



ODISHA POWER TRANSMISSION CORPORATION LIMITED

TECHNICAL SPECIFICATION FOR CURRENT TRANSFORMERS

I: - 33KV CT

- a) **RATIO-400-200A-100/1-1-1A**
- b) **RATIO-800-400-200A/1-1-1A &1-1-1-1A**

II: - 132 KV CT

- a) **RATIO-800-400-200A/1-1-1-1A**
- b) **RATIO-600-300-150A/1-1-1-1A**
- c) **RATIO-400-200A-100/1-1-1-1A**
- d) **RATIO-200-100/1-1-1-1A**

III: - 220 KV CT

RATIO-1200-600-300A/1-1-1-1-1A

IV:- 400 KV CT

RATIO:2000-1000-500/1-1-1-1-1A

**TECHNICAL SPECIFICATION FOR 33KV, 132KV,220 KV & 400KV CURRENT TRANSFORMERS WITH
METERING CORES OF ACCURACY CLASS 0.2S for 33 KV & 0.2 Accuracy class for 132, 220 & 400 KV
Current transformers.**

1.0 SCOPE :

- 1.1. The specification covers the design, manufacture, assembly, inspection and testing at the manufacture's work, packing and delivery F.O.R. (destination) of the outdoor mounted dead / live tank type, single phase, single unit type current Transformers for protection and metering services in 33KV, 132KV, 220 KV & 400KV solidly grounded system.
- 1.2. The current transformers shall be of the outdoor type, single phase, 50 C/S, oil immersed, self-cooled, hermetically sealed and suitable for operating in the tropical conditions with maximum ambient temperature up to 50°C. The C.Ts should be suitable for use in the areas subject to heavy lightning storms and highly polluted conditions.
- 1.3. Followings are the list of documents constituting this specification.

[i]	Technical specification(TS)	
[ii]	Technical Requirements	Appendix I
[iii]	Quantity and Delivery Schedule (Appendix II)	Appendix II
[iv]	Guaranteed Technical Particulars	Annexure –A
[v]	Calibration Status of testing equipments and meters / Instruments	Annexure – B
[vi]	Check-List towards Type Test Reports	Annexure-C
[vii]	Check-List for Delivery Schedule	Annexure-D
Note :	Annexure- A, B, C & D are to be filled up by the Bidder	

- 1.4 The current transformer shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of offer and purchaser shall have the power to reject any work or material which in his judgment is not in full accordance therewith.

[a] Guaranteed Technical particulars. **Bidders are required to quote for 0.2S for 33, 132, 220 & 400 KV Current transformers of metering cores with the following data / information's etc.**

[b] Technical literatures, brochures and drawings as per this specification.

[c] Type Test Reports.

[d] List of orders, executed and User's certificates, failing submission of the above particulars with the offer, the tender may not be considered for evaluation.

2.0 STANDARDS

2.1 Except to the extent modified in the specification, the C.Ts shall conform to the latest editions and amendments of the standards listed hereunder.

2.2

Sl. No.	Standard Ref. No.	Title
1	IEC-44	Instrument transformer-measurement of PDS
2.	IEC-60	High Voltage Testing Technique.
3.	IEC-171	Insulation co-ordination
4.	IEC-61869-2:2012	Current Transformers.
5.	IEC-270	Partial Discharge Measurement
6.	IEC-8263	Method for RIV Test on High Voltage Insulators.
7.	IS-335	Insulating oil for Transformers
8.	IS:2071	Method of High Voltage Testing
9.	IS:2099	High Voltage porcelain Bushings
10.	IS:2147	Degree of Protection Provided by Enclosures for Low Voltage Switchgear and Control.
11.	IS:2165	Insulation Co-ordination for equipment of 100KV and above
12.	IS:2705 [Part-I to IV)	Current Transformers
13.	IS:3347	Dimensions of Porcelain Transformer Bushing
14.	IS:5621	Specification for Large Hollow Porcelain for use in Electrical installation.

15.	IS:4201	Application guide for CTS
16.		Indian Electricity Rules, 1956
17.	IS:13072 of 1991	SF6 gas (for 220KV SF6 gas filled CT only)
18.	IEC: 60376	SF6 gas (for 220KV SF6 gas filled CT only)

2.3 Current Transformers with the requirements of other authoritative standards, which ensure equal or better quality than the standards, mentioned above, shall also be acceptable, Where the equipment, offered by the supplier conforms to other standards, salient points of difference between the standards adopted and specified standards shall be brought out in the offer. **4 (four) copies of the reference standards in English language shall be furnished along with the offer.**

2.3 **The supplier is to furnish the latest edition of the standards as mentioned above from SI.1 to SI.15 with their amendments, if any, at their own cost, if required by the Purchaser.**

2.4 All the above along with amendments thereof shall be read and interpreted together. However, in case of a contradiction between the Technical Specification and any other volume, the provisions of this specification will prevail.

3.0 CLIMATIC & SERVICE CONDITIONS :

3.1 The current Transformers are required to operate satisfactorily under the following conditions.

[a]	Maximum ambient temperature	50 ⁰ C
[b]	Minimum ambient temperature	0 ⁰ C
[c]	Maximum daily average ambient air temperature	45 ⁰ C
[d]	Maximum relative humidity	100%
[e]	Average no. of rainy days in a year.	120 days
[f]	Average annual rainfall	150 cm
[g]	Maximum wind pressure	260 Kg/Sq.m
[h]	Altitude not exceeding	1000 m

3.2 EARTHQUAKE INCIDENCE

The current Transformers are to be designed to withstand earthquakes of intensity equivalent to seismic acceleration of 0.3g in the horizontal direction and 0.15g in the vertical direction, where 'g' stands for acceleration due to gravity.

3.3 The current Transformers covered under this specification shall be suitable for outdoor installation.

4.0 PUCHASER'S AUXILIARY POWER SUPPLY :

4.1 Following power supplies shall be made available at site.

- (a) A.C. Three phase, 415V, 50HZ earthed
- (b) A.C. Single Phase, 240V, 50HZ earthed.
- (c) 220 V D.C. ungrounded.

4.2 All the equipments and devices shall be capable of continuous satisfactory operation on AC and DC supplies of normal voltage mentioned above with the variation given below.

[a]	AC voltage variation	$\pm 10\%$
[b]	Frequency variation	$\pm 5\%$
[c]	Combined voltage and frequency variation	$\pm 10\%$
[d]	DC Voltage Variation	190V to 240V

4.3 The supplier shall make his own arrangements for the power supplies other than those specified under clause 4.1 above.

5.0 GENERAL TECHNICAL REQUIREMENTS :

5.1 **The C.T. shall be of dead/ live tank design** and shall be so constructed that it can be easily transported to site within the allowable limitation and in horizontal position if the transport limitations so demand.

5.2 For compensation of variation in the oil volume due to ambient variation, ~~nitrogen-cushion~~ / metal bellows shall be used. Rubber diaphragms shall not be permitted for this purpose.

5.3 The C.T. secondary terminals shall be brought out in a weather proof terminal box. The terminal box shall be provided with removable gland plate and gland (s) suitable for 1100 volts grade PVC insulated, PVC sheathed, multicore 4 Sq. mm stranded copper conductor cable. The terminal blocks shall be stud-type **or Terminal Block** type and provided with ferrules, indelibly marked or numbered. The terminals shall be rated for not less than 10 Amps. The terminal box shall be dust and vermin proof. Suitable arrangements shall be made for drying of air inside the secondary terminal box. The dimensions of the terminal box and its openings shall be adequate to enable easy access and working space with the use of normal tools.

5.4 Polarity shall be indelibly marked on each primary and secondary terminal. Facility shall be provided for short-circuiting and grounding of the C.T. secondary terminals inside the terminal box or in Marshalling Box.

5.5 The C.T. shall be provided with non-corrosive, legible nameplate with the information, specified in the relevant standards, duly engraved/punched on it.

5.6 The current Transformer shall be vacuum filled with oil after processing and thereafter hermetically sealed to eliminate breathing and to prevent air and moisture from entering the tanks. Oil filling and / or sampling cocks, if provided to facilitate factory processing should be properly sealed before despatching the C.T., The method adopted for hermetic sealing shall be described in the offer

5.7 The castings of base, collar etc. shall be die cast and tested before assembly to detect cracks and voids, if any.

5.8 The instrument security factor of metering core shall be low enough and not greater than '5'. This shall be demonstrated on all the ratios of the metering core in accordance with procedure, specified in IEC-185 OR IS:2705

5.9 Current transformers' guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.

5.10 For 420 KV, 245KV, 145KV and 36 KV Current Transformers, characteristics shall be such as to provide satisfactory performance in accordance with latest IS & IEC.

5.11 Current Transformers shall be designed so as to achieve the minimum risk of explosion in service. The Bidder shall bring out in his offer, the measures taken to achieve this.

5.12 PRIMARY WINDING

(I) The rated extended primary current shall be 120% on all cores of the C.Ts, specified in tables for highest Ampere & for lowest Ampere it shall be 200%. The offered Primary winding type, for 400KV, 220KV, 132KV, and 33KV class C.Ts, should have been type tested.

(II) The primary windings of current transformers shall be constructed of high purity, annealed, high conductivity electrolytic copper meeting to the requirements of IEC 28/IS:2705.

5.13 SECONDARY WINDINGS:

Suitably insulated copper wire of electrolytic grade shall be used for secondary windings. Type of insulation, used shall be described in the offer. The secondary taps shall be adequately reinforced to withstand handling without damage.

The rating of the Current Transformer's secondary winding shall be 1 (One) Amp. The secondary terminals shall be brought out in a compartment for easy access.

5.14 PRIMARY TERMINALS

The primary terminals shall be heavily tinned electrolytic of 99.9% conductivity. The minimum thickness of tinning shall be 1.5 microns.

5.15 SECONDARY TERMINALS

- (I) 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 stud shall be 6 mm. The length of at least 15 mm shall be available on the studs for inserting the leads. The horizontal spacing between the centers of the adjacent studs shall be at least 1.5 times the outside circum-dia of the nuts.
- (II) The current transformer shall be provided with suitable test tap for measurement of capacitance, tan delta as well as partial discharges. Provision shall be made on a screw cap for solid and secured earthing of the test tap connection, when not in use. 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 the necessity of its solid earthing as per prescribed method before energizing the Current Transformer.
- (III) The secondary terminals shall be provided with shorting arrangements.

5.16 CORE

Each core of the Current Transformer shall be of torroidal shape. Core laminations shall be of cold rolled grain oriented silicon steel or other equivalent alloys of low hysteresis and eddy current losses, high permeability to ensure high accuracy at both normal and over-current conditions. The core material, thickness of lamination, the relevant graphs showing the characteristics of the core material shall be submitted along with the offer.

5.17 TANK

- (I) Both expansion chambers and the tanks of the Current Transformers shall be made up of high quality stainless steel for Bellow & Tank shall be of high quality Alluminium Alloy, which should be able to withstand full vacuums and pressure occurring during transit and thermal and mechanical stresses resulting from maximum short circuit current during operation.
- (II) The metal tanks shall have bare minimum number of welded joints so as to minimize possible locations of oil leakage. Welding in horizontal plane is to be avoided as welding at this location may give way due to vibrations during transport resulting in oil leakage. Supplier has to obtain specific approval from purchaser for any horizontal welding used in the bottom tank.

5.18 SECONDARY TERMINAL BOX :

- (I) Secondary Terminal Boxes shall be of Aluminium weather proof with a rating not less than IP 55
- (II) All secondary terminals shall be brought out in a compartment on the same side of each current transformer for easy access.
- (III) For 400KV, 220 kv, 132 kv and 33KV CTs, all the ratios should be achieved through secondary tapping(s) only. The primary can be bar/wound type.

The terminal box shall be provided with a removable cable gland plate at bottom for mounting cable glands for 1.1KV PVC sheathed 4 x 4 Sq. mm stranded copper conductor cables.

- (IV) The terminal box shall be provided with a door in front so as to have easy access of secondary terminals. The door shall have a sealing / locking arrangement and shall be suitable to prevent penetration of moisture and rainwater.
- (V) All terminals shall be clearly marked with identification number to facilitate connection to external wiring.

5.19 PORCELAIN HOUSING

- (I) The housing shall be made up of homogeneous, vitreous porcelain of high mechanical and dielectric strength, Glazing of porcelain shall be of uniform brown or dark brown colour with a smooth surface, arranged to shed away rain water or condensed water particles (fog.) The details of location and type of joint, if provided on the porcelain, shall be furnished by the Bidder along with the offer.
- (II) The bushings of the Current Transformers shall conform to the latest edition of IS:2099. The hollow porcelain insulator shall conform to the latest edition of IS:5621.
- (III) The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength.
- (IV) The bushings shall have ample insulation, mechanical strength and rigidity for the condition under which they shall be used and shall be designed to prevent accumulation of explosive gases and provide adequate oil circulation to remove the internal heat.
- (V) Cast metal end caps for the bushings shall be of high strength, hot dip galvanized malleable iron. They shall have smooth surface to prevent discharge-taking place between the metal parts and porcelain as a result of ionization.
- (VI) The insulation of bushings shall be coordinated with that of the current transformer such that the flashover, if any, will occur only external to the Current Transformer.
- (VII) Oil level gauge and convenient means of filling, sampling and draining of oil should be provided.
- (VIII) End shields should be provided for distribution of stresses.
- (IX) Corona shields for bushings, if required should be provided.

5.20 INSULATING MEDIUM. (OIL)

The quantity of insulating oil for the filling and the complete specification of the insulating oil shall be stated.

The oil shall comply in all respects with the provisions of latest edition of IS: 296. The current Transformers shall be supplied, filled with purified oil completely.

5.21 PREVENTION OF OIL LEAKAGE AND ENTRY OF MOISTURE:

5.21.1 The supplier shall ensure that the sealing of the Current Transformer is properly achieved. In this connection, the arrangement provided by the supplier at various locations including the following ones shall be described, supported by sectional drawings.

- (a) locations of emergence of primary and secondary terminals.
- (b) Interface between porcelain housing and metal tank/s

(c) Cover of the secondary terminal box.

5.21.2 Nuts and bolts or screws, used for fixation of the interfacing porcelain bushings for taking out terminals shall be provided on flanges, cemented to the bushings and not on the porcelain.

5.21.3 For gasketed joints, wherever used, nitrile butyl rubber gaskets shall be used. The gasket shall be fitted in properly machined groove with adequate space for accommodating the gasket under compression.

5.22 FITTINGS AND ACCESSORIES :

Fittings and accessories, listed below shall be supplied with each Current

Transformer. Any fitting, required essential other than those listed below shall also be supplied along with each Current Transformer without any extra cost to the purchaser :

- (a) Oil level gauge.
- (b) Oil filling hole and cap.
- (c) Phase terminal connectors.
- (d) Lifting lugs for core and windings, bushings and complete Current Transformers.
- (e) Tank earthing pads/terminals with necessary nuts, bolts and washers for connecting to purchaser's earth strip.
- (f) Name / Rating plate.

5.22.1 (A)OIL LEVEL GAUGE :

An oil level gauge shall be provided to indicate the oil level in the Current Transformer. This gauge shall be mounted in such a way that the oil level can be seen from ground level. If metal bellow is used, a ground glass window shall be provided to monitor the position of the metal bellow. The metal below shall be tested in accordance with relevant standards. The details shall be to the approval of the purchaser.

5.22.2 (A)OIL DRAIN COCK:

An oil drain cock along with a stop cock shall be provided in the bottom flange so as to permit taking of oil samples for testing, if required.

5.22.4 EARTHING :

Metal tank of each Current Transformer shall be provided with two separate earthing terminals for bolted connection to 50mm X 6mm flat, to be provided by the purchaser for connection to station earth-mat.

5.22.5 LIFTING ARRANGMENT :

The Current Transformer shall be provided with suitable lifting arrangement to lift the entire unit. The lifting arrangement shall be clearly shown in the general arrangement drawing. Lifting arrangement (lifting eye) shall be positioned in such a way so as to avoid any damage to the porcelain housing or the tanks during lifting for installation / transport. Necessary string guides shall be offered which shall be of removable type.

5.22.6 NAME PLATE & MARKING :

5.22.6.1 The Current Transformer shall be provided with non-corrosive, legible name plate with the information specified in relevant standards, duly engraved/punched On it.

5.22.6.2 A schematic drawing indicating the connections shall be provided in the interior of the Terminal box.

5.22.7 TERMINAL CONNECTORS :

All the Current Transformers shall be provided with bimetallic solderless clamp type, rigid type terminal connectors, suitable for

Sl. No.	CURRENT TRANSFORMER.	Terminal connector.
a)	400kV (0.2class)	
i	2000-1000-500/1-1-1-1-1	ACSR 'TWIN MOOSE' conductor
b)	220kV (0.2class)	
i	1200-600-300/1-1-1-1-1	ACSR 'TWIN ZEBRA' conductor
ii	600-300-150/1-1-1-1-1	
c)	132kV (0.2class)	
i	800-400-200/1-1-1-1	ACSR 'TWIN ZEBRA' conductor
ii	600-300-150/1-1-1-1	ACSR 'ZEBRA conductor
iii	400-200-100/1-1-1-1	
d)	33kV(0.2s class)	
i	1200-600-300/1-1-1	ACSR 'TWIN ZEBRA' conductor
ii	800-400-200/1-1-1	ACSR 'ZEBRA conductor
iii	600-300-150/1-1-1	
iii	400-200-100/1-1-1	

Each terminal connector shall be of universal type, suitable for both horizontal and vertical connections to the transmission line conductors / station bus bars.

5.22.7.1 Terminal connectors shall be manufactured and tested as per IS: 5561.

5.22.7.2 All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

5.22.7.3 No part of a clamp shall be less than 10mm thick.

5.22.7.4 All ferrous parts shall be hot-dip galvanized conforming to relevant standard.

5.22.7.5 For bimetallic connectors, copper alloy linear of minimum thickness of 2 mm shall be cast integral with aluminium body.

5.22.7.6 All current carrying parts shall be designed and manufactured to have minimum contact resistance.

5.22.7.7 Connectors shall be designed to be corona free in accordance with the requirements, stipulated in IS:5561.

6.0 TEST:

6.1 TYPE TESTS & SPECIAL TESTS:- (As per latest IEC & ISS).

The current transformers, offered should have been subjected to the following type tests and Special Tests in Government approved test laboratory. The bidder shall furnish type test and Special Tests reports along with the offer for the offered CTs. These tests should not have been conducted **earlier than Ten years** from the date of opening of the bid. For any change in the design/type already type tested and the design/type offered against this specification, the purchaser reserves the right to demand repetition of some or all type & special tests without any extra cost to OPTCL in the presence of OPTCL's representative(s) at the cost of the supplier.

- (a) Multiple chopped lightning impulse test.
- (b) High Voltage power frequency wet withstand voltage Test.
- (c) Short time current test.
- (d) Temperature rise test.
- (e) Determination of errors or other characteristics according to the requirements of the appropriate designation and accuracy class as per individual parts of IS: 2705.
- (f) Instrument Security Factor Test.
- (g) IP-55 Test on Secondary Terminal Box.

(In addition to the above tests, following type tests/special tests should have been conducted exclusively for 220KV & 400 KV C.T)

- (h) Radio Interference voltage test.
- (i) Corona Extinction test.
- (j) Thermal stability test.
- (k) Thermal Co-efficient test.
- (l) Fast transient test.
- (m) Seismic withstand test.
- (n) Mechanical terminal load on bushing.
- (o) Magnetization and internal burden tests..
- (p) Effectiveness of sealing tests.
- (q)** Capacitance and dielectric loss angle test. (For both 132KV, 220KV & 400KV CTs.)
- (r)** STC Test on primary terminal connector.
- (s)** Internal ARC test.

N.B:

The below tests are required to be carried out at least in one CT per LOT in the factory during Acceptance test. These tests will be conducted on one randomly selected unit among the lot offered for inspection and these test will be conducted after HV test only.

- (a) **The Thermal stability test.**
- (b) **Thermal Co-efficient test.**
- (c) **Temperature rise test.**
- (d) **BDV, Tandelta, Water content, Sp resistance tests of oil.**

Note: Power Oil Manufacturer report shall be submitted for Viscosity Test & Total Acidity Test:

- Lightning Impulse Test, switching Impulse Voltage test and High Voltage power frequency wet withstand voltage Tests should have been carried out on the same current transformer.
- After the current transformers have been subjected to lightning Impulse Test, and High Voltage power frequency wet withstand voltage tests, these must have been subjected to all the routine tests as per IS: 2705 (Part-I to IV).

6.2 ROUTINE TESTS:

The following routine tests shall be conducted on each Current Transformer in the presence of OPTCL's representative(s) for which no charges will be payable by OPTCL. No sampling will be allowed.

- (i) Appearance and Dimensional Check.
- (ii) Verification of Terminal Marking and polarity.
- (iii) Verification of all individual parts / components of the Current Transformer so as to ensure to have complied the above specification.
- (iv) Measurement of Insulation Resistance.
- (v) Power Frequency Dry withstanding Test on Primary and Secondary winding including primary intersections.
- (vi) Over – Voltage Interturn test.
- (vii) Partial discharge Test for 400 KV, 220 KV and 132KV C.TS
- (viii) Knee point voltage and Excitation current measurement for 'PS' class cores.
- (ix) Secondary winding resistance measurement.
- (x) Determination of errors.
- (xi) ISF Test.
- (xii) Leakage Test.
- (xiii) Magnetization Characteristics of the Current Transformers.
- (xiv) Turn ratio error on 'PS' class cores.
- (xv) Measurement of capacitance for 400KV, 220Kv and 132KV C.TS.
- (xvi) Measurement of tan delta at 0.3, 0.7, 1.0 and $1.1U_M/\sqrt{3}$ for 400KV, 220KV & 132KV C.Ts.

- The Method For Conducting Partial Discharge Test.

The test circuit for the measurement of partial discharge (PD) should have been in accordance with sub-clause 4.2 of IEC-270. The applied voltage should be raised to the rated voltage of the Current Transformers and should have been maintained for a period greater than or equal to 10 seconds. The voltage should have been reduced to measuring voltage of

1.1 X145/420KV rms/phase

3½

to ground and maintained for a period greater than or equal to 1 minute. The PD should not exceed 10 picco-coulombs.

7.0 INSPECTION :

- 7.1 The purchaser shall have access at all times to the works and all other places of manufacture, where the Current Transformers are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the supplier's works, raw materials, manufacture of all the accessories and for conducting the necessary tests.
- 7.2 The supplier shall keep the purchaser informed in advance of the time of starting and of the progress of manufacture of equipment in its various stages so that arrangement could be made for inspection.
- 7.3 No material shall be despatched from its point of manufacture unless the material has been satisfactorily inspected, tested and despatch clearance Issued. However, the purchaser reserves the right to alter the despatch schedule, attached to this specification without any extra financial liability to OPTCL.
- 7.3.1 The acceptance of any quantity of equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection, if such equipments are found to be defective.

8.0 QUALITY ASSURANCE PLAN :

- 8.1 The Bidder shall invariably furnish following information along with his offer.
- (i) Statement giving list of important raw materials, 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 material in presence of Bidders" representative, copies of test certificates.
 - (ii) Information and copies of test certificates as in (i) above in respect of bought out items.
 - (iii) List of manufacturing facilities available.
 - (iv) Level of automation achieved and list of areas where manual processing exists.
 - (v) List of areas in manufacturing process where stage inspections are normally carried out for quality control and details of such test and inspections.

- (vi) Special features provided in the equipment to make it maintenance free.
- (vii) List of testing equipments, meters available with the Bidder for final testing of equipment specified and test plant limitation, if any, vis-à-vis the type, acceptance and routine tests, specified in the relevant standards. These limitations shall be very clearly brought out in the offer.
- (viii) All the testing equipments, meters etc, should have been calibrated in a Government approved laboratory. The Bidder must submit the list of testing equipments and meters test-wise as per Annexure – B of the Technical Specification.

8.2 The supplier shall within 30 days of placement of order submit the following information to the purchaser.

- (i) List of raw materials as well as bought out accessories and the names of the materials as well as bought-out accessories and the names of sub-suppliers, selected from those, furnished along with the offer.
- (ii) Type Test Certificates of the raw material and bought out accessories.
- (iii) Quality Assurance plan (QAP) with hold points for the purchaser's inspection. The QAP and hold points shall be discussed between the purchaser and the supplier before the QAP is finalized.

8.3 The supplier shall submit the routine test certificate of bought-out items and raw materials at the time of acceptance testing of the fully assembled equipment.

9.0 **DOCUMENTATION :**

9.1 All drawings shall conform to relevant Indian Standard as per relevant IS. All drawings shall be in ink and suitable for microfilming. All dimensions and data shall be in S.I. units.

9.2 The supplier shall furnish the following drawings/documents along with his offer for 0.2S accuracy class metering core CTs in form of scanned copy.

- (a) General outline and assembly drawings of the Current Transformers.
- (b) Sectional views showing.
 - (i) General constructional features.
 - (ii) Materials / gaskets / sealing used.
 - (iii) The insulation of the winding arrangement, method of connection of the primary / secondary winding to the primary / secondary terminals etc.
- (c) Schematic drawing
- (d) Rating and Diagram plate.
- (e) Secondary Terminal Box.
- (f) Assembly Sectional view of Primary Terminal
- (g) Assembly drawing for secondary terminal.

- (h) The detailed dimensional drawing of Porcelain Housing such as ID, OD, thickness and Insulator details such as height, profile of petticoats, angle of inclination and gap between successive petticoats, total creepage distance etc.
- (i) Sectional view of Pressure Release device.
- (j) Drawing showing details of Oil level Indicator.
- (k) All type and special test reports relating to tests, as mentioned at Cl. No. 6.1 of this Technical Specification.
- (l) Ratio and phase angle error curves for CTS.
- (m) Magnetization characteristic curves such as B-H curves and sp.loss vs. flux density curves.
- (n) Drawings for Terminal Connector.

10.0 **TEST REPORTS:**

- (i) The type test and special test reports shall be furnished to the purchaser with the tender offer for CTs (having PX class & 0.2S class).
- (ii) Copies of acceptance test reports and routine test reports shall be furnished to the purchaser. One copy will be returned, duly certified by the purchaser and only thereafter shall the materials be despatched.
- (iii) All records of routine test reports shall be maintained by the supplier at his works for periodic inspection by the purchaser.
- (iv) All test reports of tests, conducted during manufacture shall be maintained by the supplier. These shall be produced for verification as and when required for by the purchaser.

11.0 **SPARE PARTS**

A list of spare parts recommended for five years operations for each Current Transformer shall be furnished with the tender. The purchaser will decide the actual quantities of spare parts to be ordered on the basis of the list and the item wise price of spare parts.

12.0 The necessary galvanized flanges, bolts etc. for the base of the Current Transformers shall be supplied without any extra cost to the purchaser.

13.0 **PACKING AND FORWARDING :**

13.1 The equipment shall be packed in suitable crates so as to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting such as lifting hooks etc. shall be provided. A material found short inside the packing cases shall be supplied by supplier without any extra cost.

13.1.1 Each consignment shall be accompanied by a detailed packing list containing the following informations :-

- (a) Name of the consignee
- (b) Details of consignment

- (c) Destination
- (d) Total weight of consignment
- (e) Sign showing upper / lower side of the crate
- (f) Handling and unpacking instructions
- (g) Bill of materials indicating contents of each package.

13.1.1 The supplier shall ensure that the bills of materials is approved by the purchaser before dispatch.

13.2 Any tender without complete information, as asked for in the above specification, is likely to be rejected.

APPENDIX-I
TECHNICAL REQUIREMENT FOR 33 KV, 132 KV, 220KV & 400KV CT .

The Current Transformers under this specification shall conform to the parameters given below :-

Sl. No.	Item.	Specification			
		36 KV	145 KV	245KV	420KV
1	Type of CT/Installation.	Single phase, Live/dead tank, oil filled, hermetically sealed, outdoor, self-cooled			Single phase, live /dead tank, oil filled, hermetically sealed, outdoor, self-cooled
2	Type of mounting.	Pedestal type			
3	Suitable for system frequency.	50 HZ \pm 5 %			
4	Rated voltage (KV rms)	33	132	220	400
5	Nominal system voltage (KV rms)	33	132	220	400
6	Highest system voltage (KV rms)	36	145	245	420
7	Current ratio (A/A)	a)800-400-200/1-1-1A b)600-300-150/1-1-1A c)400-200-100/1-1-1A d) 1200-600-300/1-1-1.A	a)800-400-200/1-1-1-1A b)400-200-100/1-1-1-1A c)600-300-150/1-1-1-1.A	a) 1200-600-300/ 1-1-1-1-1 A b) 600-300-150/ 1-1-1-1-1 A	2000-1000-500/1-1-1-1-1 A
8.	Method of earthing the system where the current transformer will be installed.	Solidly Effectively earthed.			
9	Rated continuous thermal current (A)	120 % of rated primary current(Lower & Higher)			

10	Acceptable limit of temperature rise above 50°C ambient temperature for continuous operation at rated continuous thermal current.				
(a)	Winding	45°C	As per IEC As per IEC 61869/60044-1 or IS-2705		
(b)	Oil	40°C			
(c)	External surface of the core, metallic parts in contact with or adjacent to, insulation.	45°C			
11	Acceptable partial discharge level	Less than 10 picco coulombs			
12.	Maximum radio interference voltage at I. I times the maximum rated voltage.	Less than <1000 µV			
13.	I.2/50 micro second lightning impulse withstand voltage (KVP) (dry)	170	650	1050	1425
14.	1 minute dry power frequency withstand voltage primary (KV rms)	70	275	460	630
15.	Switching Impulse with stand and voltage (KVP)	--	-	1050	
16.	I Minute dry power frequency withstand voltage secondary (KV rms)	3	3	5	5
17.	Minimum creepage distance of porcelain Housing (mm)	900	3625	6125	10500
18.	Rated short time withstand current for I second at all ratios (KA rms)	31.5 KA	40KA	50KA	63KA

19.	Instrument security factor at all ratios for metering core.	Not more than 5.0
20.	Minimum rated short time thermal current density of the primary winding at all ratios (A/mm ²)	As per clause No9.6.3- Note of IS: 2705 (Part-I)/1992
21.	Application, current ratio, output burden, accuracy class, minimum knee point voltage, secondary winding resistance, maximum excitation current at minimum knee point voltage etc.	Enclosed in separate sheets for each rating of the Current Transformers.
22.	Type of core	Torroidal type
23.	Seismic acceleration	0.15g (Vertical) 0.3g (Horizontal)
24.	Dielectric dissipation factor for 132 KV & higher voltage class C.T. at ambient temperature.	0.005 or less
25.	Accuracy class of standard C.T. to be used during testing towards determination of ratio errors and phase angle errors for metering cores.	0.05 or better.

SPECIFIED PARAMETERS FOR KPV, SEC. WDG. RESISTANCE, EXCITATION

CURRENT FOR PX CLASS CORES

33KV / 132KV/ 220KV /400KV CT

AND

BURDEN, ISF FOR METERING CORES

OF

ACC.CLASS 0.2S for 33 KV CT & 0.2 for 132,220 & 400 KV CT

FOR

33KV, 132KV, 220KV & 400KV CT

REQUIREMENT FOR 36 KV CURRENT TRANSFORMERS

No. of Cores	Core No.	Applic- ation	Current Ratilo	Output burden in VA	Acc: class as per IS: 2705	Minimum knee point voltage (V _k) at all ratios in volts.	Maximum CT resistance RCT in ohms at 75 °C at all ratios	Maximum excitation current at Vk in mA at all ratios.	Instrum- ent security factor at all ratios	
1	2	3	4	5	6	7	8	9	10	
36 KV CT ; RATIO- 1200-600-300/1-1-1.										
3	1	Protec- tion	1200/1	-	PX	400	5.0	25	-	
			600/1	-	PX					
			300/1		PX					
	2.	Meter- ing	1200/1	15	0.2S	-	-	-	5 or less	
			600/1	15	0.2S				5 or less	
			300/1	15	0.2S				5 or less	
	3.	Protec- tion	1200/1	-	PX	400	5.0	25	-	
			600/1	-	PX					
			300/1	-	PX					
	36 KV CT ; RATIO- 600-300-150/1-1-1									
	3	1	Protec- tion	600/ 1	-	PX	450	5	25	
				300/1	-	PX				
150/1					PX					

	2.	Meter- ing	600/ 1	15	0.2S	-	-	-	5 or less
			300/1	15	0.2S				5 or less
			150/1	15	0.2S				5 or less
	3.	Protec- tion	600/ 1	-	PS PX	450	5	25	-
			300/1	-	PS PX				
			150/1	-	PS PX				

36 KV CT ; RATIO- 800-400-200/1-1-1

3	1	Protec- tion	800/ 1	-	PS PX	450	10	40	
			400/1	-	PS PX				
			200/1		PS PX				
	2.	Meter- ing	800/ 1	15	0.2S	-	-	-	5 or less
			400/1	15	0.2S				5 or less
			200/1	15	0.2S				5 or less
	3.	Protec- tion	800/ 1	-	PS PX	450	10	40	-
			400/1	-	PS PX				
			200/1	-	PS PX				

36 KV CT ; RATIO- 400-200-100/1-1-1

3	1	Protec- tion	400/ 1	-	PS PX	400	5	25	
			200/1	-	PS PX				
			100/1		PS PX				
	2.	Meter- ing	400/ 1	15	0.2S	-	-	-	5 or less
			200/1	15	0.2S				5 or less
			100/1	15	0.2S				5 or less

	3.	Protection	400/ 1	-	PS PX	400	5	25	-
			200/1	-	PS PX				
			100/1	-	PS PX				

REQUIREMENT FOR 145 KV CURRENT TRANSFORMERS

No. of Cores	Core No.	Application	Current Ratio	Output burden in VA	Acc: class as per IS: 2705	Minimum knee point voltage (V_k) at all ratios in volts.	Maximum CT resistance RCT in ohms at 75 °C at all ratios	Maximum excitation current at V_k in mA at all ratios.	Instrument security factor at all ratios
1	2	3	4	5	6	7	8	9	10
145 KV CT ; RATIO- 800-400-200/1-1-1-1									
4	1.	Protection	800/1	-	PS PX	400	4	30	-
			400/1	-	PS PX				
			200/1		PS PX				
	2.	Metering	800/1	30	0.2S	-	-	-	5 or less
			400/1	30	0.2S	-	-	-	5 or less
			200/1	30	0.2S	-	-	-	5 or less
	3.	Back up	800/1	-	PS PX	400	4	30	-
			400/1	-	PS PX				
			200/1		PS PX				
	4.	For future use.	800/1	-	PS PX	400	4	30	-
			400/1	-	PS PX				
			200/1	-	PS PX				

145 KV CT ; RATIO- 600-300-150/1-1-1-1									
4	1.	Protec- tion	600/1	-	PS PX	500	5	60	-
			300/1	-	PS PX				
			150/1		PS PX				
	2.	Meter- ing	600/1	30	0.2S	-	-	-	5 or less
			300/1	30	0.2S				5 or less
			150/1	30	0.2S				5 or less
	3.	Back up	600/1	-	PS PX	500	5	60	-
			300/1	-	PS PX				
			150/1		PS PX				
	4.	For future use.	600/1	-	PS PX	500	5	60	-
			300/1	-	PS PX				
			150/1		PS PX				

145 KV CT ; RATIO- 400-200-100/1-1-1-1									
4	1.	Protec- tion	400/1	-	PS PX	800	4	30	-
			200/1	-	PS PX				
			100/1		PS PX				
	2.	Meter- ing	400/1	30	0.2S	-	-	-	5 or less
			200/1	30	0.2S				5 or less
			100/1	30	0.2S				5 or less

	3.	Back up	400/1	-	PS PX	800	4	30	-
			200/1	-	PS PX				
			100/1	-	PS PX				
	4.	For future use.	400/1	-	PS PX	800	4	30	-
			200/1	-	PS PX				
			100/1	-	PS PX				

REQUIREMENT FOR 245 KV CURRENT TRANSFORMERS

No. of Cores	Core No.	Applic- ation	Current Ratio	Output burden in VA	Acc: class as per IS: 2705	Minimum knee point voltage (V _k) at all ratios in volts.	Maximum CT resistance RCT in ohms at 75 °C at all ratios	Maximum excitation current at V _k in mA at all ratios.	Instrum- ent security factor at all ratios
1	2	3	4	5	6	7	8	9	10
245 KV CT ; RATIO- 1200-600-300/1-1-1-1-1									
5	1	Bus diff: check	1200/1	-	PS PX	600	5.0	40	-
			600/1	-	PS PX				
			300/1	-	PS PX				
	2.	Bus diff: check	1200/1	-	PS PX	600	5.0	40	-
			600/1	-	PS PX				
			300/1	-	PS PX				

	3.	Metering	1200/1	30	0.2S	-		-	5 or less
			600/1	30	0.2S				5 or less
			300/1	30	0.2S				5 or less
	4.	Trans: back B/U -Line Prot:	1200/1	-	PS PX	1200	5.0	40	-
			600/1	-	PS PX				-
			300/1	-	PS PX				-
	5.	Trans: back B/U -Line Prot:	1200/1	-	PS PX	1200	5.0	40	-
			600/1	-	PS PX				-
			300/1	-	PS PX				-

REQUIREMENT FOR 420 KV CURRENT TRANSFORMERS

No. of Cores	Core No.	Applic- ation	Current Ratio	Output burden in VA	Acc: class as per IS: 2705	Minimum knee point voltage (V _k) at all ratios in volts.	Maximum CT resistance RCT in ohms at 75 °C at all ratios	Maximum excitation current at V _k in mA at all ratios.	Instrum- ent security factor at all ratios
1	2	3	4	5	6	7	8	9	10
420 KV CT ; RATIO- 2000-1000-500/1-1-1-1-1									
5	1	Bus diff: check	2000/1	-	PS PX	2000	10	30	-
			1000/1	-	PS PX	1000	05	60	
			500/1	-	PS PX	500	2.5	120	

	2.	Bus diff: check	2000/1	-	PS PX	2000	10	30	-
			1000/1	-	PS PX	1000	05	60	-
			500/1	-	PS PX	500	2.5	120	-
	3.	Metering	2000/1	30	0.2S	-	10		5 or less
			1000/1	30	0.2S		05	-	5 or less
			500/1	30	0.2S		2.5		5 or less
	4.	Trans: back B/U –Line Prot:	2000/1	-	PS PX	2000	10	30	-
			1000/1	-	PS PX	1000	05	60	-
			500/1	-	PS PX	500	2.5	120	-
	5.	Trans: back B/U –Line Prot:	2000/1	-	PS PX	2000	10	30	-
			1000/1	-	PS PX	1000	05	60	-
			500/1	-	PS PX	500	2.5	120	-

NEXURE – A

GUARANTEED TECHNICAL PARTICULARS FOR CURRENT TRANSFORMER.

SL. NO.	DESCRIPTION	LOT-I (33 KV)	LOT-II(132KV)	LOT-III (220 Kv CT)	LOT-IV (400KV)
) RATIO-400-200-100/ 1-1-1A b) RATIO-600-300-150/ 1-1-1A c) RATIO-800-400-200/ 1-1-1A d) RATIO-1200-600-300/ 1-1-1A) RATIO-400-200-100/ 1-1-1A) RATIO-600-300-150/ 1-1-1A) RATIO-800-400-200/ 1-1-1A	a) RATIO-1200-600-300/ 1-1-1-1-1.A b) RATIO-600-300-150/ 1-1-1-1-1.A	RATIO-2000-1000-500/1-1-1-1-1A
1.	Bidder's name and address				
2.	Name and address of the Manufacturer				
3.	Manufacture's type designation				
4.	Standards applicable				
5.	Rated frequency (HZ)				
6.	Rated Voltage (KV)				
7.0	Rated current (A)				

7.1	Rated continuous current (A)				
7.2	Rated extended primary current (A)				
8.	Short time thermal current withstand for stipulated time duration (KA)				
9.	Dynamic current withstand (KAP)				
10.	1.2/50 μ s impulse withstand voltage (KVP)				
11.	One minute dry and wet power frequency withstand voltage (KV-rms)				
12.	No. of cores per CT				
13.	Transformation Ratio				
14.	No. of secondary turns				
15.	Rated output at all ratios for metering core (VA)				
16.	Accuracy class				
17.	Minimum Knee point voltage at different taps for all 'PS' class cores (V)				

18.	Secondary winding resistance at different taps for all cores (Ω) (75°C)				
19.0	Maximum exciting current at all ratios (for all PS class cores)				
19.1	100% KPV (Knee point voltage) (mA)				
19.2	25% KPV (Knee point voltage) (mA)				
19.3	20% KPV (Knee point voltage) (mA)				
19.4	10% KPV (Knee point voltage) (mA)				
20.	Instrument security factor at different ratios.				
21.	Radio interference voltage at $1.1 V_r / 3^{1/2}$ at 1.0 MHZ (Micro volts)				
22.	Whether auxiliary CT provided for metering winding				
23.	Corona extinction voltage (KV rms)				
24.	Partial discharge level (PC)				
25.	Total creepage distance (mm)				
26.	Primary				
26.1	No. of primary turns				

26.2	Material and cross-section of primary (mm ²)				
26.3	Type of primary				
27.	Whether CT is suitable for transportation horizontally.				
28.	Percentage current (ratio) error and phase displacement in minutes at rated burden and at				
28.1	5% rated current				
28.2	10% rated current				
28.3.	20% rated current				
28.4.	120% rated current				
29.	Percentage current (ratio) error and phase displacement in minutes at 25% rated burden and				
29.1	At 5% rated current				
29.2	At 10% rated current				
29.3.	At 20% rated current				
29.4.	At 120% rated current				
30.	Quantity of oil per CT (Litres)				
31.	Standard to which oil conforms generally.				
32.	Characteristics of oil (prior to filling)				

32.1	Breakdown voltage (KVrms)				
32.2	Dielectric dissipation constant (tan delta)				
32.3	Water content (ppm)				
32.4	Gas content				
32.5	Interfacial tension at 27°C (N/m)				
32.6	Specific resistance				
32.6. 1	At 90°C (Ωcm)				
32.6. 2	At 27° C (Ωcm)				
33.	Whether current transformers are hermetically sealed. If so, how ?				
34.	Total weight (Kg)				
35.	Transport weight (Kg)				
36.1	Temperature rise over an ambient temperature of 50°C for continuous operation at rated continuous thermal current.				
36.1	Winding				
36.2	Oil				

36.3	External surface of the core, metallic parts in contact with or adjacent to insulation.				
37.	Whether CT characteristic curves enclosed.				
37.1	Ratio and phase angle curve				
37.2	Magnetisation curves				
37.3	Ratio correction factor curves.				
38.	DATA ON PRIMARY WINDING				
38.1	Rated primary current (A)				
38.2	No. of conductors in one turn				
38.3	No. of turns of primary				
38.4	Material of the primary conductors				
38.5	Size of the primary conductor (Bare/ Insulated (mm x mm)				
38.6	Cross-sectional area of each conductor (mm ²)				
38.7	Total cross-sectional area of primary winding (mm ²) conductors				
38.8	Current density(A/mm ²)				
	(i) At highest ratio				

	(ii) At intermediate ratio				
	(iii) At lowest ratio				
38.9	Short circuit current density (A/mm ²)				
	(i) At highest ratio				
	(ii) At intermediate ratio				
	(iii) At lowest ratio				
38.10	Ampere-turn of Primary (AT)				
	(i) At highest ratio				
	(ii) At intermediate ratio				
	(iii) At lowest ratio				
38.11	Length of primary conductor (m)				
38.12	Weight of primary winding (kg.)				
39.	CORE				
39.1	Material and grade of the core				
39.2	Thickness of core (mm)				
39.3	Net Iron cross-sectional area of core (mm ²)				
39.3.1	Core-1				
39.3.2	Core – 2				

39.3. 3	Core – 3				
39.3. 4	Core – 4				
39.3. 5	Core – 5				
39.4	Mean magnetic path length (cm)				
39.4. 1	Core – 1				
39.4. 2	Core – 2				
39.4. 3	Core – 3				
39.4. 4	Core – 4				
39.4. 5	Core – 5				
39.5	Whether B-H curve for the core material, used, furnished ? (B-wb/m ² , H-AT/cm)				
39.6	Whether specific loss vs. flux density graph for the core material used furnished ?				
39.7	Axial length of core (mm)				
39.7. 1	Core – 1				

39.7. 2	Core – 2				
39.7. 3	Core – 3				
39.7. 4	Core – 4				
39.7. 5	Core – 5				
39.8	Inside diameter / outside diameter of the cores (mm)				
39.8. 1	Core – 1				
39.8. 2	Core – 2				
39.8. 3	Core – 3				
39.8. 4	Core – 4				
39.8. 5	Core – 5				
39.9	Weight of the core (kg)				
39.9. 1	Core – 1				
39.9. 2	Core – 2				
39.9. 3	Core – 3				

39.9. 4	Core – 4				
39.9. 5	Core – 5				
40.	SECONDARY WINDINGS				
40.1	Rated secondary current (A)				
40.2	Material of the secondary windings				
40.3.	Size of the secondary conductor [Bare / Insulated] [mm]				
40.3. 1	Core – 1				
40.3. 2	Core – 2				
40.3. 3	Core – 3				
40.3. 4	Core – 4				
40.3. 5	Core – 5				
40.4	Cross sectional area of the secondary conductor (mm ²)				
40.4. 1	Core – 1				
40.4. 2	Core – 2				

40.4. 3	Core – 3				
40.4. 4	Core – 4				
40.4. 5	Core – 5				
40.5	Current density of secondary windings (A/mm ²)				
40.5. 1	Core – 1				
40.5. 2	Core – 2				
40.5. 3	Core – 3				
40.5. 4	Core – 4				
40.5. 5	Core – 5				
40.6	No. of secondary turns				
40.6. 1	Core – 1				
40.6. 2	Core – 2				
40.6. 3	Core – 3				
40.6. 4	Core – 4				

40.6. 5	Core – 5				
40.7	No. of layers				
40.7. 1	Core – 1				
40.7. 2	Core – 2				
40.7. 3	Core – 3				
40.7. 4	Core – 4				
40.7. 5	Core – 5				
40.8	No. of turns / layer				
40.8. 1	Core – 1				
40.8. 2	Core – 2				
40.8. 3	Core – 3				
40.8. 4	Core – 4				
40.8. 5	Core – 5				
40.9	Average length / turn of secondary windings (mm)				
40.9. 1	Core – 1				

40.9. 2	Core – 2				
40.9. 3	Core – 3				
40.9. 4	Core – 4				
40.9. 5	Core – 5				
40.10	Resistance of the conductor used for secondary winding per meter length at 75°C (Ω/M)				
40.11	Weight of secondary windings (kg)				
40.11 .1	Core – 1				
40.11 .2	Core – 2				
40.11 .3	Core – 3				
40.11 .4	Core – 4				
40.11 .5	Core – 5				
41	INSULATION				
41.1	Name and class of insulating material between core and secondary winding.				

41.2	Name/s of Insulating materials between secondary winding and primary windings.				
41.3	Insulating materials used to achieve grading of capacitance.				
42.	DIAMETER OF WINDINGS				
42.1	Inside / outside diameter of secondary windings (mm)				
42.1.1	Inside / outside diameter of secondary windings (mm)				
42.1.1	Core – 1				
42.1.2	Core – 2				
42.1.3	Core – 3				
42.1.4	Core – 4				
42.1.5	Core – 5				
42.2	Inside / outside diameters of primary winding (mm)				
42.3	Minimum clearance from tank (mm)				
42.4	Minimum clearance from secondary to tank (mm)				

43.	TANK AND SECONDARY TERMINAL BOX				
43.1	Material of the CT tank				
43.2	Material of the CT secondary terminal box				
43.3	Thickness of CT tank material (mm)				
43.4	Thickness of CT secondary terminal box material (mm)				
43.5	Zinc coating of the CT tank (gm/m ²) as per relevant upto date ISS				
43.6	Zinc coating of the CT secondary terminal box (gm/m ²) as per the relevant upto date ISS.				
43.7	Ingress protection rating of the secondary terminal box.				
43.8	Weight of the tank, fittings and other accessories (kg)				
44.	TERMINAL CONNECTOR				
44.1	Manufacturer's name				
44.2	Applicable standard				
44.3	Type				
44.4	Material of connector				
44.4. 1	Clamp body				

44.4. 2	Bolts and Nuts				
44.4. 3	Spring washers				
44.5	Rated current (Amp)				
44.6	Rated terminal load (Kg)				
44.7	Factor of safety				
44.8	Minimum thickness of any part (mm)				
44.9	Weight of clamp complete with hardwares (kg)				
44.10	Type test reports as per IS enclosed				
44.11	OGA drawing enclosed				
45.	INSULATOR				
45.1	Manufacturer's name				
45.2	Type				
45.3	Applicable standards				
45.4	Height (mm)				
45.5	Diameter (top) (mm)				
45.7	Total creepage distance (mm)				
45.8.	Rated voltage (KV)				

45.9	Power frequency withstand voltage for 1 min. dry and wet. (KV – rms)				
45.10	1.2/50 micro-sec impulse withstand voltage (KVP)				
45.11	Corona extinction voltage (KV)				
45.12	Weight (Kg)				
45.13	Maximum allowable span (mm)				
45.14	Cantilever strength (Kg)				
45.15	The drawing enclosed.				
46.	Dielectric dissipation factor at 245/1.732KV (for 220KV C.T) and 145/1.732 KV (for 132 kv C.T.) at ambient temperature.				
47.	Accuracy class of standard C.T. to be used towards determination of ratio errors and phase angle errors for metering cores.				

ANNEXTURE – B.

CALLIBRATION STATUS OF TESTING EQUIPMENTS AND INSTRUMENTS / METERS

Name of the Test	Meters & Equipments required for the corresponding test with range accuracy, make & Sl.No.	Date of Calibration	Due Date of Calibration	Name of the Calibrating Agency	Whether Calibrating Agency is Govt. approved	Whether documents relating to Govt. approval of the calibrating Agency furnished	Whether the meters / equipments fulfill the accuracy class as per calibration report	Whether the calibrating agency has put any limitation towards the use of the particular meter / equipment. If yes state the limitations.	Whether green sticker or Blue Sticker or Yellow Sticker has been affixed on the body of the particular equipment / meter. State the colour of the affixed sticker	Inspite of imposed limitations , whether the particular meter / equipment t can still be used ? Justify its use for corresponding test (s)	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Signature of the tenderer with Seal & date

ANNEXURE – C

CHECK-LIST TOWARDS TYPE TEST & SPECIAL TEST REPORTS

Name of the Type Test & special test	Date of Test.	Name of the Laboratory where the Test has been conducted	Whether the Laboratory is Government approved	Whether the Test report is valid as per Cl.No. 6.1 of TS	Whether the copy of test report in complete shape alongwith drawings etc. furnished or not ?	Whether the tested Current Transformers fulfill the technical requirements as per TS	If the tested Current Transformer does not fulfill the technical requirements as per this specification, whether the bidder agrees to conduct the particular type test again at their own cost without any financial liability to OPTCL in the presence of OPTCL's representative(s) within the specified delivery period.	Remarks
1	2	3	4	5	6	7	8	9

Signature of the Tenderer with seal and date

OUTDOOR TYPE C.T., P.T. & CVT CONSOLES/ MARSHALING BOX:

C.T., P.T. & CVT consoles. Marshalling box shall be of aluminium alloy **sheet** of 3mm **thick** are to be supplied along with the C.T., P.T. & CVT equipment. One console box is required for 3 nos. equipment. Details of quantities required are to be engineered by the contractor. These consoles are suitable for outdoor mounting and shall have proper slope at the top for easy discharge of water.

- (I) Marshalling Boxes shall be weather proof with a rating not less than IP 55
- (II) The C.T., P.T. & CVT console shall be of Aluminum alloy sheets having 3 mm thickness.
- (III) The Marshalling box shall be provided with a removable cable gland plate at bottom for mounting cable glands for 1.1KV PVC sheathed 4 x 4 Sq. mm stranded copper conductor cables.
- (IV) The Marshalling box shall be provided with a **double leaf** door in front so as to have easy access of terminals. The door shall have a sealing / locking arrangement and shall be suitable to prevent penetration of moisture and rainwater.
- (V) All terminals shall be clearly marked with identification number to facilitate connection to external wiring.
- (vi) Terminal Block connectors (Reputed make like **Elmex,Wago**) built from cells of molded dielectric and brass stud inserts shall be provided for terminating the outgoing ends of the wiring and the corresponding incoming tail ends of the control cables. All the terminal connectors shall have de-link(disconnecting) facilities. Provision shall be made on each pillar for holding 20% extra connection (10% incoming + 10% outgoing). All blocks shall be shrouded by easily removable shroud molded of transparent dielectric materials. The terminal blocks shall be suitable for 660 volts service and connection with both aluminum and copper cable.
- (vii) **Provision of Illumination lamp, Thermostat control auto heater & 3 pin socket with plug in each Marshalling Box. The Supply shall be 230 V A.C. Necessary wiring in the MB shall also be provided.**
- (viii) **The sizes of the MB for C.T., P.T. & CVT shall be finalized during detailed Engineering.**