

TECHNICAL SPECIFICATION
: POLYMER BUS POST INSULATOR
Revision_2

The post insulators shall conform in general to latest IEC-62231 and IEC-62217.

1. Constructional Features

1.1 **Core:-** It shall be a glass-fiber reinforced (FRP rod) epoxy resin rod of high strength/ **FRP tube with nitrogen filled**. The rod shall be resistant to hydrolysis. Glass fibers and resin shall be optimized. The rod shall be electrical grade corrosion resistant (ECR), boron free, glass and shall exhibit both high electrical integrity and high resistance to acid corrosion. Glass Transition Temperature (T_g) for FRP rod to be minimum **120° C**. The FRP rod shall be void free.

1.2 **Housing and weather sheds:-** The FRP rod shall be covered by a sheath of HTV silicone rubber compound of a thickness of **minimum 5 mm**. The housing & weather sheds should have silicon content of minimum 32% by weight. The minimum dielectric strength (BDV) of silicon rubber compound shall be 20kV/mm. It should protect the FRP rod against environmental influences, external pollution and humidity. In case any anti-fungal and avian replant admixtures/ additives are added by the manufacturer in the material, the details shall be included by the manufacturers in their MQP. It shall be extruded or directly molded on the core. The interface between the housing and the core must be uniform and without voids. The strength of the bond shall be greater than the tearing strength of the polymer. The manufacturer shall follow non-destructive technique (N.D.T.) to check the quality of jointing of the housing interface with the core. The technique to be followed with detailed procedure and sampling shall be furnished by the Supplier and finalized during finalization of MQP.

The weather sheds of the Bus Post insulators shall be of alternate shed profile. The weather sheds shall be vulcanized to the sheath (extrusion process) or molded as part of the sheath (injection molding process) and free from imperfections. The vulcanization for extrusion process shall be at high temperature and for injection molding shall be at high temperature & high pressure. Any seams/ burrs protruding axially along the insulator, resulting from the injection molding process shall be removed completely without causing any damage to the housing. The track resistance of housing and shed material shall be class 1A 4.5 according to IEC 60587. The strength of the weather shed to sheath interface shall be greater than the tearing strength of the polymer. The composite insulator shall be capable of high pressure washing.

1.3 **End Fitting:-** End fittings transmit the mechanical load to the core. They shall be made of **malleable cast iron/ spheroidal graphite or forged steel** and all ferrous parts shall be hot dip galvanised in accordance with the latest edition of IS: 2633 & IS: 2629. 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 imperfections such as flux ash, rust stains, bulky white deposits and blisters. The metal parts shall not produce any noise generating corona under the operating conditions. End fittings shall be connected to the rod by means of a controlled compression technique. The manufacturer shall have in-process Acoustic emission arrangement or some other arrangement to

ensure that there is no damage to the core during crimping. This verification shall be in-process and done on each Bus Post Insulator. The system of attachment of end fitting to the rod shall provide superior sealing performance between housing and metal connection. The end fitting shall either be over-moulded or shall be sealed by a flexible silicone rubber compound. The sealing shall stick to both housing and metal end fitting. The sealing must be humidity proof and durable with time. End fittings shall have suitable provisions for fixing grading rings at the correct position as per design requirements.

- 1.4 When operating at normal rated voltage there shall be no electric discharge between conductor and insulators which would cause corrosion or damage to conductors or insulators by the formation of substance produced by chemical action.
- 1.5 Grading rings shall be used at high voltage side of composite BPI for reducing the voltage gradient on and within the insulator and to reduce radio and TV noise to acceptable levels. The size and placement of the metallic grading rings shall be designed to eliminate dry band arcing/corona cutting/ exceeding of permissible electrical stress of material. The insulator supplier shall furnish design calculations using appropriate electric field software showing electric field at surface of housing, inside housing & core and at the interface of housing and metal fittings with the proposed placement and design of grading rings. Also, for ensuring correct installation of grading rings, a proper slot shall be provided at the outside edge of the End fittings and on grading ring holders (or any equivalent arrangement). The design of the grading rings shall be such that it will only fit in the designated slot facing correct installation direction. The position of the slots shall be at suitable distance on end fittings to ensure acceptable levels of radio and TV noise and voltage gradient on and within the insulator.
Grading rings shall be mandatorily provided for 420kV Polymer BPIs. For 245kV and below Polymer BPIs, the grading rings shall be provided as per design/electric field study.
- 1.6 The design of the insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration.
- 1.7
 - a) Every bolt shall be provided with a hot dip galvanised steel washer under the nut so that part of the threaded portion of the bolts is within the thickness of the parts bolted together.
 - b) Flat washer shall be circular of a diameter 2.5 times that of bolt and of suitable thickness. Where bolt heads/nuts bear upon the beveled surfaces they shall be provided with square tapered washers of suitable thickness to afford a seating square with the axis of the bolt.
 - c) All bolts and nuts shall be of steel with well formed hexagonal heads forged from the solid and shall be hot dip galvanised. The nuts shall be good fit on the bolts and two clear threads shall show through the nut when it has been finally tightened up.
- 1.8 The Bidder shall furnish full description and illustration of the material offered. The Bidder shall furnish the outline drawing of each insulator unit along with grading rings(as

applicable) including a cross sectional view of the Bus Post Insulator unit. The drawing shall include but not limited to the following information:

- a. Major Dimensions with manufacturing tolerances
- b. Number of sheds
- c. Minimum Creepage distance with positive tolerance
- d. Protected creepage distance
- e. Eccentricity of the Long Rod unit
- f. Unit mechanical and electrical characteristics
- g. Weight of BPI
- h. Identification mark
- i. Manufacturer's catalogue number
- j. Materials

- 1.9 Each composite insulator unit shall be legibly and indelibly marked with the trade mark of the manufacturer and month & year of manufacture, voltage rating, Maximum design Cantilever Load (MDCL) and specified cantilever load (SCL).

2. Tests

In accordance with the stipulations of the specification, the post insulators shall be subjected to design, type, sample and routine tests as per IEC-62231 and IEC-62217.

2.1 Type Test:

- a. Verification of dimensions as per IEC 62231
- b. Tests on interfaces and connections of end fittings
- c. Assembled core load tests
- d. Dye Penetration test
- e. Water diffusion test
- f. Tracking and erosion test
- g. Hardness test
- h. Accelerated weather test
- i. Flammability test
- j. Silicon content test

Minimum content of silicone as guaranteed by supplier shall be verified through FT-IR spectroscopy & TGA analysis or any other suitable method mutually agreed between Purchaser & Supplier in Quality Assurance Programme.

- k. Recovery of Hydrophobicity test

- 1. The surface of selected samples shall be cleaned with isopropyl alcohol. Allow the surface to dry and spray with water. Record the HC classification. Dry the sample surface.
- 2. Treat the surface with corona discharges to destroy the hydrophobicity. This can be done utilizing a high frequency corona tester, Holding the electrode approximately 3mm from the sample surface, slowly move the electrode over

an area approximately 1" x 1". Continue treating this area for 2 – 3 minutes, operating the tester at maximum output.

3. Immediately after the corona treatment, spray the surface with water and record the HC classification. The surface should be hydrophilic, with an HC value of 6 or 7. If not, dry the surface and repeat the corona treatment for a longer time until an HC of 6 or 7 is obtained. Dry the sample surface.
4. Allow the sample to recover and repeat the hydrophobicity measurement at several time intervals. Silicone rubber should recover to HC 1 – HC 2 within 24 to 48 hours, depending on the material and the intensity of the corona treatment.

I. Hydrophobicity Transfer Test

m. Electrical tests

- i. Dry lightning impulse voltage test
- ii. Wet power frequency withstand voltage test
- iii. Switching impulse test (wet) (For 420 kV and above class Insulator only)
- iv. Measurement of R.I.V (Dry) (As per Annexure – C of Section-SE)
- v. Corona extinction voltage test (Dry) (As per Annexure – C of Section-SE)

n. Mechanical tests

- i. Cantilever failing load test
- ii. Specified tension load test
- iii. Compression and buckling withstand load test
- iv. Test for deflection under load

2.2 Acceptance Test:

- a. Verification of the dimensions as per IEC 62231.
- b. Galvanizing test as per IEC 62231.
- c. Verification of specified mechanical loads as per IEC 62231.
- d. Recovery of Hydrophobicity test
- e. Silicon content test
- f. Dye Penetration test
- g. Water diffusion test
- h. Hardness test
- i. Hydrophobicity Transfer Test

2.3 Routine tests:

- a. Identification of the station post insulator as per IEC 62231
- b. Visual examination as per IEC 62231
- c. Tensile load test as per IEC 62231

3. Technical Parameters of Bus Post Insulators.

Sl. No	Description	420 kV	245 kV	145 kV
a)	Type	Solid Core/FRP Tube		
b)	Voltage Class (kV)	420	245	145
c)	Dry and wet one minute power frequency withstand voltage (kV rms)	680	460	275
d)	Dry lightning impulse withstand Voltage (kVp)	±1425	1050	650
e)	Wet switching surge withstand voltage (kVp)	±1050	-	-
f)	Max. radio interference voltage (in microvolts) - Dry	500 at 305 kV	500 at 156 kV	500 at 105 kV
g)	Corona extinction voltage (kV rms) (min.)	320	156	105
h)	Cantilever Strength			
	Specified cantilever strength (Kg)	1000	800	600
	Design cantilever strength (Kg)	500(Min.)	400(Min.)	300(Min.)
i)	Minimum torsional moment	As per IEC60273	As per IEC60273	As per IEC60273
j)	Total height of insulator (mm)	3650	2300	1500
k)	P.C.D Top (mm)	127	127	127
	Bottom (mm)	300	254	254
l)	No. of bolts			
	Top	4	4	4
	Bottom	8	8	8
m)	Diameter of bolt/holes (mm)			
	Top	M16	M16	M16
	Bottom	18	18	18
n)	Pollution level as per IEC-60815	Very Heavy(IV)	Very Heavy(IV)	Very Heavy(IV)
o)	Minimum total creepage distance for Heavy Pollution (mm)	13020	7595	4495
p)	Deflection at 50% of Specified Cantilever Load	100 mm	50 mm	40 mm

Sl. No	Description	72.5 kV	36 kV
a)	Type	Solid Core/FRP Tube	
b)	Voltage Class (kV)	72.5	36

c)	Dry and wet one minute power frequency withstand voltage (kV rms)	140	70
d)	Dry lightning impulse withstand Voltage (kVp)	325	170
e)	Cantilever Strength		
	Specified cantilever strength (Kg)	600	600
	Design cantilever strength (Kg)	300(Min.)	300(Min.)
f)	Total height of insulator (mm)	770	510
g)	P.C.D Top (mm)	127	127
	Bottom (mm)	127	127
h)	No. of bolts		
	Top	4	4
	Bottom	4	4
i)	Diameter of bolt/holes (mm)		
	Top	M16	M16
	Bottom	18	18
k)	Pollution level as per IEC-60815	Very Heavy(IV)	Very Heavy(IV)
l)	Minimum total creepage distance for Heavy Pollution (mm)	2248	1116
m)	Deflection at 50% of Specified Cantilever Load	40 mm	40 mm

4. Packing and Marking

- i. All insulators shall be packed in suitable PVC/ plastic tubes of atleast 3 mm thickness or water-resistant packing material and the packaging shall not break during storage & transportation.
Further, **spare insulators** shall be packed in PVC/ plastic tubes only to ensure long storage of about 5 years. The packing shall provide protection against rodent. The Supplier shall furnish detailed design of the packing. For marine transportation, crates shall be palletted.
- ii. The packing shall be of sufficient strength to withstand rough handling during transit, storage at site and subsequent handling in the field.
- iii. Suitable cushioning, protective padding, or dunnage or spacers shall be provided to prevent damage or deformation during transit and handling.
- iv. 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 case/crate shall have all the markings stenciled on it in indelible ink.

- v. The Supplier shall guarantee the adequacy of the packing and shall be responsible for any loss or damage during transportation, handling, storage and installation due to improper packing.