# COMPOSITE POST INSULATOR

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*Engineering Department*

WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED
( A Government of West Bengal Undertaking )

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## TECHNICAL SPECIFICATION FOR COMPOSITE POST INSULATOR

## 1. SCOPE

This specification covers the design, type testing, manufacture, testing at manufacturer's works, supply, delivery, erection, testing and commissioning of Composite (polymeric) Station Post Insulators, complete with end fittings and grading / corona control rings where required, suitable for upright mounting in air-insulated substations located in heavily polluted atmosphere.

The insulators covered are of the solid load-bearing core type as defined in IEC 62231 : 2006, Clause 3.1, consisting of a fibre-reinforced resin core, a polymeric (silicone rubber) housing with sheds, and metal end fittings attached to the core.

The insulators shall be suitable for supporting tubular aluminium bus bars and associated substation equipment at the rated system voltages of 400 kV, 220 kV, 132 kV and 33 kV.

*Note 1 : IEC 62231 and IEC 62231-1 are applicable to composite station post insulators for a.c. voltages greater than 1 000 V up to 245 kV. For the 400 kV (Um = 420 kV) rating, the design principles, test methods and acceptance criteria of IEC 62231 shall be applied, and the dimensional, mechanical and designation conventions of IEC 62231-1 shall be extended by the manufacturer, subject to approval of WBSETCL during detailed engineering.*

*Note 2 : The insulators covered by this specification are primarily intended for outdoor service but may also be used indoors (IEC 62231-1, Clause 1).*

## 2. STANDARDS

The Composite Post Insulators shall comply in all respects with the provisions of the following standards, as amended up to date, unless otherwise specified hereinafter.

| SL | Standard | Title |
|---|---|---|
| 1 | IEC 62231 : 2006 | Composite station post insulators for substations with a.c. voltages greater than 1 000 V up to 245 kV — Definitions, test methods and acceptance criteria |
| 2 | IEC 62231-1 : 2015 | Composite station post insulators for substations with a.c. voltages greater than 1 000 V up to 245 kV — Part 1 : Dimensional, mechanical and electrical characteristics |
| 3 | IEC 62217 | Polymeric HV insulators for indoor and outdoor use — General definitions, test methods and acceptance criteria |
| 4 | IEC 61109 | Composite string insulator units for overhead lines with a nominal voltage greater than 1 000 V — Definitions, test methods and acceptance criteria (material and interface tests) |
| 5 | IEC 60815-1 : 2008 | Selection and dimensioning of high-voltage insulators intended for use in polluted conditions — Part 1 : Definitions, information and general principles |
| 6 | IEC 60815-3 | Selection and dimensioning of high-voltage insulators intended for use in polluted conditions — Part 3 : Polymer insulators for a.c. systems |
| 7 | IEC TR 60815 : 1986 | Guide for the selection of insulators in respect of polluted conditions (pollution levels, specific creepage distance, shed profile parameters) |
| 8 | IEC 60060-1 | High-voltage test techniques — Part 1 : General definitions and test requirements |
| 9 | IEC 60071-1 | Insulation co-ordination — Part 1 : Definitions, principles and rules |
| 10 | IEC 60437 | Radio interference test on high-voltage insulators |
| 11 | IEC 60507 | Artificial pollution tests on high-voltage ceramic and glass insulators to be used on a.c. systems |
| 12 | IEC 60587 | Electrical insulating materials used under severe ambient conditions — Test methods for evaluating resistance to tracking and erosion |
| 13 | IEC TS 62073 | Guidance on the measurement of wettability of insulator surfaces |

| SL | Standard | Title |
|---|---|---|
| 14 | IEC 60273 | Dimensions of indoor and outdoor post insulators and post insulator units (reference for fitting arrangements and torsion values) |
| 15 | IS 209 | Zinc |
| 16 | IS 2633 | Method for testing uniformity of coating of zinc-coated articles |
| 17 | IS 4759 | Hot dip zinc coatings on structural steel and other allied products |
| 18 | IS / IEC 60168 | Tests on indoor and outdoor post insulators of ceramic material or glass (for reference of mounting and test arrangements) |

In the event of a conflict between this specification and the standards referred to above, the more stringent requirement shall prevail, subject to the written concurrence of WBSETCL.

## 3. DEVIATIONS

Normally the offer should be as per this Technical Specification without any deviation. However, 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 deviations suggested may or may not be accepted.

## 4. DESIGN CRITERIA & CONSTRUCTION

### A. GENERAL

(i) The post insulator shall be of the composite type with a solid load-bearing cylindrical insulating core, a seamless polymeric housing and metal end fittings attached to the core, conforming to IEC 62231 : 2006, Clause 3.1.

(ii) The insulator shall be a single-piece (single stack) unit wherever the required height can be achieved in one piece. Where stacking is unavoidable, the number of units per stack, the intermediate flange arrangement and the resulting mechanical characteristics of the complete stack shall be clearly declared and shall be subject to the approval of WBSETCL.

(iii) The insulator shall be suitable for upright mounting on hot dip galvanised steel structures and for supporting tubular aluminium pipe bus.

(iv) The design shall be such that no part of the insulator is subjected to stresses arising from differential expansion and contraction between the core, the housing and the metal fittings, and that the surface can be cleaned by normal methods.

(v) Under normal rated voltage there shall be no electrical discharge between the insulator and the conductor which would cause corrosion or injury to the conductor or to the insulator.

(vi) The insulator shall be designed for the site conditions of West Bengal — hot, humid tropical climate, heavily polluted / industrial and coastal environment, with the ambient conditions to be indicated in the BOQ / detailed engineering.

### B. INSULATING CORE

(i) The core shall be a solid cylindrical rod of resin-impregnated, axially aligned glass fibres, of the ECR / boron-free E-CR grade, resistant to acid-induced brittle fracture. The core shall be void free, free from lamination, cavities, foreign inclusions and shall be produced by the pultrusion process.

(ii) The core diameter, the glass content and the resin system shall be declared by the bidder in the Guaranteed Technical Particulars and shall be identical to that of the core on which type / design tests have been carried out.

(iii) The core material shall satisfy the dye penetration test and the water diffusion test of IEC 62217 (design tests on core material).

(iv) The core shall be capable of withstanding, without damage, the mechanical loads specified in Clause 8 of this specification, and its damage limit shall be established by the cantilever load–deflection test of IEC 62231.

**C. HOUSING AND SHEDS**

(i) The housing and sheds shall be of High Temperature Vulcanised (HTV) silicone rubber, containing adequate Alumina Tri-Hydrate (ATH) filler. The percentage of ATH by weight and the base polymer shall be declared in the Guaranteed Technical Particulars.

(ii) The housing shall be moulded in a single piece over the entire core, or moulded shed by shed with vulcanised joints. The housing shall completely cover the core, and there shall be no joint in the housing which coincides with a change of section.

(iii) The thickness of the housing over the core (excluding the sheds) shall not be less than 3 mm. Modular / shed-by-shed construction with a thinner sheath shall not be accepted.

(iv) The housing shall be free from cracks, voids, blisters, inclusions, delamination and mould flash. The colour shall be uniform light grey.

(v) The housing material shall be resistant to tracking and erosion and shall qualify for Class 1A4.5 as per IEC 60587, and shall pass the 1 000 h tracking and erosion (multi-stress) test, the accelerated weathering test, the hardness test and the flammability test of IEC 62217.

(vi) The housing shall exhibit hydrophobicity of Class HC 1 to HC 2 as per IEC TS 62073 in the as-supplied condition, and shall retain hydrophobicity transfer / recovery capability throughout the service life.

(vii) The housing shall be resistant to the effects of ozone, ultraviolet radiation, acids, alkalis, salt spray, industrial pollutants and the extremes of tropical weather.

**D. SHED PROFILE**

The shed profile shall be selected in accordance with IEC 60815-1 / IEC 60815-3 and shall satisfy the profile parameters of IEC TR 60815 : 1986 for pollution levels III (Heavy) and IV (Very heavy), namely :

- Minimum distance between sheds, $c \geq 30$ mm ($c \geq 20$ mm is acceptable only for insulators of overall length ≤ 550 mm or with shed overhang $p \leq 40$ mm).
- Ratio of spacing to shed overhang, $s/p \geq 0.8$ (may be reduced to 0.65 for plain sheds without ribs).
- Ratio of creepage distance to clearance, $ld/d \leq 5$, checked for the worst section of the profile.
- Where alternating sheds are used, the difference between consecutive shed overhangs ($p1 - p2$) shall be ≥ 15 mm.
- Minimum inclination of the upper surface of the shed, $\alpha > 5°$.
- Creepage factor, C.F. = lt / St ≤ 4.0.
- Profile factor, P.F. ≥ 0.7.

(i) Alternating (long–short) shed profiles are preferred for the heavily polluted service conditions covered by this specification.

(ii) The diameter correction factor kD of IEC TR 60815 : 1986, Sub-clause 5.3 shall be applied to the creepage distance where the average diameter Dm of the insulating part exceeds 300 mm ( kD = 1.0 for Dm < 300 mm; kD = 1.1 for 300 mm ≤ Dm ≤ 500 mm; kD = 1.2 for Dm > 500 mm ). The value of Dm and the kD applied shall be declared by the bidder.

(iii) The maximum diameter of the insulating part shall not exceed the values declared in the approved drawing and shall in no case exceed the maxima of IEC 62231-1, Tables 1a and 1b for the corresponding designation. No positive tolerance is applicable on the maximum diameter (IEC 62231-1, Clause 8).

## E. END FITTINGS

(i) End fittings shall be of forged steel, ductile / malleable cast iron or aluminium alloy, and shall be attached to the core by a controlled crimping process. Attachment by cement or by adhesive alone shall not be accepted.

(ii) All ferrous parts, other than those of stainless steel, shall be hot dip galvanised in accordance with IS 4759, and the uniformity of the zinc coating shall satisfy IS 2633. The zinc used shall be of grade Zn 99.95 as per IS 209. The minimum average coating mass shall be 610 g/m². The coating shall be uniform, adherent, smooth, reasonably bright, continuous and free from imperfections.

(iii) Fixing holes shall be equally spaced on the pitch circle, which shall be concentric with the axis of the insulator. Holes in the top and bottom fittings shall be in line unless otherwise specified, and shall be so arranged as to permit the use of normal hexagon bolt heads and nuts (IEC 62231-1, Clause 9).

(iv) The pitch circle diameter of the top and bottom fittings shall be as per BOQ

(v) Tapped holes for bolts shall have anti-corrosion protection and the effective length of the thread shall not be less than the nominal diameter of the bolt.

(vi) Tolerances of parallelism, eccentricity and angular deviation shall be in accordance with IEC 62231 (IEC 62231-1, Clause 8).

## F. INTERFACES AND SEALING

(i) The interfaces between core and housing, between housing and end fittings, and between core and end fittings shall be permanently sealed against the ingress of moisture. The sealing system shall be an integral part of the design and shall not rely on field-applied compounds.

(ii) The interfaces shall withstand the design tests of IEC 62231 / IEC 62217 — thermal-mechanical pre-stressing, water immersion pre-stressing (boiling in deionised water with NaCl for 42 h) and sudden load release — followed by the verification tests (visual examination, steep-front impulse voltage test and dry power-frequency voltage test), without puncture, tracking, erosion or visible damage.

## G. GRADING / CORONA CONTROL RINGS

(i) Grading (corona control) rings shall be provided at the line end of the insulator, and at the earth end where necessary, for the 400 kV and 220 kV ratings, and for any other rating where they are required to meet the specified corona extinction voltage and RIV levels.

(ii) If the corona extinction voltage is achieved with the help of a corona ring or any other similar device, the same shall be deemed to be included in the scope of the contractor.

(iii) Grading rings shall be of aluminium alloy tube, free from burrs and sharp edges, and their dimensions and position shall be identical to those used during the type tests.

## H. DESIGNATION

Composite station post insulators shall be designated in accordance with IEC 62231-1, Clause 6, as :

**CSP <dry lightning impulse withstand voltage in kV> <A or B> – <MDCL in kN, two digits> – <minimum creepage distance in mm>**

Example : CSP 650B-04-3625 designates a composite station post insulator having a dry lightning impulse withstand voltage of 650 kV, a pitch circle diameter of 127 mm, a maximum design cantilever load of 4 kN and a minimum creepage distance of 3 625 mm — i.e. the 132 kV insulator of this specification at 25 mm/kV.

The designations applicable to this specification are given in Clause 8, Table of Specific Technical Particulars.

## I. MARKING

(i) Each insulator shall be legibly and indelibly marked, in accordance with IEC 62231, Clause 7 and IEC 62231-1, Clause 7, with : manufacturer's name or trade mark, year of manufacture, designation as per Clause 4-H above, the Specified Cantilever Load (SCL) in kN, the Maximum Design Cantilever Load (MDCL) in kN, and "WBSETCL".

## 5. GUARANTEE

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

The bidder shall guarantee that the offered insulator will perform satisfactorily under the pollution severity of the site for the specified USCD, and shall guarantee the housing material against tracking, erosion, chalking, crazing and loss of hydrophobicity for a period to be stated in the offer.

## 6. CONTRACT DRAWING AND CATALOGUE / MANUAL

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

(i) Dimensional general arrangement drawing of the composite post insulator showing the core, housing, shed profile, all fittings and accessories, sectional drawing, with all technical parameters and G.T.P.

(ii) Shed profile drawing showing the parameters c, s, p, p1, p2, ld, d, α, the average diameter Dm and the computed values of C.F. and P.F. as defined in IEC TR 60815 : 1986.

(iii) Dimensional drawing of the grading / corona control ring (where applicable) and of the mounting arrangement, including the base flange and bolt pitch circle.

(iv) Load–deflection curve and combined load curve of the insulator (IEC 62231-1, Tables 1a / 1b, Notes 2 and 3), showing the damage limit and the MDCL.

(v) Catalogue for the composite post insulator including the maintenance manual, handling and storage instructions.

(vi) Type test certificates and design test certificates of the offered composite post insulator.

## 7. TESTS AND TEST CERTIFICATES

All type, sample and routine tests shall be carried out in accordance with IEC 62231 : 2006 read with IEC 62217, and shall be witnessed as specified below.

Only type tested insulators are to be offered, conforming to this technical specification and to the relevant IEC. Offered material shall be identical to that on which type testing has been carried out. Complete type test reports carried out in a Government recognised test house / NABL accredited laboratory shall be submitted. Type tests carried out more than five (5) years prior to the date of bid opening shall not be accepted unless specifically waived by WBSETCL.

All acceptance (sample) tests shall be carried out at the manufacturer's works on every lot offered for inspection, in the presence of the representative of WBSETCL. Selection of samples for acceptance tests, as well as rejection and re-testing, shall be guided by IEC 62231. The entire cost of acceptance and routine tests shall be treated as included in the quoted price.

The representative of WBSETCL shall have full facilities for unrestricted inspection of the manufacturer's works, the raw materials and the manufacture of the insulator, and for carrying out the necessary tests. Insulators shall not be dispatched before they have been satisfactorily inspected and 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 the requirements of this specification, and shall not prevent subsequent rejection if such material is later found to be defective.

An advance notice shall be given by the contractor to the Chief Engineer, Engineering Department, intimating the actual date of tests, along with routine test reports and details of all inspections to be carried out.

### 7.2 TYPE TESTS (IEC 62231, Clause 6)

| SL | Test | Reference / acceptance criteria |
|---|---|---|
| 1 | Dry lightning impulse withstand voltage test | IEC 60060-1 / IEC 62231 — values as per Clause 8 |
| 2 | Wet power-frequency withstand voltage test | IEC 60060-1 / IEC 62231 — values as per Clause 8 |
| 3 | Dry power-frequency withstand voltage test | Values as per Clause 8 |
| 4 | Wet switching impulse withstand voltage test (250/2500 µs) | Applicable to the 400 kV rating |
| 5 | Visible corona extinction voltage test | Values as per Clause 8; with grading ring where provided |
| 6 | Radio interference voltage (RIV) test | IEC 60437 — values as per Clause 8 |
| 7 | Cantilever load–deflection test | IEC 62231 — determination of the damage limit; the declared MDCL shall not exceed the damage limit |
| 8 | Specified cantilever load (SCL) test | IEC 62231 — no failure at SCL |
| 9 | Specified torsion load (SToL) test | IEC 62231 — values as per Clause 8 |
| 10 | Specified tension load (STL) test | IEC 62231 — values as per Clause 8 |
| 11 | Specified compression load (SCoL) test | IEC 62231 — values as per Clause 8 |
| 12 | Water penetration / dye penetration on the assembled insulator | IEC 62231 |
| 13 | Verification of dimensions, creepage distance and shed profile parameters | IEC 62231-1, Clause 8; IEC TR 60815 : 1986, Appendix D |
| 14 | Artificial pollution test (where called for in the BOQ) | IEC 60507 / IEC 60815-3, at the severity corresponding to the specified USCD |
| 15 | Galvanising test on metal fittings | IS 2633 / IS 4759 |

### 7.3 ACCEPTANCE (SAMPLE) TESTS (IEC 62231, Clause 7)

The following acceptance tests, as applicable, shall be carried out on every lot offered for inspection, in the presence of the WBSETCL representative :

(i) Visual examination.

(ii) Verification of dimensions, including height, creepage distance, maximum diameter of the insulating part, pitch circle diameter and shed profile.

(iii) Verification of the tightness of the interface between the end fitting and the housing — water immersion pre-stressing followed by verification test.

(iv) Dye penetration test on the core.

(v) Water diffusion test on the core.

(vi) Cantilever load test up to the SCL / damage limit, as per IEC 62231.

(vii) Torsion test.

(viii) Galvanising test on the metal end fittings (IS 2633).

(ix) Hardness and density check of the housing material.

(x) Hydrophobicity classification as per IEC TS 62073.

(xi) Dry power frequency withstand voltage test.

### 7.4 ROUTINE TESTS (IEC 62231, Clause 8)

The following routine tests shall be carried out by the manufacturer on every insulator, and the reports shall be submitted :

(i) Visual examination of the housing, sheds, core–housing interface and end fittings.

(ii) Routine mechanical load test — a cantilever load of not less than the MDCL applied for not less than 10 s, in accordance with IEC 62231, without any sign of damage.

(iii) Verification of the marking.

## 8. SPECIFIC TECHNICAL PARTICULARS OF COMPOSITE POST INSULATOR

| SL NO | DESCRIPTION | TECHNICAL PARAMETERS | | | |
|---|---|---|---|---|---|
| | | **400 kV** | **220 kV** | **132 kV** | **33 kV** |
| 1 | Rated system voltage (kV) | 400 | 220 | 132 | 33 |
| 2 | Highest system voltage, Um (kV) | 420 | 245 | 145 | 36 |
| 3 | Type | Composite station post insulator — solid core, single stack, upright | | | |
| 4 | Insulating material | Pultruded ECR glass fibre / resin core with HTV silicone rubber housing and sheds, light grey | | | |
| 5 | Minimum total creepage distance (mm) — 25 mm/kV of Um to be considered | 10500 | 6125 | 3625 | 900 |
| | 31 mm/kV of Um, if only mentioned in BOQ | 13020 | 7595 | 4495 | 1116 |
| 6 | Maximum Design Cantilever Load, MDCL (kN), minimum | 8 | 6 | 4 | 4 |
| 7 | Specified Cantilever Load, SCL (kN), minimum ( ≥ 1.5 × MDCL ) | 12 | 9 | 6 | 6 |
| 8 | Specified Torsion Load, SToL (Nm), minimum | 6000 | 4000 | 3000 | 3000 |
| 9 | Specified Compression Load, SCoL (kN), minimum | 80 | 50 | 40 | 45 |
| 10 | Specified Tension Load, STL (kN), minimum | 110 | 110 | 80 | 80 |
| 11 | 1.2/50 µs dry lightning impulse withstand voltage (kVp) | 1425 | 1050 | 650 | 170 |
| 12 | Dry & wet one-minute power-frequency withstand voltage (kV rms) | 630 | 460 | 275 | 75 |
| 13 | 250/2500 µs switching impulse withstand voltage, wet (kVp) | 1050 | — | — | — |
| 14 | Visible corona extinction voltage (kV rms), minimum | 320 | 156 | 105 | N A |
| 15 | Maximum Radio Interference Voltage (µV) at 1 MHz | 500 | 500 | 500 | N A |
| 16 | RIV test voltage, phase to ground (kV rms) | 305 | 156 | 92 | N A |
| 17 | Pitch circle diameter of top and bottom fittings (IEC 62231-1, Cl. 6) | As mentioned in BOQ | | | |

** IEC 62231-1 covers insulators up to a highest system voltage of 245 kV. The 400 kV designation shown is an extension of the IEC 62231-1, Clause 6 convention and shall be confirmed against the manufacturer's approved drawing during detailed engineering.*

**Notes :**

(a) The creepage distances at Sl. 5 are the values required at kD = 1.0 (average diameter of the insulating part, Dm < 300 mm). Where Dm ≥ 300 mm, the creepage distance shall be increased by the factor kD of IEC TR 60815 : 1986, Sub-clause 5.3.

(b) The MDCL values at Sl. 6 are the minimum values specified by WBSETCL. The declared MDCL shall not exceed the damage limit established by the cantilever load–deflection test of IEC 62231.

(c) The SCL, SToL, SCoL and STL minima at Sl. 7 to Sl. 10 are specified by WBSETCL, derived from the corresponding rows of IEC 62231-1, Table 1b (pollution class 'd', Type 'B' fittings). Higher declared values are acceptable.

(d) For applications where the deflection of the post under load is critical, the manufacturer's load–deflection curve shall be referred to in order to ensure suitability; an insulator of higher strength rating may be selected to provide adequate rigidity (IEC 62231-1, Tables 1a / 1b, Note 2).

(e) Where two different types of force may be applied to the insulator simultaneously — e.g. a compressive and a cantilever load — the manufacturer's combined load curve shall be consulted to ensure suitability (IEC 62231-1, Tables 1a / 1b, Note 3).

(f) If the corona extinction voltage is achieved with the help of a corona ring or any other similar device, the same shall be deemed to be included in the scope of the contractor.

## 9. GUARANTEED TECHNICAL PARTICULARS FOR COMPOSITE POST INSULATOR

**(To be filled in and signed by the Bidder)**

| Sl. No. | Description | 400 kV | 220 kV | 132 kV | 33 kV |
|---|---|---|---|---|---|
| 1 | Maker's name and address | | | | |
| 2 | Applicable standard | | | | |
| 3 | Type designation as per IEC 62231-1, Clause 6 | | | | |
| 4 | Core material — type of glass fibre and resin system | | | | |
| 5 | Core diameter (mm) | | | | |
| 6 | Housing material — base polymer and % ATH by weight | | | | |
| 7 | Minimum thickness of housing over the core (mm) | | | | |
| 8 | Colour of the housing | | | | |
| 9 | Method of attachment of end fittings | | | | |
| 10 | Material of end fittings | | | | |
| 11 | Height of the unit (mm) and tolerance | | | | |
| 12 | Total number of sheds (long / short) | | | | |
| 13 | Largest shed diameter (mm) | | | | |
| 14 | Minimum total creepage distance (mm) | | | | |
| 15 | Arcing distance / dry arcing distance (mm) | | | | |
| 16 | Maximum Design Cantilever Load, MDCL (kN) | | | | |
| 17 | Specified Torsion Load, SToL (Nm) | | | | |
| 18 | Specified Compression Load, SCoL (kN) | | | | |
| 19 | Specified Tension Load, STL (kN) | | | | |
| 20 | Deflection at MDCL (mm) | | | | |
| 21 | 1.2/50 µs dry lightning impulse withstand / flashover voltage (kVp), +ve / −ve | | | | |
| 22 | One-minute power-frequency withstand / flashover voltage, dry (kV rms) | | | | |
| 23 | One-minute power-frequency withstand / flashover voltage, wet (kV rms) | | | | |
| 24 | 250/2500 µs switching impulse withstand voltage, dry / wet (kVp) | | | | |
| 25 | Visible corona extinction voltage (kV rms) — with / without grading ring | | | | |
| 26 | RIV at the specified test voltage (µV) and the test voltage (kV rms) | | | | |
| 27 | Pitch circle diameter (mm) — top / bottom | | | | |
| 28 | Type, dimensions and material of grading / corona ring | | | | |
| 29 | Galvanising — grade of zinc and coating mass (g/m²) | | | | |
| 30 | Weight of individual post insulator (kg) | | | | |
| 31 | Number of units in each assembly / stack | | | | |
| 32 | Tracking and erosion class (IEC 60587) | | | | |
| 33 | Hydrophobicity class (IEC TS 62073) | | | | |

| Sl. No. | Description | 400 kV | 220 kV | 132 kV | 33 kV |
|---|---|---|---|---|---|
| 34 | Whether type tested as per IEC 62231 / IEC 62231-1 (Yes / No) — reference of report | | | | |
| 35 | Name and accreditation of the test laboratory, and date of type test | | | | |

Signature of the Bidder with seal : _____ Date : _____