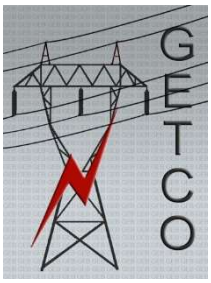


# GUJARAT ENERGY TRANSMISSION CORPORATION LTD.

**SARADAR PATEL VIDYUT BHAVAN,**
**RACE COURSE, BARODA – 390 007.**

# TECHNICAL SPECIFICATIONS

## FOR

## POLYMER HOUSED

## 66 kV CURRENT TRANSFORMER

## &

## 66 kV POTENTIAL TRANSFORMER
(with tariff-metering)

**GETCO/E/06TS CT PT- PH /R2/Jun-22**

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# TECHNICAL SPECIFICATION FOR 66 kV POLYMER HOUSED CURRENT AND VOLTAGE TRANSFORMERS

## SECTION – I

### 1.1 GENERAL DESIGN FEATURES OF CURRENT TRANSFORMERS:

1.1.1 This section covers this design, manufacture, assembly, testing at manufacturer's works, supply and delivery of outdoor, **dead tank type**, **oil impregnated paper,** single phase, 50 Hz, oil immersed, self-cooled, current transformer suitable for operation in the climate conditions specified. The current transformers shall be complete in all respects.

### *1.1.2 STANDARDS:*

#### 1.1.2.1 CURRENT TRANSFORMERS:

| SR. NO. | STANDARD NO. | TITLE |
|---|---|---|
| 1 | IS:2165 | Insulation co-ordination for equipment of 100 KV and above |
| 2 | 16227(I to III) | Instrument Transformers |
| 3 | IEC 61462 | Silicon Rubber Insulator |
| 4 | IS:2071 | Method of high voltage testing |
| 5 | IS:335 | Insulating oil for transformers and switchgears |
| 6 | IS/IEC 60529 | Degree of protection provided by enclosures for low voltage switchgear and control. |
| 7 | IEC 61869-1 | Instrument Transformers |
| 8 | IEC-270 | Partial discharge measurement |
| 9 | IEC-44(4) | Instrument transformer measurement of PDs |
| 10 | IEC-171 | Insulation co-ordination |
| 11 | IEC-60 | High voltage testing techniques |
| 12 | IEC-8263 | Method for RIV test on high voltage insulators |
| 13 | -- | Indian Electricity Rules 1956 |

**1.1.2.2** Equipment meeting with the requirement of other authoritative Standards, which ensure equal or better performance than the standards mentioned above, shall also be considered. When the equipments offered by the Bidder conforms to other standards, salient points of difference between standard adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule. Four copies of such standards with authentic translation in English shall be furnished along with the bid.

**1.1.2.3** The Instrument Transformers covered by this specification shall comply with the requirement of the latest edition of IEC Publication No. **61869-1 &/** or Indian Standard No. 16227 Parts – I to III (as amended up to date) but

the Instrument Transformers for the accuracy class 'PX' shall confirm to Part - II of IS : 16227 except where specified otherwise in the specification.

**1.1.2.4** The core shall be high grade, non – ageing, silicon laminated steel of low hysteresis loss and high permeability. The core material used in case of metering core shall be stated in the tender.

1.1.3 The current transformers shall be hermitically sealed to eliminate breathing and entering of air and moisture in the tank. Provision of pressure releasing device is not permitted.

For compensation of variation in volume of oil due to temperature variation, stainless steel bellows shall be provided. The successful bidder shall have to submit calculations of volumetric expansion and contraction. These calculations shall be submitted along with the basic parameters of SS bellow used in CT.

Rubber bellow or Nitrogen gas cushioning for above purpose shall not be permitted.

The current Transformers provided with stainless steel bellows for compensation of oil volume variation shall be provided with a suitable oil level indicator at suitable location to enable an observer to see the oil level of the C.T. from the ground level. Oil level indicator shall be provided with fluorescent floating ball ***of non-oil reacting material.***
***All parts of bellow shall be of stainless steel only.***

1.1.4 The core of current transformers to be used for metering and instrumentations shall have saturation factor, low enough to avoid damage to the instruments, in the event of maximum short circuit current.

1.1.5 a) The C.T. core, to be used for protective relays shall be of accuracy class, specified or appropriate class suitable for back up, over current and earth fault, differential and bus-bar protection.

1.1.5 b) The tenderer shall give assurance for trouble free and maintenance free performance for a period of 60 months from the date of receipt at store; during which period, the CTs shall be repaired / reconditioned / replaced free of cost, immediately in case of any trouble. Therefore, the tenderer shall ensure that sealing of current transformer is properly achieved. In this connection, the arrangement provided by the tenderer at various locations including the following ones shall be described supported by sectional drawings.

i) Location of emergence of primary and secondary terminals.
ii) Interface between polymer housing and metal tank.
iii) Cover of the secondary terminal box.
iv) G.A. drawing complete with details of primary and secondary windings overall dimensions, weight, nameplate, Polymer Housed insulator, primary & secondary terminals, terminal connectors, etc.

1.1.5 c) Nuts and bolts (or screws used for fixation of interfacing polymer bushings for taking out terminals) shall be provided on flanges, cemented to the bushing and not on the polymer i.e. Flange type 66 KV bushing for CT, shall be provided.

1.1.5 d) For gasket joints, wherever used, Nitrile Butyl rubber NBR/Viton/ RC70C/RC80C gaskets shall be used. No plain CORK gaskets shall be used. All O rings shall be fixed in a machine groove. The gaskets shall be securely fitted for perfect sealing

1.1.5 e) The bolts required for fitting the dome shall be of stainless steel of minimum 6 mm dia.

1.1.5 f) The outer surface of metal tank if made of steel shall be Hot Dip Galvanized, whereas, the inner portion shall be painted with oil resistive, insoluble paint. The GETCO reserves right for stage inspection during manufacturing process of tank / CT. **The galvanizing shall be as per applicable standard IS :2629 and minimum thickness of zinc coating shall be 610 gm/ sqmt.** If made of aluminum, external surface of aluminum can have natural finish.

1.1.5 g) The tank of CT shall be provided with pressboard of 2 mm thickness inside and at bottom.

1.1.5 h) Provision of drain valve for sampling / draining of oil purpose at the bottom of tank is not permitted.

1.1.5 i) The minimum thickness of flange & gasket provided on tank shall be as follow:

a) Flange thickness of tank - 8 mm
b) Top plate thickness - 5 mm
c) Gasket thickness - 6 mm

1.1.5 j) The current transformers shall be suitable for mounting on steel structures or concrete pedestals.

**1.1.6 WINDING AND TERMINALS:**

1.1.6.1 The rating of the secondary winding shall be as specified under Section II of this specification. Ratio changing arrangement shall be provided on secondary winding for multi–ratio design, either a number of identical secondary winding may be provided to achieve desired ratios by series / parallel connection for the secondary winding or the secondary winding may be tapped. However, identical secondaries for tapped secondary winding shall meet requirement as specified.

1.1.6.2 Primary and secondary windings shall be of electrolytic grade copper and shall have continuous thermal rating as specified for all ratios. The primary winding is to be designed for continuous extended primary current at 120 % of rated primary current. The secondary winding wherever tapped, shall be adequately reinforced to withstand normal handling without damage.

1.1.6.3 The primary terminals shall be of standard size of 30 mm dia x 80 mm length for all CTs rated up to 1200 Amps. For higher values of primary current, each primary terminal shall be made out of two such rods of 30/40/50mm mm dia x 80 mm length in parallel. The primary terminals shall be of heavily tinned electrolytic copper. The maximum thickness of tinning shall be 15 microns.

1.1.6.4 The secondary terminals shall be brought out in a compartment for easy access. Secondary terminal studs shall be provided with at least three nuts and adequate plain and spring washers for fixing the leads. The studs, nuts and washers shall be of brass, duly nickel-plated. The minimum outside diameter of the studs shall be 6mm. The length of at least 15mm shall be available on the studs for inserting the leads. The horizontal spacing between centers of the adjacent studs shall be at least 1.5 times the outside circum dia. of the units.

***1.1.6.5*** The current transformer shall be provided with suitable test tap for measurement of capacitance, tan delta as well as partial discharges, in factory as well as at site. Provision shall be made of a screw on cap for solid and secured earthing of the test tap connection, when not in use. ***Tan delta test tap shall measure tan delta value of whole mass of insulation***. A suitable caution plate shall be provided duly fixed on the cover of the secondary terminal box, indicating the purpose of the test tap and necessity of its solid earthing as per prescribed method, before energizing the CT.

### 1.1.7 TERMINAL BOX OF CURRENT TRANSFORMERS:

**1.1.7.1** The exterior of the secondary terminal box shall be hot dip galvanized. A cable box along with necessary glands for receiving control cables suitable for mounting on bottom plate of the terminal box shall be included in the scope of supply. A door with locking arrangement shall be provided on the front of the terminal box. The secondary terminals shall be taken out through composite epoxy or FRP mould having single gasket packing & shall be provided by suitable link with dummy secondary leads. For control cable connections, separate terminal connector block to be provided. Secondary jumpers shall be terminated at one side of this terminal connector block. **The secondary terminal box shall comply with Degree of Protection (IP - 55) standards and type test report shall be furnished with technical bid.**

### 1.1.8 TEMPERATURE RISE:

1.1.8.1 The maximum temperature rise of the current transformer and its oil, winding and external surface of the core and other parts shall be as specified in Table Vof IS: 16227 (Part I) 2016.

### 1.2 BUSHING AND INSULATORS:

1.2.1 Polymer housing material shall be silicon rubber. Polymer Rubber housing shall be free from lamination cavities or other flaws affecting the maximum level of mechanical and electrical strengths. Properties of the polymer

materials shall be specified in the offer and test reports for the same from a NABL accredited laboratory shall be submitted for approval of the purchaser. The polymer material which is used for housing must be resistant to tracking & erosion, and stabilized against UV radiation.

1.2.2 The Current Transformer shall not fail due to housing contamination. TERT (Tracking & Erosion resistance test) test shall be carried out on the material used for housing as per ASTM D 2303 and type test reports hall be submitted.

1.2.3 The rain sheds / petticoats shall be of polymeric material and shall confirm to the properties and type test reports shall be submitted and shall not be pre-molded push on type or slip on type. The adhesion between the polymeric housing and the metal oxide resistors or any other metallic or non-metallic parts inside the housing must be strong enough, homogeneous, robust and resistant to thermal cycles and environmental stresses. Tests shall be carried out on each batch during manufacturing and records maintained and provided as & when required during inspection.

1.2.4 The creepage distance of the housing shall be as stated cl. 2.4.1.

1.2.5 The Polymer weather shed design shall be preferably of self-cleaning type (Aerofoil design.) The details of the Polymer housing shed profile such as distance, angle of inclination, gap between the shed, diameter (ID and OD) etc. shall be as per relevant standard and shall be indicated by the Bidder in his offer in the form, during detailed drawing.

1.2.6 The Current Transformer housing shall conform to the requirements of latest IEC 61869-2, amended up to date.

1.2.7 The quantity of insulating oil for the first filling of oil in each CT and the complete specifications of the oil shall be stated in the tender. The oil shall conform to the requirements of latest edition of IS: 335. The actual oil to be used shall be of the GETCO approved make only.

The manufacturer of CT shall measure the PPM value of oil before filling inside the CT and shall keep record of the same.

## 1.3 TERMINAL CONNECTORS AND EARTHING TERMINALS:

1.3.1 (a) Compression joint type bimetallic terminal connectors suitable for ACSR 'PANTHER' conductors (with 510 amps.) shall be supplied for CTs having ratio from 100-50 / 1-1-1 Amp up to 600-300 / 1-1-1 Amp.

(b) Compression joint type bimetallic terminal connectors suitable for ACSR twin Moose conductor (with 880 x 2 amps.) shall be supplied for CTs, having ratio 1200-600/1-1-1A.

The terminal connectors shall be suitable for 31.5 KA for 3 sec. They shall be suitable for vertical & horizontal connections of the transmission line conductors or station bus bar. The bolt and nuts shall be of stainless steel and one SS washer and two SS nuts (including lock nut) for each bolt shall be supplied. Two grounding terminals suitable for receiving connections for grounding shall be provided for the current transformers.

### 1.4 GALVANIZING:

All ferrous parts of current transformers including bolts, nuts etc. shall be hot dip galvanized as per IS: 2629 – 1966 with (latest edition) **and the minimum thickness of zinc coating shall be 610 gr/ sqmt.**

### 1.5 TESTS AND TEST REPORTS:

1.5.1 Reports of all type tests as stipulated in the latest edition of IS: 16227 & IEC **61869-2** for current transformers shall be submitted along with the tender.

1.5.2 The following tests from NABL accredited laboratory shall be carried out in accordance with latest / amended / up to date IS/IEC. The bidder has to submit the all type test reports as stated hereunder for the offered item along with the technical bid. **The type test reports from NABL approved laboratory shall not be older than TEN years**. Type Test shall be valid as on the last date of submission of bid.

**Following test reports shall be submitted.**

1. **Chopped** Impulse voltage withstand test on Primary terminal.-(350kVp)
2. High voltage power frequency wet withstand test on Primary winding
3. Temperature rise test
4. Short Time Current test
5. Test for Accuracy
6. Measurement of dielectric dissipation factor
7. Degree of protection IP55 for secondary terminal box
8. STC test on primary terminal connector

**10 Mechanical tests**

**11 Thermal stability test**(IEEMA-22-2005)

**12 *Temperature* coefficient test**(IEEMA-22-2005)

**13** All applicable test on silicon rubber as per standard IEC- 61462 and TERT (Tracking & Erosion resistance test) as per ASTM D2303.

**14 Transmitted overvoltage test**

**15 Internal arc fault test**

**Notes: -**

1. Test no. 13 for composite hollow insulator shall not be older than 5 years & shall be valid as on the last date of submission of bid.

The type test reports for offered terminal connectors (confirming to IS: 5561 (latest edition), but not older than Ten years prior to the date of bid opening and those for offered insulators confirming to the applicable standard shall, also, be submitted along with the offer.

**IMPORTANT NOTE:** *In case of non-submission/partial submission or type test reports of which validity is over, bidder shall submit pending type test report/s from NABL accredited laboratory, in the event of an order, before commencement of supply without affecting delivery schedule, free of cost to GETCO. Confirmation for above shall be invariably submitted along with technical bid.*

***If bidder has submitted all valid type / special / additional test reports as per requirement of technical specifications, then the same are not required to be repeated. However, those tests which are covered under acceptance/ additional/routine tests will be required to be carried out during the inspection, which is not a repetition.***

1.5.3 Routine tests as per the latest edition of IS: 16227 for current transformers shall be carried out on each current transformer (in presence of purchaser's representative, if desired by the purchaser).
Following tests shall be performed:

1. Verification of terminal marking and polarity (on 10% of offered lot)
2. High voltage power frequency dry withstand test on primary winding (on 10% of offered lot)
3. High voltage power frequency dry withstand test on secondary winding (on 10% of offered lot)
4. Over Voltage inter turn test (on 10% of offered lot)
5. Measurement of Partial Discharge test (on 10% of offered lot)
6. Test of Accuracy (on 10% of offered lot)
7. Measurement of dielectric dissipation factor **(0.3% max)** & Capacitance **at 10 kV and at Um/√3.** (on 100% of offered lot)
8. Determination of the secondary winding resistance (on 10% of offered lot)
9. Test for rated knee point e.m.f & exciting current at rated knee point e.m.f(on 10% of offered lot)
10. Power-frequency voltage withstand tests between sections (on 10% of the offered lot)

Test no. 1 to 6 shall only be performed on 100% tariff metering CTs in an NABL accredited/Govt lab.

1.5.4 General points:

a) The manufacturer shall use 5 KV motorized egger for measuring IR valves of CTs.
b) The manufacturer shall carry out Partial Discharge test and tan delta test as per relevant ISS, and shall keep record of the same.
c) If so required, the purchaser shall select one CT of each ratio from the first lot or any subsequent lot of CTs, which shall be type tested in presence of purchaser's representative at third party Govt. recognized laboratory. The balance CT from the first offered lot or any subsequent lot shall be inspected and tested for routine tests.
d) The manufacturer shall offer CTs for routine tests / inspection in line with the requirement as per delivery schedule specified in the A/T
e) Record of each manufacturing process shall be maintained by the manufacturers, and shall be shown to the inspector, on demand at the time of inspection.

**1.5.5 ADDITIONAL ACCEPTANCE TEST:**

1.5.5.1 In addition to the acceptance tests indicated in IS 16227 (with latest amendment), the successful bidder has to conduct following tests on all offered lot of CTs during inspection:

**a)** Tan Delta test **(0.3% Max)** (On all units) **(at 10 kV & Um/√3)**
**b)** Measurement of Capacitance test (On all units) **(at 10 kV & Um/√3)**
c) Thermal stability test (On randomly selected one unit)
d) Partial Discharge test *(<10 pC)* (On selected unit for (c), but to be carried out before and after Temperature Rise test)

e) Tests on Oil:

| | |
|---|---|
| i) BDV test<br>ii) Tan Delta test | (For Sr. No. i to vi), On |
| iii) Water PPM test<br>**iv) Resistivity at 90 $^0$**<br>***v) Viscosity***<br>***vi) Total acidity*** | randomly selected unit of very first lot offered for inspection and to be conducted after HV test only. |
| vii) DGA test | Copy of test report, received from the power oil manufacturer, to be submitted. |

(NOTE: If the supplier of oil is changed during execution of order, same test shall be repeated for the oil of new supplier.

f) **Thermal stability test on CT** (On any one unit) (IEEMA-22-2005)
g) **Thermal coefficient test on CT (**On any one unit) (IEEMA-22-2005)

1.5.6 All the tests reports and oscillograms shall be submitted and got approved from the purchaser before dispatching the equipment.

## 1.6 QUALITY ASSURANCE PLAN:

The tenderer shall invariably furnish following information along with his offer; failing which his offer shall be liable for rejection. Information shall be separately given for individual type of instrument transformer.

i) Statement giving list of important raw materials, including but not limited to:

a) Primary Conductor
b) Insulator Bushing
c) Core
d) Oil
e) Sealing material
f) Secondary wire

Names of sub-suppliers for the raw materials, list of standards; according to which the raw materials are tested, list of tests normally carried out on raw materials in presence of tenderer's representative, copies of test certificates.

ii) Information and copies of test certificates as in (i) above, in respect of, bought out accessories

iii) List of manufacturing facilities available. In this list the tenderer shall specifically mention whether lapping machine, vacuum drying plant, air conditioned dust free room with positive air pressure for provision of insulation, oil leakage testing facility, facility for testing tan delta of insulation at rated voltage etc. are available.

iv) Levels of automation achieved and list of areas where manual processing still exists.

v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

vi) Special features provided in the equipment to make it maintenance free.

vii) List of testing equipment available with the tenderer for final testing of instrument transformer and test plant limitation, if any for the type, special acceptance and routine tests specified in the relevant standards. These

limitations shall be very clearly brought out in schedule 'C' i.e. schedule of deviations.

**viii) The following testing equipments s hall be available for testing at bidders works.**

**1) Partial Discharge test set up (preferably Robinsons)**

**2) Tan delta and capacitance test set u p (Tettex or Dobble)**

**3) Minimum Sensitivity o f high voltage laboratory - 2.5pC for PD measurement. This is to be demonstrated before test.**

**All test set up shall be calibrated at NABL accredited laboratory and report shall be submitted with inspection report.**

**ix) Bidder shall have ISO certification.**

**1.7** Guaranteed and technical particulars as called for in attached Appendix –I shall be furnished along with the tender.

**1.8 COMPLETENESS OF EQUIPMENTS:**

Any fittings, accessories or apparatus which may not have been specifically mentioned in these specifications, but which are usual or necessary for the equipment of similar plant shall be deemed to be included in the contract and shall be supplied by the contractor without extra charges. All plant and equipment shall be complete in all details whether such details are mentioned in the specification or not.

## 1.9 INSPECTION:

i) The purchaser shall have access at all times to the works and all other places of manufacture, where the Instrument Transformers

are being manufactured and the supplier shall provide purchaser's representative all facilities for unrestricted inspection of the works, raw materials, manufacture of all the accessories and for conducting necessary tests.

**ii) The successful bidder shall submit the stage wise inspection program. Stages of inspection and owners participation would be defined and tied up at the time of award of contract.**

*iii) " The successful bidder shall first offer PROTO unit for stage inspection. During stage inspection all the raw material and manufacturing process shall be verified. On clearance of stage inspection bidder shall process for manufactur ing of PROTO unit and offer the same for inspection. During inspection all the acceptance tests as indicated at respective clause under head of 'Acceptance tests' along with additional* ***Sealing test*** *as detailed here under, shall be carried out before temper ature coefficient test.*

*In the event of failure of PROTO unit, bidder shall analyze the defects & submit report to GETCO along with remedial measures taken and again offer PROTO for inspection.*

*On successful completion of all acceptance tests along with* ***Sealing test*** *on PROTO unit, release for manufacturing will be given by GETCO.*

*The successful PROTO unit shall be kept aside and made available to inspector for verification. This unit shall be dispatched after the inspection of last lot is over.*

*Sealing test shall be carried out on one randomly selected unit out of every 20 or less offered quantity. In the event of failure of unit during sealing test next unit will be randomly selected from the offered lot. Failed unit shall not be accepted. If second unit also fail to clear Sealing test WHOLE lot shall be rejected."*

***SEALING TEST PROCEDURE:***

*(i) Test shall be performed on completely assembled unit.*

*(ii) Test shall be performed on PROTO as well as during acceptance test on one randomly selected unit.*

*(iii) Temperature o f CT/ PT under test will be elevated and maintained at 50 ( °C) and simultaneously it shall be subjected to internal pressure of 103 kPa (@1.1 kg/ sqcm) for 12 hrs.*

*(iv) Arrangement shall be made by manufacturer to maintain required pressure and temperature for 12 h rs.*

*(v) During and after the test, there shall not be any oil leakage from any part or joint of CT/ PT. Readings of temperature, internal pressure applied and duration test along with observation of leakage, if any, shall be noted in inspection report.*

*iv) Applicability of PROTO unit will be to each class and not to each ratio, if the design is not changed.*

*v) Manufacturing of PROTO unit will start from drawing approval. However, if the type tests are pending then bidder shall ensure to complete type tests with in commencement period.*

*vi) Applicability of Sealing test for every lot of 20 units even after Proto confirms sealing test & manufacturing clearance is issued by GETCO.*

*If bidder wants to offer PROTO from first lot of 20 units and if Proto successfully passes all tests then sealing test on other unit from that lot is not required. But if PROTO do not pass any of the tests whole lot will be rejected.*

*vii) Sealing test is applicable to each lot of each class and each ratio even if the design is same.*

viii) No material shall be dispatched without Inspection.

ix) The acceptance of any quantity of the equipments shall in no way, relieve the successful Bidder of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection, if such equipments are found defective later.

**SEAL OF THE FIRM** **SIGNATURE OF THE TENDERER**

# TECHNICAL SPECIFICATION FOR 66 kV CURRENT AND VOLTAGE TRANSFORMERS

## SECTION – II

## TECHNICAL REQUIREMENTS FOR 66 kV CURRENT TRANSFORMERS

### 2.1 SCOPE:

2.1.1 This section covers the specific technical requirements, climatic and Isoceraunic conditions and systems particulars for which current transformers shall be offered as per the general technical requirements given under section – I of this specification and the schedule of requirements specified herein for various substations.

### 2.2 CLIMATIC & ISOCERAUNIC CONDITIONS:

2.2.1 The climatic conditions, under which the equipment shall operate satisfactorily are as follows:

| | |
|---|---|
| a) Maximum ambient temperature of air in Shade (C) | 50°C |
| b) Minimum ambient temperature of air in shade (C) | 4°C |
| c) Maximum daily average ambient temperature (C) | 40°C |
| d) Maximum yearly average ambient temperature (C) | 30°C |
| e) Maximum relative humidity (%) | 95% |
| f) Average number of thunderstorm (days / annum). | 15 |
| g) Average annual rainfall (cm) | 150 cm. |
| h) Maximum wind pressure (kg/Mtr$^2$) | 150 kg/Mtr$^2$ |
| i) Height above mean seal level (Mtrs) | Not exceeding 1000M |

2.2.2 All equipments offered shall be suitable for continuous satisfactory operation at the extended primary current of 120 % of full rated capacity, under the above climatic conditions.

2.2.3 Since the substations may be near seashore or industrial area, the equipment offered shall be suitable for heavily polluted atmosphere.

### 2.3 SYSTEM DETAILS:

| | | |
|---|---|---|
| i) | Nominal system voltage | 66 KV |
| ii) | Maximum rated voltage | 72.5 KV |
| iii) | Minimum rated voltage | 60 KV |
| iv) | Frequency | 50 Hz. |
| v) | Number of phases | 3 |
| vi) | Neutral earthing | Solidly Earthed |

## 2.4 TYPE & RATING OF CURRENT TRANSFORMER:

2.4.1 The 66 KV Current transformer shall have the rating as given below:

| **66 kV Current transformer** | | | |
|---|---|---|---|
| 1) | CT ratio | (a): | 100- 50 / 1-1-1 A |
| | | (b): | (i)150-100 / 1-1-1 A<br>(ii)200-100 / 1-1-1 A |
| | | (c): | (i)300-150 / 1-1-1 A<br>(ii)300-200 / 1-1-1 A<br>(iii) 400-200 / 1-1-1 A |
| | | (d): | 600-300 / 1-1-1 A |
| | | (e): | 1200-600 / 1-1-1 A |
| | | (f): | 1600-1200/1-1-1A |
| | | ***(f1)*** | ***2500-1600-1200/1A*** |
| | | (g): | As indicated in Schedule – A of respective tender (one core) |
| | | (h): | As indicated in Schedule-A of respective tender(Two core) |
| 2) | Core | (a)to***(f1):*** | Three |
| | | (g): | One |
| | | (h): | Two |
| 3) | Purpose | (a)to***(f1):*** | Core-1 Metering<br>Core-2 Relaying<br>Core-3: Differential |
| | | (g): | Core-1 tariff Metering |
| | | (h): | Core-1 Tariff metering<br>Core-2 Relaying |
| 4) | Rated burden (VA)<br>(lowest ratio)<br>(minimum tap) | (a)to***(f1):*** | 15 (Core-1)<br>15 (Core-2)<br>-- (Core-3) |
| | | (g): | 5(Core-1) |
| | | (h): | 5(Core-1)<br>15(Core-2) |
| 5) | Class of Accuracy | (a)to***(f1):*** | 0.5(Core-1)<br>5P(Core-2)<br>P.X.(Core-3) |
| | | (g): | 0.2S |
| | | (h): | 0.2S (Core-1)<br>5P (Core-2) |
| 6) | i) Rated accuracy limiting factor (ALF) | 10 at minimum ratio for all 66 kV CTs | |
| | ii) Instrument security Factor (I.S.F) | 5 or less at minimum ratio for all 66kv CTs except tariff metering CTs<br>5 or less for all the ratio for tariff metering | |
| 7) | Minimum knee point voltage (at highest ratio) | 600V for (a) & (b)<br>650V for (c) & (d)<br>950V for (e) & (f)<br>***1200 V for (f1)*** | |

| | | |
|---|---|---|
| | | NA for (g) & (h) |
| 8) | Exciting current at Knee point voltage | As per IS:16227(latest edition) |
| 9) | Resistance of secondary winding | -Do- |
| 10) | 1.2/50 microsecond lightning impulse withstand voltage(kV peak) | 350 |
| 11) | Power frequency withstand voltage for one minute(kV rms) | 140 |
| 12) | Short time withstand current(kA) (corresponding to fault level in MVA for 3.0 sec) | 31.5 for 3 sec |
| 13) | Minimum total for creepage distance for heavily polluted atmosphere: (mm) | 1810 |
| 14) | Partial dicscharge level | <10pC |
| 15) | Power frequency voltage withstand of secondary winding | 3kV for one minute |

2.4.2 The ratings specified shall be guaranteed at all primary connections. Any changes in the particulars of the CTs that may be required for the protective relays (protective relays being procured separately) actually ordered shall have to be met by the supplier of CTs without any extra cost.

2.4.3 All current transformers shall meet the requirements of this specification for  3% variation in rated system frequency of 50 Hz.

**2.4.4 EARTH QUAKE & WIND DESIGN LOADS:**

Each CT, including its supporting structure shall be designed to withstand repeated earthquake acceleration of 0.08 x 2g with wind loads of 150 kg/$m^2$ on the projected area (non-simultaneous) without damage to component parts and without impairment of operation.

**SEAL OF THE FIRM** **SIGNATURE OF THE TENDERER**

# TECHNICAL SPECIFICATION FOR 66 kV CURRENT AND VOLTAGE TRANSFORMERS

## TECHNICAL REQUIREMENTS FOR 66 kV VOLTAGE TRANSFORMERS

## SECTION – I

### 1.1 SCOPE:

This specification is intended to cover the design, manufacturing, assembly, testing at manufacturer's works, supply and delivery of voltage transformers for metering and relaying service in 66 KV phase system.

### 1.2 TYPE AND RATING:

The voltage transformers shall be of outdoor, dead tank type, **oil impregnated paper,** single phase, oil immersed, self-cooled suitable for operation in 3 phase, 66 KV solidly grounded system as per system details at cl. 2.3 of Section II of CT, under the climatic conditions specified at clause 2.2 under Section – II of CT.

`The voltage transformers shall have the following ratings:

| | POTENTIAL TRANSFORMER | For metering and protection purpose: | ***for tariff metering purpose – as indicated in Schedule A of respective tender*** | |
|---|---|---|---|---|
| i) | Nominal system voltage | 66 kV | | |
| ii) | Highest system voltage | 72.5 kV | | |
| iii) | Frequency | 50 Hz | | |
| iv) | Earthing | Effective | | |
| v) | Number of Windings | Two | One | ***Two*** |
| | a) Ratio: Winding – I | 38.1 kV/63.5V | 38.1 kV/63.5V | *38.1 kV / 63.5V* |
| | b) - Do - II | 38.1 kV/**63.5 V** | NA | *38.1 kV / 63.5V* |
| vi) | a) Rated Burden, Winding – I ] | For 66 kV s/s: | | |
| | ] | 100 VA | 10 VA | ***10 VA*** |
| | b) - Do - – II ] | For above 66 kV s/s: | | |
| | ] | 200 VA | NA | ***100 VA*** |
| vii) | a) Class of accuracy windings – I | 0.5 (Metering) | 0.2 (Tariff metering) | ***0.2 (Tariff metering)*** |
| | b) - Do - – II | 3 P (Protection) | NA | 3P (Protection) |

| | | |
|---|---|---|
| viii) | Over voltage factor: | 1.2 continuous |
| ix) | 1.2/50 micro sec. lightning impulse withstand voltage | 350 kVp |
| x) | P.F. withstand voltage for one minute | 140 kV rms |
| xi) | Total Creepage (Min) Distance | 1815 mm |
| ***xii)*** | ***Partial discharge level*** | < 10 pC |
| ***xiii)*** | ***Power Frequency Voltage withstand of secondary winding*** | 3 kV for One minute. |

## 1.3 STANDARDS:

The voltage transformers shall conform in all respects to the latest issue of IEC, recommendations publication No. 61869-3 or British Standards No. 81 & 2046, and IS:16227(latest issue) except wherein specified otherwise, where the equipment conforms to any other standard, the salient points, differences between the standards adopted and the British Standards shall be clearly brought out in the tender.

Equipment meeting any other authoritative standard, which ensures an equal or better quality than the standard mentioned above, is also acceptable.

## 1.4 CLIMATIC CONDITIONS:

The climatic conditions prevailing at site is as specified at clause – 2.2 of Section- II of 66KV CT.

## 1.5 GENERAL:

**1.5.1** The voltage transformers shall be outdoor, oil immersed and self-cooled type suitable for the services indicated conforming to the modern practice of design and manufacture.

**1.5.2** The core shall be of high grade, non-ageing, electrical silicon laminated steel of low hysteresis less and high permeability to ensure high accuracy at both normal and over voltage.

**1.5.3** The voltage transformers shall be hermitically sealed to eliminate breathing and entering of air and moisture in the tank. Provision of pressure releasing device is not permitted.

For compensation of variation in volume of oil due to temperature variation, stainless steel bellows shall be provided. The successful bidder shall have to submit calculations of volumetric expansion and contraction. These calculations shall be submitted along with the basic parameters of SS bellow used in PT.

Rubber bellow or Nitrogen gas cushioning for above purpose shall not be permitted.

The Voltage Transformers provided with stainless steel bellows for compensation of oil volume variation shall be provided with a suitable oil level indicator at suitable location to enable an observer to see the oil level of the C.T. from the ground level. Oil level indicator shall be provided with fluorescent floating ball.

***All parts of bellow shall be of stainless steel only.***

**1.5.4** The bolts required for fitting the dome shall be stainless steel of minimum 6 mm diameter.

**1.5.5** The outer surface of metal tank shall be Hot Dip Galvanized, whereas, the inner portion shall be painted with oil resistive paint. The GETCO reserves right for inspection during manufacturing process of metal tank.

**1.5.6** The tank of PT shall be provided with pressboard of 2 mm thickness inside and at bottom.

**1.5.7** The bidder shall provide packing between insulator and tank. This packing shall be preferably Nylon Bush/pressboard of minimum 3 mm thickness.

**1.5.8** The exterior, upper and lower joints of insulator bushing shall be sealed with suitable sealant.

**1.5.9** The provision of drain valve for sampling / draining of oil purpose at the bottom of the tank is not permitted.

**1.5.10** The minimum thickness of flange & gasket provided on tank shall be as follow:

a) Flange thickness of tank - 8 mm
b) Top plate thickness - 5 mm
c) Gasket thickness - 6 mm

## 1.6 WINDINGS:

### 1.6.1 PRIMARY & SECONDARY WINDING:

The primary winding shall be of electrolytic grade copper. All primaries of potential transformers will be connected in phase to neutral with the neutral point solidly earthed. The neutral of the system is also solidly earthed.

The primary terminal shall be of heavily tinned electrolytic grade copper and shall be of standard size 30 mm dia. x 80 mm long and tinning shall be adequate.

The secondary winding shall be of electrolytic grade copper. Secondary terminal shall be nickel-plated brass.

The secondary terminals shall be taken out through composite epoxy or FRP mould having single gasket packing & shall be provided by suitable link with dummy secondary leads. For control cable connections, separate terminal connector block to be provided. Secondary jumpers shall be

terminated at one side of this terminal connector block.

All potential transformers for phase to ground connection shall be provided with two separate windings rated for 110 V and 63.5 V for connection in star and delta winding respectively. The star winding, to be used for metering and relaying (distance relays) shall be of accuracy class specified or appropriate class. The rated burden of this winding shall not be less than that specified above.

The delta winding to be used for synchronizing and relaying (directional relays) shall be of accuracy class specified or appropriate class and its rated burden shall not be less than that specified above.

## 1.7 INSULATION:

a) The potential transformer shall withstand 1.2/50 microsecond lightning impulse withstand voltage of 350 kV peak.

b) They shall withstand power frequency withstand voltage of 140 kV (rms) (dry & wet) for one minute.

## 1.8 TEMPERATURE RISE:

The potential transformers shall be designed to limit the temperature of windings and other parts as specified in the British Standards / relevant standards when corrected or the differences between the temperature prevailing at site and temperature specified by the standards. The temperature rise, at 1.2 times rated primary voltage when applied continuously at rated frequency and at rated burden, shall not exceed the limits specified above and the temperature rise at 1.5 times rated primary voltage when applied for 30 seconds, starting from previous stable operating condition at rated frequency and rated burden shall not exceed the above temperature limits by more than 10$^{o}$C.

## 1.9 INSULATING OIL:

The quantity of insulating oil for the first filling of oil in each PT and the complete specifications of the oil shall be stated in the tender. The oil shall conform to the requirements of latest edition of IS: 335. The actual oil to be used shall be of the GETCO approved make only.

The manufacturer of PT shall measure the PPM value of oil before filling inside the PT and shall keep record of the same.

## 1.10 TYPE OF MOUNTING:

The voltage transformers shall be suitable for mounting on steel structures or concrete pedestals. The necessary flanges, bolts etc. For the base of the voltage transformer shall be supplied and these shall be galvanized. Nuts and bolts shall be provided on flanges, cemented to the bushing and not on the polymer i.e. flange type bushing to be provided.

**1.10.1 TERMINAL BOX OF VOLTAGE TRANSFORMERS:**

The exterior of the secondary terminal box shall be hot dip galvanized. A cable box along with necessary glands for receiving control cables suitable for mounting on bottom plate of the terminal box shall be included in the scope of supply. A door with locking arrangement shall be provided on the front of the terminal box. The secondary terminals shall be taken out through composite epoxy or FRP mould having single gasket packing & shall be provided by suitable link with dummy secondary leads. For control cable connections, separate terminal connector block to be provided. Secondary jumpers shall be terminated at one side of this terminal connector block. **The secondary terminal box shall comply with Degree of Protection (IP -55) standards and type test report shall be furnished with technical bid.**

**1.10.2** Polymer housing material shall be silicon rubber. Polymer Rubber housing shall be free from lamination cavities or other flaws affecting the maximum level of mechanical and electrical strengths. Properties of the polymer materials shall be specified in the offer and test reports for the same from a NABL accredited laboratory shall be submitted for approval of the purchaser. The polymer material which is used for housing must have be resistant to tracking & erosion, and stabilized against UV radiation.

**1.10.3** The Voltage Transformer shall not fail due to housing contamination. TERT (Tracking & Erosion resistance test) test shall be carried out on the material used for housing as per ASTM D 2303 and type test reports hall be submitted.

**1.10.4** The rain sheds / petticoats shall be of polymeric material and shall confirm to the properties and type test reports shall be submitted and shall not be pre-molded push on type or slip on type. The adhesion between the polymeric housing and the metal oxide resistors or any other metallic or non-metallic parts inside the housing must be strong enough, homogeneous, robust and resistant to thermal cycles and environmental stresses. Tests shall be carried out on each batch during manufacturing and records maintained and provided as & when required during inspection.

**1.10.5** The creepage distance of the housing shall be as stated cl. 1.1

**1.10.6** The Polymer weather shed design shall be preferably of self-cleaning type (Aerofoil design.) The details of the Polymer housing shed profile such as distance, angle of inclination, gap between the shed, diameter (ID and OD) etc. shall be as per relevant standard and shall be indicated by the Bidder in his offer in the form, during detailed drawing.

**1.10.7** The Voltage Transformer housing shall conform to the requirements of latest IEC 61869-3, amended up to date.

**1.10.8** For gasket joints, wherever used, Nitrile Butyl rubber NBR/Viton/ RC70C/RC80C gaskets shall be used. No plain CORK gaskets shall be used. All–O rings shall be fixed in a machine groove. The gaskets shall be securely fitted for perfect sealing

**1.10.9** All other relevant clauses of CT shall also be applicable to VT.

**1.11 TERMINAL CONNECTIONS:**

The compression joint type terminal connector suitable for ACSR 'PANTHER' conductor shall be supplied. Suitable terminal earth connector for connections for earthing shall also be supplied.
The terminal connectors shall be suitable for 31.5 KA for 3 secs. They shall be suitable for vertical & horizontal connections of the transmission line conductors or station bus bar. The bolt and nuts shall be of stainless steel and one SS washer and two SS nuts (including lock nut) for each bolt shall be supplied. Two grounding terminals suitable for receiving connections for grounding shall be provided for the voltage transformers.

**1.12 TESTS:**

**1.12.1 TYPE TESTS:**

The following tests from NABL accredited laboratory shall be carried out in accordance with latest / amended / up to date IS/IEC. The bidder has to submit the all type test reports as stated hereunder for the offered item along with the technical bid. **The type test reports from NABL approved laboratory shall not be older than TEN years**. Type Test shall be valid as on the last date of submission of bid. Following test reports shall be submitted.

1. **chopped** Impulse voltage withstand test on Primary terminal (350 kVp)
2. High voltage power frequency wet withstand test on primary winding
3. High voltage power frequency dry withstand test on secondary winding
4. Temperature rise test
5. Test of Accuracy
6. Degree of protection IP55 for secondary terminal box
7. STC test on primary terminal connector
8. **Mechanical load test on primary terminal**
9. All applicable test on silicon rubber as per standard IEC- 61462 and TERT (Tracking & Erosion Resistance Test) as per ASTM D2303
10. **Transmitted overvoltage test**
11. **Internal arc fault test**

**Notes:-**

1. Test no. 9 for composite hollow insulator shall not be older than 5yrs & shall be valid as on the last date of submission of bid.

**IMPORTANT NOTE:** *In case of non-submission/partial submission or type test reports of which validity is over, bidder shall submit pending type test report/s from NABL accredited laboratory, in the event of an order, before commencement of supply without affecting delivery schedule, free of cost to GETCO. Confirmation for above shall be invariably submitted along with technical bid.*

***If bidder has submitted all valid type / special / additional test reports as per requirement of technical specifications then the same are not required to be repeated. However, those tests which are covered under acceptance/ additional/ routine tests will be required to be carried out during the inspection, which is not a repetition.***

Each voltage transformer shall be subject to routine tests as stipulated in IS: 16227(latest edition) in presence of purchaser's representative, if so desired, by the purchaser. All the type test reports shall be submitted and got approved from the purchaser before the dispatch of potential transformer.

Following tests shall be performed:

1. Verification of terminal marking & polarity test (on 10% of the offered lot)
2. High voltage power frequency dry withstand test on primary winding (on 10% of the offered lot)
3. High voltage power frequency dry withstand test on secondary winding (on 10% of the offered lot)
4. Measurement of Partial Discharge test (on 10% of the offered lot)
5. Test of Accuracy (on 10% of the offered lot)
6. Measurement of dielectric dissipation factor **(0.3% max)** & Capacitance **at 10 kV and at Um/√3.** (on 100% of the offered lot)
7. Temperature Rise test (On any one unit from offered lot)
8. Power-frequency voltage withstand tests between sections (on 10% of the offered lot)

### 1.12.2 ADDITIONAL ACCEPTANCE TEST:

In addition to the acceptance tests indicated in IS-16227-III (with latest amendment), the successful bidder has to conduct following tests on all offered lot of PTs during inspection:

| | | |
|---|---|---|
| **a)** | Tan Delta test **(0.3% Max)** | (On all units) **(at 10 kV & Um/√3)** |
| **b)** | Measurement of Capacitance test | (On all units) **(at 10 kV & Um/√3)** |
| c) | Temperature Rise test | (On randomly selected one unit) |
| d) | Partial Discharge test | (On selected unit for (c), but to be carried out before and after Temperature Rise test) |

e) Tests on Oil:

| | |
|---|---|
| i) BDV test<br>ii) Tan Delta test<br>iii) Water Ppm test<br>**iv) Resistivity at 90 °**<br>***v) Viscosity***<br>***vi) Total acidity*** | (For Sr. No. i to vi), On randomly selected unit of very first lot offered for inspection and to be conducted after HV test only. |
| iv) DGA test | Copy of test report, received from the power oil manufacturer, to be submitted. |

(NOTE: If the supplier of oil is changed during execution of order, same test shall be repeated for the oil of new supplier.

### 1.13 GUARANTEED AND TECHNICAL PARTICULARS:

Guaranteed and technical particulars as called for in attached Appendix –II shall be furnished along with the tender.

### 1.14 COMPLETENESS OF EQUIPMENTS:

Any fittings, accessories or apparatus which may not have been specifically mentioned in these specifications, but which are useful or necessary for the equipment of similar plant shall be deemed to be included in the contract and shall be supplied by the contractor without extra charges. All plant and equipment shall be complete in all details whether such details are mentioned in the specification or not.

## 1.9 INSPECTION:

i) The purchaser shall have access at all times to the works and all other places of manufacture, where the Instrument Transformers are being manufactured and the supplier shall provide purchaser's representative all facilities for unrestricted inspection of the works, raw materials, manufacture of all the accessories and for conducting necessary tests.

**ii) The successful bidder shall submit the stage wise inspection program. Stages of inspection and owners participation would be defined and tied up at the time of award of contract.**

*iii) " The successful bidder shall first offer PROTO unit for stage inspection. During stage inspection all the raw material and manufacturing process shall be verified. On clearance of stage inspection bidder shall process for manufacturing of PROTO unit and offer the same for inspection. During inspection all the acceptance tests as indicated at respective clause under head of 'Acceptance tests' along with additional* ***Sealing test*** *as detailed here under, shall be carried out before temperature coefficient test.*

*In the event of failure of PROTO unit, bidder shall analyze the defects & submit report to GETCO along with remedial measures taken and again offer PROTO for inspection.*

*On successful completion of all acceptance tests along with* ***Sealing test*** *on PROTO unit, release for manufacturing will be given by GETCO.*

*The successful PROTO unit shall be kept aside and made available to inspector for verification. This unit shall be dispatched after the inspection of last lot is over.*

*Sealing test shall be carried out on one randomly selected unit out of every 20 or less offered quantity. In the event of failure of unit during sealing test next unit will be randomly selected from the offered lot. Failed unit shall not be accepted. If second unit also fail to clear Sealing test WHOLE lot shall be rejected."*

***SEALING TEST PROCEDURE:***

*(i) Test shall be performed on completely assembled unit.*

*(ii) Test shall be performed on PROTO as well as during acceptance test on one randomly selected unit.*

*(iii) Temperature of CT/ PT under test will be elevated and maintained at 50 ( $^{o}$C) and simultaneously it shall be subjected to internal pre ssure of 103 kPa (@1.1 kg/ sqcm) for 12 hrs.*

*(iv) Arrangement shall be made by manufacturer to maintain required pressure and temperature for 12 hrs.*

*(v) During and after the test, there shall not be any oil leakage from any part or joint of CT/ PT.*

*Readings of temperature, internal pressure applied and duration test along with observation of leakage, if any, shall be noted in inspection report.*

*iv) Applicability of PROTO unit will be to each class.*

*v) Manufacturing of PROTO unit will start from drawing approval. However, if the type tests are pending then bidder shall ensure to complete type tests within commencement period.*

*vi) Applicability of Sealing test for every lot of 20 units even after Proto confirms sealing test & manufacturing clearance is issued by GETCO. If bidder wants to offer PROTO from first lot of 20 units and if Proto successfully passes all tests then sealing test on other unit from that lot is not required. But if PROTO do not pass any of the tests whole lot will be rejected.*

*vii) Sealing test is applicable to each lot of each class and each ratio even if the design is same.*

viii) No material shall be dispatched without Inspection.

ix) The acceptance of any quantity of the equipments shall in no way, relieve the successful Bidder of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection, if such equipments are found defective later.

**SEAL OF THE FIRM** **SIGNATURE OF THE TENDERER**

# APPENDIX – I

## SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 66 kV CURRENT TRANSFORMERS

(To be filled in and signed by the Tenderer)

1) Manufacturer's Name & Address, in brief
2) Type of CT
3) Rated voltage (kV)
   a) Nominal
   b) Maximum rated voltage (kV)
4) Rated primary current (Amp)
5) Rated secondary current (Amp)
6) No. of cores :

| | Rated output | Class of accuracy | Accuracy limit factor |
|---|---|---|---|
| Core – 1 | | | |
| Core – 2 | | | |
| Core – 3 | | | |

| 7) Secondary Voltage: | Knee Point Voltage & Corresponding Exciting current | Resistance of the secondary winding | Secondary limiting Factor |
|---|---|---|---|
| Core – 1 | | | |
| Core – 2 | | | |
| Core – 3 | | | |

8) Short time rating of primary for 3 sec (kA)

9) Rated dynamic current of Primary peak value (kA)

10) Rated continuous
   a) Primary current (Amp)
   b) Thermal Current (kA)

11) Temperature rise at rated Continuous thermal current Over ambient temperature At site for
   a) Winding (°C)
   b) Oil at the top (°C)

c) Exposed current carrying parts (°C)
d) Reference ambient temperature (°C)

12) One – Minute power frequency dry withstand Test voltage for primary kV (rms)

13) One – Minute power frequency wet withstand voltage for primary kV (rms)

14) 1.2/50 microsecond lightning impulse withstand test voltage (kV Peak)

15) One-minute power frequency withstand test voltage for secondary (kV rms)

16) Minimum total creep age distance (mm)

17) Submission of
a) Ratio & phase angle curves
b) Magnetization curves
c) Ratio correction factor curves
d) Limit of composite error at rated primary saturation current (For protective C.T. Core)
(Yes / No to be stated)

18) Variation in ratio & phase angle error due to variation in :
a) Voltage by 1%
b) Frequency by 1 Hz

19) Current density in primary winding for Each ratio to be stated clearly in Amp./$cm^2$

20) Weight of oil (kg)

21) Total weight (kg)

22) * Mounting details (mm)

23) * Overall dimensions (mm)

24) Cross – section of the primary conductor along with cross section of each wire and total nos. of such wires. (sq. mm)

25) Nos. of primary turns

26) Dimensional details drawings of primary terminals complete (to be attached with GTP), in offer invariably. (Yes / No)

27) The design of the CTs to be stated clearly (i.e. Dead tank to be stated)

28) COSTRUCTIONAL DETAILS:

28.1 TANK:
- i) Thickness of
- a) Flange
- b) Top plate
- ii) Thickness of Press Board provided inside tank

28.2 GASKET:
- i) Material
- ii) Thickness

28.3 DOME FITTING & LEVEL INDICATORS:
- i) Material of fitting bolt
- ii) Size of fitting bolt
- iii) Location of oil level indicator

28.4 SECONDARY TERMINALS:
- i) Material of composite secondary mould (FRP / EPOXY)
- ii) Dummy leads provided? (YES / NO)
- iii) Terminal connector block
- a) Make
- b) Size
- c) Rating

28.5 INSULATOR:
- i) Make
- ii) Sealant used
- iii) Packing at neck
  - a) Material
  - b) Thickness
- iv) Material of cylindrical tube
- v) Material of Housing
- vi) Metal fitting details
- a) Material
- b) Thickness

28.6 INSULATING OIL:
- i) Make
- ii) Quantity in ltrs

28.7 NAME OF RAW MATERIAL SUPPLIERS:
- a) Primary Conductor
- b) Insulator Bushing
- c) Core
- d) Oil

e) Secondary wires

f) Sealing Material

28.8 Location of test tap for Tan Delta measurement:

**24. . Provision of hermetic sealing**

**a) By Bellow**

**i) Make**

**ii) Material**

**iii) Size (I/ D and O/ D) Mean dia**

**iv) Free length**

**v) Nos of convolutions**

**vi) Maximum expanded height**

**vii) Maximum compressed height**

**viii) Maximum co mpensating volume in ltrs. of bellow**

**ix) Design temperature**

**x) Flange material & thickness**

**xi) Working pressure**

**xii) Oil quantity of CT in ltrs.**

**xiii) Change of oil of CT due to temperature variation from 04 to 95 deg. cel.**

**28.9 Class of insulation**

Note : a) The details against each point of GTP are required to be submitted along with the tender, otherwise, tender is liable for rejection.

**b)** *Actual details should be furnished instead of writing “as per drawing”

**SEAL OF THE FIRM** **SIGNATURE OF BIDDER**

**APPENDIX – II**

# SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 66 kV VOLTAGE TRANSFORMERS

(To be filled up and signed by the Tenderer)

1. Type of PT

2. Manufacturer's Name & Type designation:

3. Nominal rated primary voltage (kV)

4. Maximum (continuous) service rated primary voltage (kV)

5. No. of secondary winding

6. Rated secondary voltages:
   **a)** Winding – I ( volts)
   **b)** Winding – II (volts)

7. Rated burden:
   **a)** Winding – I (VA)
   **b)** Winging – II (VA)

8. Accuracy class
   **a)** Winding – I
   **b)** Winding – II

9. Temperature rise at 1.2 times rated voltage with rated burden (°C)

10. Temperature rise at 1.5 times rated primary voltage for 30 sec. (cl. 1.7) (°C)

11. Rated voltage factor and time

12. One minute power frequency withstand test voltage (dry) for primary (kV rms)

13. One minute power frequency withstand test voltage (wet) for primary (kV rms)

14. 1.2/50 microsecond lightning impulse withstand test voltage (kV peak)

15. One minute power frequency withstand voltage for secondaries (kV rms)

16. Minimum total creepage distance of bushings (mm)

17. Weight of oil (kg)
18. * Total weight (kg)

19. * Overall dimension (mm)

20. * Mounting details (mm)

21. Other details

**22. COSTRUCTIONAL DETAILS:**

22.1 TANK:

i) Thickness of
a) Flange
b) Top plate
ii) Thickness of Press Board provided inside tank

22.2 GASKET:

i) Material
ii) Thickness

22.3 DOME FITTING & LEVEL INDICATORS:

i) Material of fitting bolt
ii) Size of fitting bolt
iii) Location of oil level indicator

22.4 SECONDARY TERMINALS:

i) Material of composite secondary mould (FRP / EPOXY)
ii) Dummy leads provided? (YES / NO)
iii) Terminal connector block
a) Make
b) Size
c) Rating

22.5 INSULATOR:

i) Make
ii) Sealant used
iii) Packing at neck
a) Material
b) Thickness
*iv) Material of cylindrical tube*
a) Material of Housing
b) Metal fitting details
*a) Material*
*b) Thickness*

22.6 INSULATING OIL:

i) Make
ii) Quantity in ltrs

22.7 NAME OF RAW MATERIAL SUPPLIERS:

a) Primary Conductor
b) Insulator Bushing

c) Core
d) Oil
e) Secondary wires
f) Sealing Material

22.7.1 Location of test tap

**23. . Provision of hermetic sealing**

**a) By Bellow**

**i) Make**

**ii) Material**

**iii) Size (I/ D and O/ D) Mean dia**

**iv) Free length**

**v) Nos of convolutions**

**vi) Maximum expanded height**

**vii) Maximum compressed height**

**viii) Maximum compensating volume in ltrs. of bellow**

**ix) Design temperature**

**x) Flange material & thickness**

**xi) Working pressure**

**xii) Oil quantity of CT in ltrs.**

**xiii) Change of oil of CT due to temperature variation from 04 to 95 deg. cel.**

**24. Class of insulation**

NOTE: a) The details against each point of GTP are required to be submitted along with the tender, otherwise tender is liable for rejection.

b) * Actual details should be stated instead of stating “as per drawing”

**SEAL OF THE FIRM** **SIGNATURE OF THE BIDDERS**

# Annexure - C

## List of documents attached with technical bid:

Bidder shall invariably attach the following documents and clearly marked and duly flagged in technical bid. In absence of these documents offer will be evaluated as a non-submission. (Separately for CT & PT)

| Sr. No. | Particulars of document | Whether attached the with technical bid |
|---|---|---|
| 1 | Drawings in AutoCAD format | |
| 2 | Drawings hard copies as indicated in specification | |
| 3 | Manual in PDF format | |
| 4 | QAP for manufacturing process in SOFT format | |
| 5 | QAP for manufacturing process in Hard format | |
| 6 | FQP in SOFT format | |
| 7 | FQP in Hard copy | |
| 8 | Type test Reports in hard copies | |
| a | for CT | |
| b | for PT | |
| 9 | Confirmation regarding type tests as per clause on page no. 9 (for CT) & 23 (for PT) – "IMPORTANT NOTE" | |
| 10 | Guaranteed Technical Particulars, completely filled in | |
| 11 | SS bellow calculation | |
| 12 | Any other essential documents | |

**SIGNATURE OF BIDDER** **COMPANY'S ROUND SEAL**

**DATE:**
**PLACE:**