

REFERENCE COPY

Government of India, Ministry of Railways
Research Design & Standards Organisation
Menak Nagar, Lucknow-226 011.

Specification no. ETL/PSI/70(11/84)

HOLLOW PORCELAIN INSULATORS & BUSHINGS

MASTER COPY

1. Scope

This specification applies to bushings and hollow porcelain insulators used on the following equipments:-

Equipment	Rated voltage	System voltage class
1) Current transformer	132 kV	132 kV
2) Current transformer	25kV (between phase and earth)	52 kV
3) Voltage transformer	132 kV	132 kV
4) Voltage transformer	25 kV (between phase & earth)	52 kV
5) Booster Transformer (HT)	25 kV (between phase & earth)	52 kV
✓ 6) Auxiliary transformer 25kV/230V, 10kVA	25 kV (between phase & earth)	52 kV
7) Lightning arrestors	120 kV	132 kV
8) Lightning arrestors	42 kV	52 kV

The rated voltage may vary within a range of $\pm 10\%$.

2. Service Condition

These bushings/hollow porcelain insulator shall be used in medium polluted atmosphere, moist tropical climate and in areas subjected to heavy rains and severe lightning in India. The maximum ambient air temperature may reach 45°C in shade; the daily average ambient air temperature in shade reaching 35°C, minimum ambient temperature -50C with max. relative humidity of upto 100%.

⊗ 65°C in sun and

3. Governing Specification

- i) DIN 42534 - 45 kV/1000 Amp. transformer bushing.
- ii) IEC 137-1973 - Bushing for alternating voltage above 1000 Volts.
- iii) IS:2099-1973 - Bushing for alternating voltage above 1000 Volts.

- iv) IS:5621-1980 - Large hollow porcelains for use in electrical equipment.
- v) IS:3347-1979 Pt.V,Sec.1&2 - Dimensions for porcelain transformer bushings.
- vi) IS:2071-1974 (Pt.I to III) - Methods of high voltage testing
- vii) IS:4759-1979 - Hot dip zinc coating on structural steel and other allied products.
- viii) IS:2633-1972 - Methods of testing uniformity of coating on zinc coated articles.
- ix) IS:8704-1978 - Methods for artificial pollution tests on HV insulators.

4. Reference Atmospheric Conditions:

- 4.1 Reference atmospheric conditions at which bushing characteristic shall be expressed for the purpose of comparison shall be as given below:-

- Ambient temperature - 20°C
- Barometric pressure - 1013 millibars.
- Absolute humidity - 11 g of water per cubic metre corresponding to 63 per cent relative humidity at 20°C.

- 4.2 Tests for the purpose of this standard shall preferably be carried out under conditions of temperature and humidity specified in IS:196-1966 (that is, a temperature 27± 2°C and relative humidity of 65± 2 percent) and at the prevailing atmospheric pressure. When this is not possible, test may be carried out under conditions naturally prevailing at the time of the test. The barometric pressure, air temperature and humidity shall be recorded for the purpose of corrections.

5. General Requirements

- 5.1 The porcelain shall be sound, free from defects, thoroughly vitrified and fully glazed. The quality of the porcelain shall be such that it shall withstand repeated flashover, at the maximum arc current of 6 kA for 0.2 sec. followed by 2 kA for 0.2 sec., followed after a pause of 60 sec. by a further 6 kA for 0.2 sec. without any damage.
- 6.2 The glaze shall be brown in colour. The glaze shall cover all the porcelain parts of the insulator except those areas which are purposely left unglazed or are metallised.

5.3 The shed profile shall be simple, free from ribs on the underside to avoid accumulation of dust and pollutants. The profiles indicated in the figs. 1-6 are for the guidance of the manufacturers. The dimensions given in the figures are required to be followed from the point of view of interchangeability. Alternative shed profiles may be offered if considered superior by the tenderer, indicating specific advantages, details of service experience and other technical particulars.

5.4 The shed dimensions shall conform to the criteria laid in IEC document 36 (Bureau Central Office) 64, "Guide for the selection of insulators in respect of polluted conditions/(draft)". The relevant extracts are given in Appendix 'D'.

The hollow porcelains meant for use in 132 kV CT, 132 kV PT, 25 kV CT & 25 kV PT shall have pre-drilled metal flanges at both ends.

5.5 The metallic end flange shall be made of grey cast iron castings to IS:210-1978(Grade-15) or black heart malleable iron castings conforming to IS:2108-1977, grade IM-340. The flanges shall be hot dip galvanized, min. mass of zinc coating shall be 610 gms/m².

5.6 The end flange shall be fixed to the porcelain body with port-land cement. The cement used in construction of the insulator shall not cause fracture by expansion or loosening by contraction. Cement shall not react chemically with the metal fittings and its thickness shall be as uniform as possible. The porcelain body shall be centrally located in the end flanges by suitable jigs during cementing.

6. Rating and Other particulars: The rating and other particulars of bushings/insulators to be used on various equipments viz. 132kV CT & PTs, 25kV booster transformers, current transformers, potential transformers, auxiliary transformers, 120kV & 42kV lightning arresters are indicated below:-

Sl. No.	Name of equipment on which insulator to be used.	25 kV booster transformer.	132kV current transformer	25kV current transformer & 25kV potential transformer type-I & II.	25kV/230V auxiliary transformer (Station Class)	42kV lightning arrester (Station Class)	120kV Lightning arrester.
1.	Type of bushing/porcelain insulators.	Oil filled, outdoor type metallised transformer bushing*.	Hollow porcelain insulator filled type	Hollow porcelain insulator.	Transformer bushing oil filled outdoor door type.	Hollow porcelain insulator, outdoor, oil filled type.	Hollow porcelain insulator, outdoor, oil filled type.
2.	Voltage class(kV)	52	145	52	44	24	36
3.	Current rating in Amp.	1000	-	-	630	-	-
4.	One minute power frequency withstand voltage in kV rms.	105	275	105	80	55	75
5.	Impulse withstand voltage(1.2/50 μ s wave) in kVp.	250	650	150	190	125	170
6.	Creepage path in mm	1040	2900	1040	860	480	720

- *1. Metallising shall be done with copper.
 *2. The minimum thickness of metallising shall be 0.04 mm.
 *3. Please refer to fig. 3 of enclosed drg.No. ETI/PSI/516.

7. Tests:

7.1 Type Tests: The following shall constitute the type tests:-

- i) Visual inspection.
- ii) Verification of dimensions.
- iii) Dry power frequency voltage withstand test.
- iv) Wet power frequency voltage withstand test.
- v) Dry lightning impulse voltage withstand test.
- vi) Visible discharge test.
- vii) Electrical routine test.
- viii) Porosity test.
- ix) Temperature cycle test.
- x) Artificial pollution test.
- xi) Galvanising test on metallic end flanges.

Tests at Sl.Nos. (i) to (v) shall be carried out as per IS:2099-1973 or latest, whereas tests at Sl.Nos.(vi) to (ix) shall be conducted as per IS:5621-1980. Galvanization shall be tested in accordance to IS:2633-1964. All these tests shall be witnessed by the authorised representative of RDSO/Lucknow.

7.2 Routine Tests:- The manufacturer shall be required to submit the routine test report as per IS:5621-1980 to original equipment manufacturers for onward transmission to DG/PI/RDSO/LKO and various consignees.

8. Approval of drawings:

The manufacturer shall submit dimensional/cross sectional drawings drawn to scale (in triplicate) for the bushing/insulator to Director General Traction Installation, RDSO, Lucknow-226011, for approval. The drawing shall indicate total creepage path, style No., elec. and mech. characteristics, shed profile etc. in detail. Manufacture of the prototype sample should be undertaken only after the approval of drawings. After approval of drawings, manufacturer shall submit the tracings of the same which will be signed in token of approval, and returned to the manufacturer.

*The artificial pollution test shall be carried out as per IS:8704:1978.

.....