

TENDER TECHNICAL SPECIFICATION

33 kV / 433 V Indoor Cast Resin Dry Type Distribution Transformers

Ratings: 1600 kVA and 1250 kVA

Scope: Design, manufacture, supply, factory testing, delivery at site and OEM supervision/support for testing and commissioning

IMPORTANT SCOPE CLARIFICATION

Physical unloading, shifting, placement, erection, cabling, bus duct installation, terminations, earthing and civil works are excluded from the OEM/bidder scope and shall be executed by the installation contractor.

1. General

This specification covers the design, engineering, manufacture, assembly, routine and applicable type testing, packing, forwarding, transportation, transit insurance, delivery at site, and OEM supervision/support for installation, site testing and commissioning of indoor 33 kV/433 V, 50 Hz, three-phase cast resin dry type distribution transformers, complete with OLTC, RTCC panel and all specified accessories.

The equipment shall be complete in all respects and suitable for continuous operation under the stated service conditions. Any component essential for safe, reliable and satisfactory operation, whether specifically listed or not, shall be included in the supply.

2. Schedule of Equipment

Sl. No.	Description	Rating	Voltage Ratio	Unit
1	Indoor cast resin dry type distribution transformer complete with OLTC, RTCC panel and accessories	1600 kVA	33 kV / 433 V	Set
2	Indoor cast resin dry type distribution transformer complete with OLTC, RTCC panel and accessories	1250 kVA	33 kV / 433 V	Set

Quantities shall be as indicated in the priced BOQ. The technical requirements below shall apply to both ratings unless stated otherwise.

3. Scope of the Transformer OEM / Bidder

- Design and engineering of the transformer, enclosure, OLTC, RTCC panel, marshalling box, protection, controls and interfaces.
- Manufacture and supply of the transformer complete with all accessories, base frame, rollers, lifting lugs, jacking pads and terminal/interface arrangements.
- Routine tests at the manufacturer's works, submission of test certificates and arrangement of Factory Acceptance Test (FAT).
- Packing, forwarding, transportation, transit insurance and delivery at the designated project site.
- Submission and approval of drawings, Guaranteed Technical Particulars (GTP), calculations, test reports, manuals and as-built documents.
- OEM supervision during unloading, shifting, placement and installation by the installation contractor.
- OEM support for pre-commissioning checks, testing, energisation and commissioning, including required visits by qualified service engineers.
- Functional testing of OLTC, AVR, RTCC, temperature protection, alarms, trips and SCADA/BMS communication provisions.
- Training of the Employer's operating personnel at site.

4. Exclusions from OEM / Bidder Scope

- Physical unloading from vehicle, shifting inside the premises and final placement on the foundation.
- Erection or mechanical installation of the transformer and RTCC panel.
- Construction of plinth/foundation, grouting, embedded items and other civil works.
- HT/LT/control cable laying, glands, lugs, termination kits and physical cable terminations, unless specifically included in the priced BOQ.
- Bus duct supply, erection, supports and final connection, except the transformer-side adapter/interface included with the transformer.
- External earthing network and connection of earth strips to the transformer earth terminals.
- Power and control cabling between equipment, except internal wiring within supplied equipment.

Notwithstanding these exclusions, the OEM shall provide supervision, drawings, interface details and commissioning support necessary for correct installation by others.

5. Service Conditions

Parameter	Requirement
Installation	Indoor, floor/plinth mounted
Enclosure protection	IP23
System frequency	50 Hz
Maximum ambient temperature	50 °C
Minimum ambient temperature	-5 °C
Type of loading	Mixed, including non-linear hospital loads
Cooling	AN ; bidder shall state continuous rating under AN
Insulation class	Class H or better
Winding temperature rise	Not exceeding 115 °C above the specified maximum ambient temperature at continuous full load

6. Principal Technical Particulars

Parameter	Requirement
Transformer type	Cast resin dry type, air-cooled, indoor
Continuous ratings	1600 kVA and 1250 kVA as scheduled
HV system voltage	33,000 V, three phase, three wire
LV system voltage	433 V, three phase, four wire
HV winding connection	Delta
LV winding connection	Star with neutral brought out
Vector group	Dyn11
HV winding	Copper
LV winding	Copper coil/foil/strip, as per approved design
Percentage impedance	1250KVA – 5% with IS Tol (+/- 10%) 1600KVA - 6% with IS Tol (+/- 10%)
Impedance tolerance	with IS Tol (+/- 10%) of guaranteed value
Voltage withstand levels	As applicable for 33 kV equipment under IS 2026 / applicable IEC standards
Painting	Pebble Grey RAL 7032, unless otherwise approved

7. Tap Changer, AVR and RTCC

- A vacuum type On-Load Tap Changer (OLTC) shall be provided on the HV side, suitable for 33 kV cast resin transformer duty.
- Tap range shall be +5% to -15% in steps of **2.5%**, unless otherwise confirmed in the approved design and system study. The bidder shall clearly state the number of tap positions in the GTP.
- OLTC shall be suitable for local and remote electrical operation and manual emergency operation, with mechanical and electrical interlocks.
- RTCC panel shall be supplied complete with Automatic Voltage Regulating Relay, tap position indicator, raise/lower controls, auto/manual and local/remote selection, annunciation, lamps, control protection and all required internal wiring.
- The RTCC panel and OLTC shall provide potential-free contacts and RS485 communication for SCADA/BMS integration.
- All tap positions shall have suitable mechanical indication and locking/interlocking provisions.

8. HV and LV Termination Interfaces

- HV side adapter cable box shall be suitable for termination of 33 kV (E) grade, 2 runs of 3-core x 300 sq.mm XLPE aluminium armoured cable, or for the approved 33 kV bus trunking/interface arrangement, as applicable to the final design.
- All HV insulation and termination clearances shall be suitable for the 33 kV system.
- LV side shall be provided with an adapter chamber/flange suitable for connection to the specified sandwich aluminium bus duct.
- The transformer manufacturer shall coordinate interface dimensions, phase sequence, terminal arrangement and flexible connection requirements with the bus duct and installation contractors before manufacture.
- External cable glands, lugs and termination kits are excluded unless specifically identified in the priced BOQ.

9. Enclosure and Mechanical Construction

- The transformer shall be housed in a robust indoor IP23 sheet-steel enclosure with removable bolted panels and lockable access doors.
- Door limit switches shall be provided for alarm/trip interlock as required by the approved protection philosophy.
- The complete transformer shall be supplied with base channels, jacking pads, lifting lugs and four bi-directional rollers suitable for movement and positioning by the installation contractor.
- Two external earthing terminals shall be provided on diagonally opposite sides of the enclosure/base frame.
- All live parts shall be adequately warning labels, danger plates, rating plate and terminal marking plates shall be provided.
- Anti-vibration pads suitable for the equipment weight and indoor hospital installation shall be included.

10. Temperature Monitoring and Cooling Control

- Six thermistors/sensors shall be provided for winding alarm and trip functions, distributed across the three phases.
- One winding temperature relay/scanner with RS485 communication shall be provided.
- One winding temperature indicator with local display and RS485 communication shall be provided.
- One PT100 type temperature scanner with wiring to the marshalling box shall be provided.
- Automatic fan start/stop logic, fan healthy/failure indication and alarm contacts shall be provided for forced cooling equipment.
- Temperature alarm and trip set points shall be adjustable and clearly indicated in the approved drawings and commissioning records.

11. Marshalling Box and Internal Wiring

- A marshalling box shall be supplied complete with terminal blocks, internal wiring, ferrules, labels, illumination lamp, space heater with thermostat, MCBs/fuses, cable glands and lugs for internal equipment wiring.
- Marshalling box enclosure protection shall be suitable for indoor service and not less than IP54.
- All alarm, trip, indication and communication signals shall be wired to clearly labelled terminal blocks for connection by others.
- A complete terminal schedule and interconnection diagram shall be submitted for approval.

12. Surge Protection

- One complete set of surge arresters suitable for the 33 kV system shall be included.

13. SCADA / BMS Interface

All temperature parameters, OLTC tap data and RTCC panel status shall be provided with necessary hardware and software provisions for integration with the project SCADA/BMS system. Communication shall be through RS485 using Modbus RTU, unless otherwise approved. The following minimum points shall be available:

- Winding temperatures for all phases
- Temperature alarm and trip
- OLTC tap position
- Raise/lower operation and auto/manual status
- RTCC healthy/trouble status
- Transformer door open/interlock status
- Common alarm and common trip

The bidder shall submit a complete register map, communication protocol details and point schedule prior to FAT.

14. Losses, Efficiency and Performance

- No-load loss, load loss, auxiliary loss, total loss, efficiency and impedance shall be guaranteed in the GTP for each transformer rating.
- Losses at 50% and 100% loading shall comply with the applicable **ECBC 2021** requirements stated in the tender documents
- Load losses shall be declared at the reference temperature specified by the applicable standard.
- No positive tolerance on guaranteed total losses shall be accepted unless specifically permitted by the tender conditions.

15. Standards and Statutory Compliance

The transformer and accessories shall comply with the latest applicable editions and amendments of the following, as relevant:

- IS 2026 series / IEC 60076 series for power transformers.
- IEC 60076-11 for dry type transformers.
- IS/IEC requirements applicable to OLTC, surge arresters, control panels, wiring and enclosure protection.
- **ECBC2021** requirements applicable to transformer losses and efficiency.

In case of conflict, the more stringent requirement shall apply, subject to approval by the Employer/Engineer.

16. Dry Type Transformer Classification and Partial Discharge

- The transformer shall be tested for environmental class E2, climatic class C2 and fire behaviour class F1 as per IEC 60076-11, with supporting test evidence or test certificate on complete transformer to be provided. No part or test certificate on raw materials only is not acceptable.

- Partial discharge measurement shall be carried out as required by IEC 60076-11. The guaranteed partial discharge level shall not exceed 10 pC at the specified test voltage.
- Cast resin insulation shall be void-free, moisture-resistant, flame-retardant and suitable for the stated ambient conditions.

17. Factory Acceptance Test and Inspection

Factory inspection and witnessing of tests shall be mandatory before dispatch. One engineer from ACCF and authorised representative(s) from PMC shall visit the manufacturer's works. The successful bidder shall bear all costs for travel, local conveyance, boarding and lodging of the visiting representatives and shall make all necessary arrangements for the inspection.

- The bidder shall give at least 15 calendar days' written notice of readiness for inspection.
- Routine tests shall be conducted on each transformer in accordance with the applicable standard.
- Functional tests of OLTC, RTCC, AVR, temperature monitoring, alarms, trips, door interlocks and communication shall be demonstrated.
- The bidder shall provide calibrated test equipment, test personnel, approved drawings, test formats and safe access to the works.
- No transformer shall be dispatched without written dispatch clearance from the Employer/Engineer after satisfactory FAT.
- Waiver of inspection, if issued, shall not relieve the bidder of any contractual responsibility.

18. Tests

18.1 Routine Tests on Each Transformer as per IS2026-11

- Measurement of winding resistance.
- Voltage ratio, polarity and vector group verification.
- Measurement of no-load loss and no-load current.
- Measurement of load loss and short-circuit impedance.
- Applied voltage withstand test.
- Induced overvoltage withstand test.
- Partial discharge measurement.
- Insulation resistance and functional checks of accessories, alarms, trips, OLTC and RTCC.

18.2 Type / Special Test Evidence or test certificate

- Temperature rise test.
- Lightning impulse withstand test applicable to the 33 kV class.
- Short-circuit withstand test evidence for a transformer of similar/higher design, rating and voltage class.
- Environmental, climatic and fire behaviour classification tests for E2, C2 and F1.
- Sound level measurement, where specified.

Valid type test reports from NABL/CPRI/ERDA or an internationally recognised accredited laboratory shall be submitted with the bid. Where the offered design is not covered by submitted reports, testing requirements and associated cost shall be clearly stated and included as required by the tender.

19. Drawings and Documents

- Guaranteed Technical Particulars for each rating.
- General arrangement and sectional drawings with dimensions, weights and centre of gravity.
- Foundation, base frame, roller and loading details.
- HV cable box and LV bus duct interface drawings.

- Electrical schematic, control and wiring diagrams for transformer, OLTC, RTCC and marshalling box.
- Terminal schedule, interconnection diagram, alarm/trip matrix and SCADA/BMS point list/register map.
- Protection and temperature set-point schedule.
- Routine and type test reports, FAT report and calibration certificates.
- Packing list, transport/handling instructions, erection supervision checklist and commissioning procedure.
- Operation and maintenance manuals, spare parts list and as-built drawings in hard copy and editable soft copy.

20. Mandatory Bid Submissions

Sl. No.	Document / Information	Bidder Compliance
1	Complete GTP for 1600 kVA and 1250 kVA transformers	
2	Clause-by-clause compliance statement with deviations clearly identified	
3	GA drawings and preliminary dimensions/weights	
4	Guaranteed losses, efficiency, impedance and sound level	
5	OLTC/RTCC technical data, tap range and number of positions	
6	33 kV cable box and LV bus duct interface details	
7	Type test reports and E2/C2/F1 certificates on complete transformer	
8	Partial discharge guarantee and test evidence	
9	SCADA/BMS communication protocol and offered data points	
10	FAT plan and confirmation that inspection travel/boarding/lodging costs are included	
11	List of inclusions, exclusions and recommended spares	
12	Warranty terms and OEM service support arrangement	

21. Warranty and Service Support

- The complete equipment shall be covered by the warranty period stated in the tender conditions. The bidder shall clearly state the offered warranty in the technical bid.
- Defects attributable to design, material, manufacture or workmanship shall be rectified or replaced by the bidder without cost to the Employer during warranty.
- OEM service support and availability of critical spares shall be confirmed for the service life of the equipment.

22. Recommended Commissioning Checks

- Visual inspection, verification of rating plate and checking for transit damage.
- Insulation resistance and winding resistance measurement.
- Ratio, vector group and phase sequence check.
- Tightness and torque verification of HV/LV/earth connections by the installation contractor under OEM supervision.
- Functional testing of OLTC, RTCC, AVR, temperature scanner, fans, alarm/trip contacts and door interlocks.
- SCADA/BMS communication and point-to-point verification.
- Verification of earthing continuity, protection settings and statutory clearances.

- Controlled energisation, no-load observation and commissioning report signed by the OEM representative and Employer/Engineer.