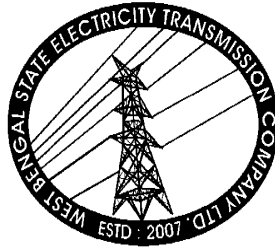


INSULATOR AND HARDWARE FITTINGS



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Engineering Department

WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED

পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড
(পশ্চিমবঙ্গ সরকারের একটি উদ্যোগ)

Regd. Office: VidyutBhawan, Block – DJ, Sector-II, Bidhannagar, Kolkata – 700091.

CIN: U40101WB2007SGC113474; Website: www.wbsetcl.in

TECHNICAL SPECIFICATION FOR POST AND DISC INSULATOR AND INSULATOR HARDWARE FITTINGS FOR SUB-STATIONS

1. SCOPE :

This specification covers design, manufacture, testing at manufacturer's works, supply, delivery of - Post Insulators, Anti Fog type Disc. Insulators and Disc Insulator Strings complete with hardware & associated fittings. The same shall be 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.

<u>Sl. No.</u>	<u>Standards</u>	<u>Title</u>
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 (Part-1, 2 & 4)	: 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 168	: 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 utility of the Post/Disc insulator and insulator hardware fittings must be mentioned in the Deviation Schedule with reasons duly supported by documentary evidence. Such deviation suggested may or may not be accepted. Deviation not mentioned in 'Deviation Schedule' will not be considered.

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. 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.
- (v) The caps and ball pins of Disc Insulator shall be hot dip galvanised in accordance with the latest edition of IS : 2629 and mechanically strong. The Zn 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 imperfection such as flux, ash, rust stains bulky white deposits and blisters. 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.
- (vi) 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.
- (vii) The electrical and mechanical characteristic of the Disc Insulator shall conform to specific technical parameters of this specification and relevant Indian Standards. Each Insulator shall have rated strength markings on porcelain printed and applied before firing.

- (viii) Tension insulators are to be anchored to the girders of sub-station gantries at suitable height and intervals depending upon the different voltage classes. No. of insulator strings to be provided for high level bus connections/phase shall be as per approved layout design.

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.

5. HARDWARE FITTINGS FOR INSULATOR STRING

- (i) General design of hardware fittings shall be such as to ensure uniformity, high strength, and freedom from corona formation and high resistance against corrosion.
- (ii) The materials of the fittings shall be so selected that yield strength of the material shall not be less than maximum working load.
- (iii) All shackles, fasteners, eyes, suspension and tension clamp and other fittings for attaching insulators to the Gantry tower, A-frame & other sub-station structure with conductor shall be so designed as to reduce any damage to conductor, insulator & hardware fittings. Anchor shackles, Ball hook, Ball eye, Ball clevis, Ball link, Socket clevis, Yoke plates, Arcing horn, turnbuckle, jumper cone. Comp. Dead end assembly Bolted type suspension clamp etc. shall be supplied as per requirement.

The materials for various hardware accessories shall conform to IS:2486.

- (iv) All ferrous metal parts, which will be exposed to the atmosphere in service, shall be protected by hot dip galvanizing.
- (v) All forgings and castings shall be of good finish and free from flaws and other defects. The edges on the outside of fittings such as the eye, clevis and holes shall be rounded.
- (vi) All parts of different fittings which provide the inter connection shall be made such that sufficient clearance is provided at the connection point to ensure free movement and suspension of the insulator string assembly. Suspension clamps shall be so designed that the effects of vibration both on conductors and fitting itself are minimised. The clamp shall permit the conductor to slip before the failure of the conductor occurs. The fitting shall have sufficient contact surface to minimise damage due to fault current.
- (vii) The Hardware fittings for Suspension and Tension string shall be supplied complete in all respect.
- (viii) The suspension hardware is to be used with normal (B-type) disc insulator having Electro-mechanical Strength of 70 KN for all voltage classes except 400KV and tension hardware are to be used with normal. (B-type) disc insulator having Electro-mechanical Strength of 120 KN for 220 KV, 132 KV & 33 KV voltage class & 160KN for 400KV voltage class. For 400KV suspension string Disc insulator with normal (B) type disc insulator having electro mechanical strength of 120KN shall be used.
- (ix) Suspension and tension hardware shall be suitable for insulator with nominal pin shank diameter of either 16 mm. or 20 mm. as per approved 12KV Class Disc insulator to be utilised at sub-station. Unless specifically mentioned the tension clamps shall be of compression dead end type and shall have a steel sleeve to be compressed on the steel core end of the conductor.
- (x) Sag compensating spring shall be within the scope of supply by the Contractor for 400 KV Main I, Main II and Transfer Bus. Design calculation of the springs are to be submitted during detailed Engineering
- (xi) Suspension clamp shall be of Armour Grip type.
- (xii) Design of fittings shall be such as to avoid local corona formation or discharges and shall have smooth finished surface of all parts.
- (xiii) COMPONENT ASSEMBLY:

Each suspension and tension hardware set shall comprise of the following components.

SINGLE SUSPENSION & DOUBLE SUSPENSION HARDWARE SET FOR 132KV, 220KV

- | | | |
|------------------------------|----------------|------------------|
| a) Ball hook/Ball Link | e) Yoke Plate | h) Socket Clevis |
| b) Socket Eye | f) Arcing horn | i) Turn Buckle |
| c) Anchor Shackle | g) Ball Clevis | |
| d) AGS type suspension clamp | | |

Any other hardware components not mentioned above but necessary for suspension string shall be within the scope of supply of Contractor.

SINGLE TENSION & DOUBLE TENSION HARDWARE SET FOR 132KV, 220KV

- | | | |
|--|-----------------|---------------|
| • Ball Link | • Ball Eye | • Chain link |
| • Anchor Shackle | • Socket Clevis | • Ball Clevis |
| • Dead End assembly (Compression type) | • Socket Eye | • Arcing horn |

Any other hardware components not mentioned above but necessary for tension string shall be within the scope of supply of Contractor.

- (xiv) All necessary hardwares for following type of 400KV String insulators shall be within the scope of supply.
- a) 400KV Double Tension string insulator with double anchoring point suitable for Quad ACSR Moose Conductor.
 - b) 400KV Double Tension String insulator with double anchoring point suitable for Twin ACSR Moose Conductor.
 - c) 400KV Single Suspension String insulator suitable for Quad ACSR Moose Conductor.
 - d) 400KV Single Suspension String insulator suitable for Twin ACSR Moose Conductor.

400KV DOUBLE TENSION HARDWARE SET

- | | | |
|----------------------|--------------------|--------------------|
| (i) Twisted Eye Link | (ii) Turn Buckle | (iii) Yoke Plate |
| (iv) Clevis Clevis | (v) Corona ring | (vi) H-H Ball Link |
| (vii) Anchor Shackle | (viii) Corona ring | (ix) Turn Buckle |
| (x) Tension Clamp | (xi) Socket Clevis | |

Any other hardware components not mentioned above but necessary for Double tension string shall be within the scope of supply of Contractor.

400KV SINGLE SUSPENSION HARDWARE SET

- | | | |
|--------------------|--------------------|--|
| (i) Anchor Shackle | (ii) Clevis eye | (iii) Yoke Plate |
| (iv) Socket Clevis | (v) Ball Link | (vi) Anchor Shackle |
| (vii) Grading ring | (viii) Corona ring | (ix) Drop type or through type Suspension Clamp. |

Any other hardware components not mentioned above but necessary for Single Suspension string shall be within the scope of supply of Contractor.

6. GUARANTEE :

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, WBSEB shall have right to reject the material. Guaranteed Technical Particulars are to be submitted by successful bidder during detailed engineering alongwith submitted drawings/documents. However format for submission of GTP shall be handed over to intending bidders at the time of sale of tender documents.

7. CONTRACT DRAWING AND CATALOGUE / MANUAL :

In the event of placement of Letter of Award the contractor shall submit six (6) copies of the following drawings and catalogue/manuals to the Chief Engineer, Engg. Deptt., WBSETCL, VidyutBhawan (9th floor), Kolkata – 700 091 or 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 and drawing of individual hardware components along with G.T.P.
- (iii) Catalogue for individual disc and post insulators including maintenance manual, if any.

Ten (10) sets of approved drawings, G.T.P. and ten (10) copies of Catalogue / Manual shall be submitted to the Chief Engineer, Engg. Deptt., WBSETCL, VidyutBhawan (9th floor), Kolkata – 700 091 for our record and distribution to site.

8. TESTS AT MANUFACTURER'S WORKS AND TEST CERTIFICATES :

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

All acceptance tests shall be carried out at the manufacturer's works on every lot offered for inspection as per relevant Indian Standards. 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 of Disc and Post insulator, Disc Insulator string and hardware accessories. Three (3) copies of test reports shall be submitted to the Chief Engineer, Engg. Deptt., WBSETCL, VidyutBhawan (9th floor), Kolkata – 700 091 for approval and distribution to site.

An advance notice of 15 (fifteen) days shall be given by the contractor to Chief Engineer, Engg. Deptt. intimating the actual date of tests 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.

9. TEST REPORTS AND TYPE TESTS :

Only type tested Disc Insulators , Post insulator & Insulator Hardware are to be offered conforming to our technical specification, and relevant IS and IEC. Disc Insulators , Post insulator & Insulator Hardware offered should be similar with ones on which type testing has been carried out as per relevant IS and IEC. Three sets of complete type test reports carried out in Govt. recognized Test House or Laboratory /NABL accredited laboratory shall have to be submitted by successful bidder positively alongwith submission of drawings during detailed Engineering. The submitted type test report shall proof that the type test have been carried out within five years from the date of submission of bid. Successful bidder may require to produce original copies of type test reports at the time of detail Engineering if asked by WBSETCL.

Each type test report shall comply the following information with test result

- i) Compete identification, date and serial no.
- ii) Relevant drawings as documented with test report.
- iii) Method of application, Where applied, duration and interpretation of each test.

SPECIFIC TECHNICAL PARTICULARS OF POST AND 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	Minimum no. of units in complete string (No)	2x25	16	11	3

	i) 1.2/50 microsecond Impulse withstand insulator string (KVp)voltage of the	1425	1050	650	170
	ii) 250/2500 Switching Impulse withstand voltage of insulator string (KVp)	1050	-	-	-
	iii) Minimum Corona extinction voltage level of insulator string (KVrms)	320	156	-	-
	iv) Maximum RIV level (in micro volts) of 220 KV string at 156 KV level	Not exceeding 1000	1000	-	-
	v) One minute power frequency withstand voltage of insulator string (KVrms)	630	460	275	70
19	Bus-bar Conductor	Quadruple Moose for main I & II, Twin Moose for Transf Bus for 400/220/132/33K V S/stn.	Twin Moose for Main I&11 Bus Single Moose for Transf Bus for 400/220/132/33K V &220/132/33KV S/stn.	Twin Moose for Main 1&11 Bus & Single Moose For Transf Bus for 400/220/132/33K V S/stn.& Twin Moose for Main Bus & Single Moose For Transf Bus for 220/132/33KV & 132/33KV S/stn.	Twin Moose for Main Bus & Single Moose For Transf Bus FOR 220/132/33K V & 132/33KV S/stn.

Suspension Disc Insulator :

The disc of 255 mm dia. with electromechanical strength of 70 KN for 220 KV , 132 KV & 33 KV Switchyard. Distance between centre of unit shall be 145mm for 400KV, 220KV, 132KV & 33KV. The minimum number of disc per suspension string for 400KV, 220 KV, 132 KV, & 33 KV shall be 24nos., 15 nos., 10 nos and 3 nos. respectively. The disc of 280 mm. Dia with electro-mechanical strength of 120KN shall be used for suspension insulator string for 400KV.

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)	10500	6125	3625	900
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 to be 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	160 KN	120 KN	70 KN
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 :**

	Suspension Insulator String <u>Single / Double</u>	Tension Insulator String <u>Single / Double</u>
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. 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) :
- 7. a) 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) :
- b) 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 :**

400KV 220 KV 132 KV 33 KV

- 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) :
- viii) 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) :