INSULATOR:**

| Sl no | description | 400kV | 220kV | 132kV | 33kV |
|---|---|---|---|---|---|
| i) | Maker's Name and Address | | | | |
| ii) | Applicable Standard | | | | |
| iii) | Colour of glazed porcelain | | | | |
| iv) | Height of the Unit (mm) | | | | |
| v) | Cantilever Strength (Kgf) | | | | |
| vi) | Tensile Strength (Kg) | | | | |
| vii) | Torsional Strength (Kgm) | | | | |
| vii) | 1.2/50 microsecond Impulse withstand / flashover value (KVp) | | | | |
| ix) | One-minute P.F. withstand / flashover voltage (KVrms)(Dry/Wet) | | | | |
| x) | 250/2500 micro sec. switching surge withstand voltage | | | | |
| | a) One Complete Stack | | | | |
| | i. Dry (KVp) | | | | |
| | ii. Wet (KVp) | | | | |
| xi) | Radio interference voltage of complete stack | | | | |
| | i) Test Voltage (KVrms) | | | | |
| | ii) RIV (micro volt) | | | | |
| xii) | Weight of individual Post Insulator (Kg) | | | | |
| xiii) | Min. Creepage Distance (mm) | | | | |
| xiv) | Largest shell diameter (mm) | | | | |
| xv) | Total weight of Post Insulator including fittings (Kg) | | | | |
| xvi) | Pitch Circle diameter (mm) | | | | |
| | a) Top | | | | |
| | b) Bottom | | | | |
| xvii) | No. of unit in each assembly (No.) | | | | |
| xviii) | Voltage rating of each unit (KV) | | | | |
| xix) | Corona Extinction voltage (KVrms) | | | | |
| xx) | Packing details | | | | |
| xxi) | Type of Post Insulator | | | | |
| xxii) | Confirm whether type tested as per IS IEC (Yes/No) | | | | |