BIDDING DOCUMENT

FOR

"Supply of main metering CT and PT for replacement of old equipment of SCL"

(E-Tender)

VOLUME -2

https://assamtenders.gov.in

BID IDENTIFICATION NO:

AEGCL/MD/TECH-291/PP&D/2023/Star Cement/CTPT/BID

ASSAM ELECTRICITY GRID CORPORATION LIMITED

Section-1
SCOPE AND GENERAL TECHNICAL CONDITIONS

1.1.0 INTENT OF THE SPECIFICATION

1.1.1 This volume of the specification deals with the general technical information & criteria for design, manufacture, supply & delivery of equipment/material as defined in Volume-1.

1.1.2 The provisions of this section shall supplement all the detailed Technical Specifications and requirements brought out herein. The Contractor's proposal shall be based on the use of materials complying fully with the requirements specified herein.

1.2.0 SCOPE

1.2.1 The work involves design, engineering, manufacture, assembly, inspection, testing at manufacturer's works before dispatch, packing, supply, including insurance during transit, delivery at site of various equipment and materials as specified in subsequent Clauses and Sections.

1.2.2 It is not the intent to specify completely herein all details of design and construction of the equipment and accessories. However, the equipment and accessories shall conform in all respects to high standards of engineering, design and workmanship and be capable of performing in continuous operation up to the bidder's guarantees in a manner acceptable to the Purchaser. The Purchaser will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material, which in his judgement is not in full accordance therewith.

1.2.3 The major items of works included in the scope of this specification are listed below: -

i) Design, engineering, manufacture, assembly and testing at manufacturer's works of Instrument Transformers and cables as specified in the BoQ.

ii) Loading at manufacturer's works, transportation and delivery to site, including unloading at destination site.

1.2.4 The various items of supply are described very briefly in the schedule of Bid Form, Prices & Other Schedules and annexure. The various items as defined in these schedules shall be read in conjunction with the corresponding section in the technical specifications including amendments and, additions if any.

1.2.5 The bidder is required to fill up the BOQ/price schedule as given in the e-tendering portal.

1.3.0 DESIGN IMPROVEMENTS

1.3.1 The Employer or the Contractor may propose changes in the specification and if the parties agree upon any such changes and the cost implication, the specification shall be modified accordingly.

1.4.0 DESIGN CO-ORDINATION

1.4.1 Wherever, the design is in the scope of Contractor, the Contractor shall be responsible for the selection and design of appropriate material/item to provide the best coordinated performance of the entire system. The basic design requirements are detailed out in this Specification. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

1.5.0 DESIGN REVIEW MEETING

1.5.1 The contractor will be called upon to attend design review meetings with the Employer, and the consultants of the Employer during the period of Contract. The contractor shall attend such meetings at his own cost at Assam or at mutually agreed venue as and when required. Such review meeting will be held generally minimum once a month or the frequency of these meeting shall be mutually agreed between the Employer and the Contractor. Frequency of Design Review Meetings shall depend upon the project requirement to ensure project implementation as per the Master Programme.

1.6.0 PACKING

1.6.1 All the materials shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. The CONTRACTOR shall be responsible for any loss or damage during transportation, handling and storage due to improper packing.

1.6.2 The CONTRACTOR shall include and provide for securely protecting and packing the materials so as to avoid loss or damage during transport by air, sea, rail and road.

1.6.3 All packing shall allow for easy removal and checking at site. Wherever necessary, proper arrangement for attaching slings for lifting shall be provided. All packages shall be clearly marked for with signs showing 'up' and 'down' on the sides of boxes, and handling and unpacking instructions as considered necessary. Special precaution shall be taken to prevent rusting of steel and iron parts during transit by sea.

1.6.4 The cases containing easily damageable material shall be very carefully packed and marked with appropriate caution symbols, i.e., fragile, handle with care, use no hook etc. wherever applicable.

1.6.5 Each package shall be legibly marked by the-CONTRACTOR at his expenses showing the details such as description and quantity of contents, the name of the consignee and address, the gross and net weights of the package, the name of the CONTRACTOR etc.

SECTION-2
TECHNICAL SPECIFICATION FOR CURRENT TRANSFORMERS (AIS)

2.1.0 SCOPE OF CONTRACT

2.1.1 This Section of the Specification covers general requirements for design, engineering, manufacture, assembly and testing at manufacturer's works of 220 kV outdoor Current Transformers.

2.2.0 STANDARDS

2.2.1 The equipment covered by this specification shall, unless otherwise stated be designed, constructed and tested in accordance with the latest revisions of relevant Indian Standards and shall conform to the regulations of local statutory authorities.

2.2.2 In case of any conflict between the Standards and this specification, this specification shall govern.

2.2.3 The current transformer shall comply also with the latest issue of the following Indian standard.

(i)	IS: 2705(Part-I)	Current transformers: General requirement.
(ii)	IS: 2705(Part-II)	Current transformers: Measuring Current transformers
(iii)	IS: 2705(Part-III)	Current transformers: Protective Current transformers
(iv)	IS: 2705(Part-IV)	Current transformers: Protective Current transformers for special purpose application.

2.3.0 GENERAL REQUIREMENTS

2.3.1 The cores of the instrument transformers shall be of high grade, non-aging CRC steel of low hysteresis loss and high permeability.

2.3.2 Current transformers shall be of Live Tank design.

2.3.3 The instrument transformers shall be truly hermetically sealed to completely prevent the oil inside the tank coming into contact with the outside temperature. To take care of oil volume variation the tenderer is requested to quote the current transformers with stainless steel diaphragm (bellow).

2.3.4 The instrument transformers shall be completely filled with oil.

2.3.5 A complete leak proof secondary terminal arrangement shall be provided with each instrument transformers, secondary terminal shall be brought into weather, dust and vermin proof terminal box. Secondary terminal boxes shall be provided with facilities for easy earthing, shorting, insulating and testing of secondary circuits. The terminal boxes shall be suitable for connection of control cable gland. IP rating of terminal box shall be IP 55. Spare terminals shall be provided.

2.3.6 All instrument transformers shall be of single-phase unit.

2.3.7 The instrument transformers shall be so designed to withstand the effects of temperature, wind load, short circuit conditions and other adverse conditions.

2.3.8 All similar parts, particularly removable ones, shall be interchangeable with one another.

2.3.9 All cable ferrules, lugs, tags, etc. required for identification and cabling shall be supplied complete for speedy erection and commissioning as per approved schematics.

2.3.10 The instrument transformers shall be designed to ensure that condensation of moisture is controlled by proper selection of organic insulating materials having low moisture absorbing characteristics.

2.3.11 All steel work shall be degreased, pickled and phosphated and then applied with two coats of Zinc Chromate primer and two coats of finishing synthetic enamel paint.

2.3.12 Test terminal for tan-delta/capacitance shall be provided for 132kV CT's.

2.4.0 INSULATING OIL

2.4.1 The insulating oil shall conform to the requirement of latest edition of IS: 335. GTP of Insulating Oil shall be furnished.

2.5.0 COMMON MARSHALLING BOXES (shall be supplied by CT manufacturer)

2.5.1 The outdoor type common marshalling boxes shall conform to the latest edition of IS 5039 and other general requirements specified hereunder.

2.5.2 The common marshalling boxes shall be suitable for mounting on the steel mounting structures of the instrument transformers.

2.5.3 One common marshalling box shall be supplied with each set of instrument transformers. The marshalling box shall be made of sheet steel and weather-proof. The thickness of sheet steel used shall be not less than 3.0 mm. It is intended to bring all the secondary terminals to the common marshalling. The marshalling box shall be of hot dipped galvanized steel.

2.5.4 The enclosures of the common marshalling boxes shall provide a degree of protection of not less than IP 55 (As per IS 2147).

2.5.5 The common marshalling boxes shall be provided with double hinged front doors with pad locking arrangement. All doors and removable covers and plates shall be sealed all around with neoprene gaskets or similar arrangement.

2.5.6 Each marshalling box shall be fitted with terminal blocks made out of moulded non-inflammable plastic materials and having adequate number of terminals with binding screws washers etc. Secondary terminals of the instrument transformers shall be connected to the respective common marshalling boxes. All out going terminals of each instrument transformer shall terminate on the terminal blocks of the common marshalling boxes. The terminal blocks shall be arranged to provide maximum accessibility to all conductor terminals.

2.5.7 Each terminal shall be suitably marked with identification numbers. Not more than two wires shall be connected to any one terminal. At least 20 % spare terminals shall be provided over and above the required number.

2.5.8 All terminal strips shall be of isolating type terminals and they will be of minimum 10 A continuous current rating.

2.5.9 All cable entries shall be from bottom. Suitable removable gland plate shall be provided on the box for this purpose. Necessary number of cable glands shall be supplied fitted on to this gland plate. Cable glands shall be screw on type and made of brass.

2.5.10 Each common marshalling box shall be provided with two numbers of earthing terminals of galvanised bolt and nut type.

2.5.11 All steel, inside and outside work shall be degreased, pickled and phosphated and then applied with two coats of Zinc Chromate primer and two coats of finishing synthetic enamel paint. The colour of finishing paint shall be as follows: -

i)	Inside:	Glossy White
ii)	Outside:	Light Grey (Shade No. 697 of IS: 5)

2.6.0 BUSHINGS AND INSULATORS

2.6.1 Bushings and Insulators shall be of Porcelain, Solid core type. Porcelain used for the manufacture of bushings and insulators shall be homogeneous, free from defects, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture.

2.6.2 Glazing of the porcelain shall be of uniform brown colour, free from blisters, burns and other similar defects. Bushings shall be designed to have sufficient mechanical strength and rigidity for the conditions under which they will be used. All bushings of identical ratings shall be interchangeable.

2.6.3 Puncture strength of bushings shall be greater than the dry flashover value. When operating at normal voltage, there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the bushings when operating at the normal rated voltage.

2.6.4 The design of bushing shall be such that the complete bushing is a self-contained unit and no audible discharge shall be detected at a voltage up to a working voltage (Phase Voltage) plus 10%. The minimum creepage distance for severely polluted atmosphere shall be 31 mm/KV.

2.6.5 Sharp contours in conducting parts should be avoided for breakdown of insulation. **The insulators shall be capable to withstand the seismic acceleration of 0.5 g in horizontal direction and 0.6g in vertical direction.**

2.6.6 Bushings shall satisfactorily withstand the insulation level specified in data sheet.

2.6.7 Rain shed/drain cover/dome shall be present in CT.

2.6.8 Bellow level indicator shall be present in CT.

2.6.9 **Nitrite butyl rubber/Neoprene gaskets shall be used.**

2.7.0 TESTS

2.7.1 Routine/Acceptance Tests (all units)

All routine tests shall be carried out in accordance with relevant Standards. All routine/acceptance tests shall be witnessed by the Employer/his authorised representative.

2.7.2 Type Tests: The bidder shall furnish type test certificates and results for the all tests as per relevant Standards along with the bid for current and potential transformers of identical design.

Type test certificates so furnished shall not be older than 5 (five) years as on date of Bid opening.

2.7.3 At factory/works tests the Ten Delta shall not exceed 0.3% (at Um/√3). Thesame shall not exceed 0.7% at the end of warranty period (refer Vol-1). If tan delta value of CTs exceed prescribed limit of 0.7% within warranty period, it will be considered as failure within warranty period (Tan delta & capacitance test of CTs shall be measured at 10KV at site). The bidder has to replenish failed CTs within guarantee period without any cost implication to AEGCL.

QAP: QAP shall be submitted.

2.8.0 NAME PLATES

2.8.1 All equipment shall have non-corrosive name plates fix at a suitable position indelibly mark with full particular there on in accordance with the standard adapted. Thickness (1mm), purchase order, project name, serial no etc. shall be present in the Name plate.

2.9.0 MOUNTING STRUCTURES

2.9.1 All the equipment covered under this specification shall be suitable for mounting on steel structures. Supply of mounting structures is also in the scope of this tender.

2.9.2 Each equipment shall be furnished complete with base plates, clamps, and washers etc. and other hardware ready for mounting on steel structures.

2.10.0 SAFETY EARTHING

2.10.1 The non-current carrying metallic parts and equipment shall be connected to station earthing grid. For these two terminals suitable for 40mm X 10mm GI strip shall be provided on each equipment.

2.11.0 TERMINAL CONNECTORS (Shall be under manufacturer scope)

2.11.1 The equipment shall be supplied with required number of terminal connectors of approved type suitable for ACSR. The type of terminal connector, size of connector, material, and type of installation shall be approved by the Employer, as per installation requirement while approving the equipment drawings. No part of a clamp shall be less than 12mm. thick.

2.12.0 PRE-COMMISSIONING TESTS

2.12.1 Contractor shall carry out following tests as pre-commissioning tests. Contractor shall also perform any additional test based on specialties of the items as per the field instructions of the equipment Supplier or Employer without any extra cost to the Employer. The Contractor shall arrange all instruments required for conducting these tests along with calibration certificates and shall furnish the list of instruments to the Employer for approval.

(a) **Current Transformers**

(i) Insulation Resistance Test for primary and secondary.
(ii) Polarity test.
(iii) Ratio identification test - checking of all ratios on all cores by primary injection of current.
(iv) Dielectric test of oil (wherever applicable).
(v) Magnetising characteristics test.
(vi) Tan delta and capacitance measurement
(vii) Secondary winding resistance measurement
(viii) Contact resistance measurement (wherever possible/accessible).
(ix) Knee-point voltage measurement

2.13.0 TECHNICAL DATA SHEET FOR CURRENT

2.13.1 For 245/145/36 kV CTs the instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CTs/reactor are used in the current transformers then all parameters specified shall have to be met treating auxiliary CTs as an integral part of the current transformer. The auxiliary CTs/reactor shall preferably be inbuilt construction of the CTs. In case these are to be mounted separately these shall be mounted in the central marshalling box suitably wired up to the terminal blocks.

2.13.2 **TYPE AND RATING:**

All instrument transformer shall be outdoor type, single phase, oil immersed, self-cooled suitable for mounting on steel structure. The instrument transformer shall have the following ratings and particulars.

SL No.	Item	Ratings and Particulars
I	II	III
A	Nominal system voltage	220 kV
B	Highest system voltage, kV	245
C	Rated frequency, HZ	50
D	System earthing	Solidly earth
E	Insulation level	
a)	Impulse withstand voltage: kVp	1050
b)	One-minute p.f. Withstand voltage, kV (r.m.s.)	
		460
F	Short time current for 3 seconds, kA	50
G	Minimum creepage distance, mm	7595
H	Temperature rise	As per ISS
I	**FEEDER C.T.**	
	(i) No. of Cores	3
	(ii) Transformation ratio	
	(iii) Rated out put	
	(a) Core-1	30 VA
	(b) Core-2	30 VA
	(c) Core-3	30 VA
	(d) Core-4	-
	(e) Core-5	-
	(iv) Accuracy class	
	(a) Core-1	0.2S
	(b) Core-2	0.2S
	(c) Core-3	0.2S
	(d) Core-4	-
	(e) Core-5	-
	(v) Accuracy limit factor	
	(a) Core-1	-
	(b) Core-2	-
	(c) Core-3	-
	(d) Core-4	-
	(e) Core-5	-
	(vi) Instrument security factor	
	(a) Core-1	<5
	(b) Core-2	<5
	(c) Core-3	<5
	(d) Core-4	-
	(e) Core-5	-
	(vii) Minimum Knee point voltage, Volts	
	(a) Core-1	-

	(b) Core-2	-
	(c) Core-3	-
	(d) Core-4	-
	(e) Core-5	-
	(viii) Maximum secondary resistance, ohm (Mfg. to specify)	
	(a) Core-1	-
	(b) Core-2	-
	(c) Core-3	-
	(d) Core-4	-
	(e) Core-5	-
	(ix) Maximum exciting current, at Vk/4 mA (Mfg. to specify)	
	(a) Core-1	-
	(b) Core-2	-
	(c) Core-3	-
	(d) Core-4	-
	(e) Core-5	-
	(x) Rated extended primary current	120%

Note:

(i) It is intended to use different ratios of the same CT at the same time for various protections and metering cores. The CTS should therefore be suitable for the above purpose by secondary tapings only. The ratio change by secondary taps is acceptable as long as the required CT specifications are achieved at all ratios.

(ii) The knee point voltage specified above shall be at higher ratio/ taps.

(iii) CT and PT sizing calculations shall be submitted. Burden values and knee point voltage, shall be decided as per the calculations during detailed engineering

SECTION-3
TECHNICAL SPECIFICATION FOR 33 KV, 132KV, 220KV & 400 KV CVT & IVT

3.1. SCOPE:

3.1.1. This specification provides for the design, manufacture, assembly inspection and testing at the manufacturer's works, packing and delivery to site, erection, testing and commissioning of outdoor mounted type, single phase, oil filled, self-cooled, single unit type Inductive voltage transformers for 33 KV &132KV systems, & Capacitive Voltage Transformers for,132KV, 220kV & 400 KV system to be used for voltage indication, supply of potential to energy meters, relays for feeder protection in Grid Sub- stations of AEGCL, ASSAM.. In addition to the above functions the 400 KV, 220kV, 132KV CVT shall be suitable for carrier coupling.

3.1.2. The IVTs shall be complete in all respects with insulators, bimetallic connectors, fixing details etc. as described herein.

3.1.3. Bidders are required to quote for 0.2 accuracy class [metering winding] for 33 KV and 132KV IVTs & 132KV, 220kV, 400kV CVTs in the following manner.

(a) Guaranteed Technical Particulars.
(b) Technical literatures, brochures and drawings as per this specification.
(c) Type Test reports.
(d) List of orders, executed and Users' certificates with minimum 5years of field proven experience failing submission of the above particulars with the offer, the tender may not be considered for evaluation.

3.2. Following is the list of documents constituting this Specification:

(i) Technical Specification (TS).
(ii) Technical requirements.

3.3. STANDARDS:

3.3.1 The IVTs & CVTs shall conform in all respects to high standards of Engineering, design, workmanship and latest revisions of relevant standards at the time of offer and the Purchaser shall have the power to reject any work or material which in his judgement is not in full accordance therewith.

3.3.2. Except to the extent modified in the specifications, the IVTS & CVTs shall conform to the latest editions and the amendments of the standards listed hereunder:

Sl. No.	Standard Ref. No.	Title
01	IEC-44(4)	Instrument Transformer – measurement of PDS.
02	IEC-60	High voltage testing techniques.
03	IEC-171	Insulation co-ordination.
04	IEC-186	Voltage Transformers.
05	IEC-186(A)	Voltage Transformers (first supp. to IEC-186)
06	IEC-270	Partial discharge measurement.
07	IS-335	Insulating oil for transformers and switchgears.
08	IEC-8263	Method for RIV Test on high voltage insulators.
09	IS-2071	Method of high voltage testing.
10	IS-2099	High Voltage porcelain bushings.
11	IS-2147	Degree of protection provided by enclosures for low voltage switchgear and control.
12	IS-2165	Insulation co-ordination for equipments of 100KV and above.
13	IS-3156 (Part-I to IV).	Voltage transformers.
14	IS-3347	Dimensions of porcelain transformer bushings.
15	IS-4146	Application guide for voltage transformers.
16	IS-5547	Application guide for Capacitor Voltage Transformers.
17	IS-9348	Coupling Capacitor & Capacitor Devices.

3.3.3 All the above along with the 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 Technical Specification

will prevail.

3.3.4. The voltage 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 equipments, offered by the supplier conform to other standards, salient points of difference between the 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.

3.3.5. **The supplier is to furnish the standards as mentioned above from Sl. 1 to 17 at their own cost, if required by the purchaser.**

3.4. CLIMATIC AND SERVICE CONDITIONS:

3.4.1 Earthquake Incidence:

The VTS are to be designed to withstand earthquake of intensity, equivalent to 0.5g in the horizontal and 0.6g in the vertical direction

Where, 'g' stands for acceleration due to gravity.

3.5. INSTALLATION:

The VTS covered under this specification shall be suitable for outdoor installation without any protection from rain, dust, mist and direct rays of the sun.

3.6. GENERAL TECHNICAL REQUIREMENTS:

3.6.1. GENERAL TECHNICAL REQUIREMENTS FOR IVT:

3.6.1.1. Each IVT shall be supplied, filled with insulating oil and shall be hermetically sealed to prevent atmosphere coming in contact with oil, avoiding filtration and change of oil. Stainless steel diaphragm Bellow with bellow level indicator shall be provided.

3.6.1.2. However, the IVT shall have a provision for draining and filling insulating oil after drying or preferably must have arrangement for drying the oil by continuous process with oil filters.

3.6.1.3. The IVT shall be suitable for transport in horizontal position if the transport limitations so demand.

3.6.1.4. Secondary Terminal Box:

3.6.1.4.1. The secondary terminals shall be brought out in a weatherproof terminal box with a rating not less than IP-55.

3.6.1.4.2 All secondary terminals shall be brought out in a compartment on one side of each IVT for easy access.

3.6.1.4.3. The exterior of this terminal box shall be hot dip galvanized.

3.6.1.4.4. The terminal box shall be provided with removable gland plate and glands suitable for 1100 volts grade. PVC insulated, PVC sheathed multi core 4 sq.mm to 6 sq.mm stranded copper conductor cable.

3.6.1.4.5. 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.

3.6.1.4.6. The dimensions of the terminal box and its openings shall be adequate to enable easy access and sufficient working space for use of normal tools.

3.6.1.4.7. The terminal blocks shall be standard type and provided with ferrules indelibly marked or numbered and their identifications shall correspond to the designation on the relevant wiring diagram.

3.6.1.4.8. Secondary wiring terminal studs shall be provided with at least three nuts, plain and spring washers. The studs, nuts and washers shall be of brass, duly nickel plated. The minimum diameter of the studs shall be 6 mm. The length of at least 15 mm shall be available on the studs for inserting the leads.

3.6.1.4.9. Primary earthling link should be provided for measurement of capacitance & di-electric dissipation factor.

3.6.1.4.10. Separate point should be provided

3.6.1.4.11 Polarity shall be indelibly marked on each primary and secondary terminal.

3.6.1.5. The IVT 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. The method adopted for hermetic sealing shall be described in the offer.

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

any.
3.6.1.7. The characteristics of the IVTS shall be such as to provide satisfactory performance such as voltage error and phase displacement at rated frequency shall not exceed the values as per relevant standards at any voltage between 80% and 120% of rated voltage and with burdens of between 25% and 100% of rated burden at a power factor of 0.8 lagging. The error shall be determined at the terminals of the IVT and shall include the effects of any fuses or resistors as an integral part of the IVT.

3.6.1.8. Inductive voltage transformers shall be ferro-resonance proof and adequately designed to use in HT cable circuit wherever applicable.

3.6.1.9. Primary Winding:
Primary winding of the IVT will be connected phase to neutral with the neutral point solidly earthed. The arrangement for this shall be included in the scope of supply. The primary conductor shall be of adequate cross-section so that the maximum permissible current density shall not be exceeded even during short-circuit conditions. Primary Windings shall be made of copper.

3.6.1.10. Secondary Winding:
Suitably insulated copper wire of electrolytic grade shall be used for secondary windings. The secondary conductor shall be of adequate cross section so that the maximum permissible current density shall not be exceeded even during short- circuit conditions. Secondary windings details, burden & accuracy class are mentioned in Appendix-I. Secondary windings shall be used for metering, relaying and synchronizing. Each winding shall comply requirements of both Part-II and III of up-to-date editions of IS-3156/IEC-186.

3.6.1.11. Core:
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 accuracy i.e. 0.2 accuracy class at both normal and high over voltage. **The core material, thickness of lamination, the relevant graphs showing the characteristics of the core materials shall be submitted along with the offer**.

3.6.1.12. Tank:
3.6.1.12.1. Both expansion chambers and tanks of the IVT shall be made of high-quality steel / Aluminum and shall be able to withstand full vacuum and pressure, occurring during transit and thermal and mechanical stresses resulting from maximum short circuit current during operation. The tanks along with all ferrous parts shall be hot- dip galvanized as per relevant standard.
3.6.1.12.2. 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 the purchaser for any horizontal welding, used in the bottom tank
3.6.1.12.3. Paint inside the metallic housing shall be of anti-condensation type.

3.6.1.13. Porcelain Housing:
3.6.1.13.1. 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 rainwater 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.
3.6.1.13.2. The bushings of the IVTS shall conform to latest edition of IS-2099.The hollow porcelain insulators shall conform to the latest edition of IS-5621
3.6.1.13.3. The insulators shall be cemented with Portland cement to the flanges resulting in high mechanical, tensile and breaking strength
3.6.1.13.4. The bushings shall have ample insulation, mechanical strength and rigidity for the condition under which they shall be used and shall be used and shall be designed to prevent accumulation of explosive gases and provide adequate oil circulation to remove the internal heat.
3.6.1.13.5. Cast metal and 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 ionisation.
3.6.1.13.6. The insulation of bushings shall be coordinated with that of the IVT such that the flashover, if any, shall occur only external to the IVT.
3.6.1.13.7. Oil level gauge and convenient means of filling, sampling and draining of oil shall be provided.

3.6.1.13.8. End shields should be provided for distribution of stresses.
3.6.1.13.9. Corona shields for bushings, if required, should be provided.

3.6.1.14. Insulating Oil:
The quantity of insulating oil for the filling and the complete specification of the insulating oil shall comply in all respects with the provisions of the latest edition of IS-335. The IVTS shall be supplied completely filled with purified oil.

3.6.1.15. Prevention of Oil Leakage and Entry of Moisture:
The supplier shall ensure that the sealing of the IVT 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 & secondary terminals.
(b) Interface between porcelain housing and metal tank(s).
(c) Cover of the secondary terminal box.

3.6.1.15.1. 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.

3.6.1.15.2. For gasketed joints, wherever used, **nitrite butyl rubber/Neoprene gaskets shall be used**. The gasket shall be fitted in properly machined groove with adequate space for accommodating the gasket under compression.

3.6.1.15.3. Fittings and Accessories:
Fittings and accessories listed below shall be supplied with each IVT. Any fitting required essential other than those listed below shall also be supplied along with each IVT.
(a) Oil level gauge.
(b) Oil filling hole and cap.
(c) Pressure relieving device.
(d) Lifting lugs for core and windings, bushings & complete transformers.
(e) Phase terminal connectors.
(f) Tank earthing pads/terminals with necessary nuts and bolts and washers for connecting to Purchaser's strip.
(g) Name/Rating plate.
(h) H.R.C. fuse of Adequate rating
(i) Bellow

3.6.1.16. Provisions
3.6.1.16.1. Oil Level Gauge:
An oil level gauge shall be provided to indicate the oil level in the IVT. This gauge shall be mounted in such a way that the oil level can be seen from the ground level.

3.6.1.16.2. Pressure Relieving Device:
Each IVT shall be provided with a pressure relieving device so as to protect bushing of the IVT even under unfavorable conditions.

3.6.1.16.3. 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.

3.6.1.16.4. Earthing:
Metal tank of each IVT 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.

3.6.1.16.5. Lifting Arrangement:
The IVT 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.

3.6.1.16.6. Name Plate:
The IVT shall be provided with non-corrosive legible name plate with the information specified in relevant standards, duly engraved/punched on it.

3.6.1.16.7. Gasket Joint:
The manufacturer shall furnish the type of gasket used or setting methods.

3.6.1.16.8. Terminal Connectors:
All the IVTs shall be provided with bimetallic solder less clamp type, rigid type terminal connectors, suitable for ACSR Conductor as per site requirement. Each terminal connector shall be of universal type, suitable for both horizontal and vertical connections to the transmission line conductors/station bus bar.
3.6.1.16.8.1. Terminal Connectors shall be manufactured and tested as per IS:5561.
3.6.1.16.8.2. All castings shall be free from blow holes, surface blisters, cracks and cavities.All sharp edges and corners shall be blurred and rounded off.
3.6.1.16.8.3. No part of a clamp shall be less than 12mm. thick.
3.6.1.16.8.4. All ferrous parts shall be hot dip galvanized conforming to IS-2633. For bimetallic connectors, copper alloy linear of minimum thickness of 2 mm shall be cast integral with aluminium body.
3.6.1.16.8.5. All current carrying parts shall be designed and manufactured to have minimum contact resistance.
3.6.1.16.8.6. Connectors shall be designed to be corona free in accordance with the requirements, stipulated in IS-5561.

3.6.1.16.9. Secondary Wiring:
The Secondary wiring shall be enclosed in conduits and shall be brought to a terminal block ready for external connections. The wiring shall be of adequate cross-section and not less than 4.00 sq.mm copper wire.

3.6.1.16.10. The supplier shall supply necessary hardware, required for connection of phase side conductor to the line terminal and the grounding strip to the grounding terminal.

3.6.1.16.11. Necessary nuts and bolts for fixing the IVTS on the supporting structures shall be in tenderer's scope of supply.

3.6.2. GENERAL TECHNICAL REQUIREMENTS FOR 400KV, 220KV & 132KV CAPACITIVE VOLTAGE TRANSFORMER:

3.6.2.1. The design of capacitor voltage transformers shall such that its accuracy shall not be affected by the presence of pollution on the external surface of its insulators.

3.6.2.2. The CVT shall operate satisfactorily in system with high X/R ratio. (Tp=100 ms.).

3.6.2.3. The CVT transformer tanks along with top metallic shall be galvanized and painted to required shade.

3.6.2.4. Impregnation details along with tests and checks to ensure successful completion of impregnation cycle shall be furnished for purchaser's approval.

3.6.2.5. Bellows, if used to cater for expansion of insulating oil, shall be tested in accordance with relevant standards. The details shall be subject to the approval of the purchaser.

3.6.2.6. The CVT shall be capacitor voltage type with electromagnetic units and shall be suitable for carrier coupling.

3.6.2.7. All windings of voltage transformer secondaries shall be protected by HRC cartridge type fuses. In addition, fuses shall be provided for the protection and metering windings for fuse monitoring scheme. The secondary terminals of the CVTs shall be terminated to stud type non-disconnecting terminal blocks in the individual phase secondary boxes via the fuse. Fuse ratings shall be clearly mentioned.

3.6.2.8. CVTs shall be suitable for high frequency (HF) coupling, required for power line carrier communication. The carrier signal must be prevented from flowing into potential transformer (EMU) circuit by meant of a RF choke/reactor, suitable for effectively blocking the carrier signal over the entire carrier frequency range i.e. 40 to 500 KHZ. Details of the arrangement shall be furnished along with the bid. HF terminal of the CVT shall be brought out through a suitable

bushing and shall be easily accessible for connection to the coupling devices of the carrier communication equipment, when utilized. The bushing shall be fully protected against rain and vermin so as to avoid the possibility of short circuits to earth. An earthing link with fastener shall be provided for HF terminal. Test tap for Tan-delta and capacitance shall be provided.

3.6.2.9. The electromagnetic unit, comprising compensating reactor, intermediate transformer and protective and damping devices should have a separate terminal box with all secondary terminals, brought out.

3.6.2.10. The accuracy of the windings (0.2/3P/3P) shall be maintained throughout the entire burden range preferably in the frequency range of 48 HZ to 51.5 HZ on all the three windings without any adjustment during operation. Preference will be given to such bidders who can offer for maintaining the above accuracy class in the frequency range i.e., 48 HZ to 51.5 HZ up to the above specified burden values.

3.6.2.11. Constructional Features:

3.6.2.11.1. The 400KV, 220KV & 132KV CVT shall be suitable for mounting on support structure of lattice type structures.

3.6.2.11.2. Access to secondary terminals shall be possible without any danger of access to high voltage circuit.

3.6.2.11.3. CVTs shall be hermetically sealed units.

3.6.2.11.4. **A protective surge Arrester/spark gap shall be provided to prevent break down of insulation by incoming surges and to limit abnormal rise of terminal voltage of shunt capacitor/primary winding, tuning reactor/RF choke etc. due to short circuit in transformer secondaries. Surge arrester shall be provided in the secondary winding also.**

3.6.2.11.5. The CVT secondary terminals shall brought out into a weatherproof terminal box for ease of access. The terminal box shall have an IP rating of not less than IP 55. The terminal box shall be provided with a removable gland plate at the bottom and shall be suitable for accepting the required number of PVC insulated PVC sheathed, 10 core 2.5 mm² standard copper conductor cable.

3.6.2.11.6. All terminals shall be clearly marked to facilitate connection of secondary wiring.

3.6.2.11.7. Secondary fuses or MCBs shall be provided on or adjacent to each CVT, located such that they are accessible while the primary is live and shall be provided with labels indicating their function and their phase colours CVT secondary circuits shall be complete in themselves and shall be earthed at one point only. A separate earth link shall be provided for each secondary winding and shall be situated at the CVT. Primary earthing links should be provided.

3.6.2.11.8. Where CVTs are supplied which are or may be connected to different sections of the bus bar, it shall not be possible for the CVT secondary circuits, to be connected in parallel.

3.6.2.11.9. To prevent ferro resonance, suitable damping devices shall provide for connection to the transformer secondaries.

3.6.2.11.10. CVTs shall meet the requirements, given in this section of the specification.

3.6.2.11.11. The creepage and flashover distances of the high voltage insulator shall be suitable for the outdoor service conditions, specified in the schedules.

3.6.2.11.12. The bidder in the offer is to state the suitable precautions/methods, adopted during design stage of the CVT to avoid the un-desirable effects due to ferro resonance phenomena. The precautions/methods include lower level of working flux density in EMU, greater utilization of the linear portion of the magnetization curve, providing an air gap in the magnetic circuit, connecting a suitable damping resistance permanently across the secondary etc.

3.6.2.11.13. It should be stated in the bid offer regarding the steps taken in the design stage for elimination/minimization of the influence of the transient response on the behaviour of high-speed relays.

3.6.2.11.14. It shall be ensured by the bidder in the offer that the connection of carrier, frequency coupling device across the CVT will not affect the designated accuracy class of the CVT windings.

3.6.2.11.15. The capacitor divider unit shall comply to IS: 9348/1979.

3.6.2.11.16. It shall also be complied in the offer through a calculation sheet, proving that the designated accuracy class of the CVT (both metering and protection) are not affected by extreme temperatures, to be encountered in service conditions (Max. ambient temperature 50º C and minimum -0º C). The terminal connectors should be suitable for 'ACSR' Conductor as per site requirement.

3.6.2.11.17. Separate point should be provided for measurement of capacitance & dielectric dissipation factor.

3.6.2.11.18. Capacitor Voltage Transformers shall be suitable for high frequency (HF) coupling required for power line carrier communication.

3.6.2.11.19. The coupling of Capacitor Voltage Transformers shall be suitable for the entire carrier frequency range of 40 KHz to 500 KHz. Necessary arrangements for preventing the HF signal to flow to the other circuits shall be provided.

3.6.2.11.20. The HF terminal shall be kept earthed when not used for PLCC purpose. Earthing link with fastener to be provided for HF terminal.

3.6.2.11.21. Capacitor Voltage Transformers shall be suitable for high frequency (HF) coupling required for power line carrier communication.

3.7. TESTS:

3.7.1 Type Tests:

The offered 33 KV& 132KV Inductive voltage transformer 400kV, 220kv, 132KV capacitive voltage transformer should have been subjected to the following type tests in a government approved Test Laboratory. The bidder shall furnish four sets of type test reports along with the offer. These tests must not have been conducted earlier than five years from the date of opening of the bid. For any change in the design/type already type tested and to the design/type offered against this specification, the purchaser reserves the right to demand repetition of some or all type tests/special tests without any extra cost to AEGCL in the presence of purchaser's representative at the cost of the supplier.

For 33 KV, 132 KV IVT:

(a) Temperature rise test.
(b) Lightning Impulse Test.
(c) High Voltage power frequency wet withstand voltage tests.
(d) Determination of errors.
(e) IP-55 Test on secondary Terminal Box.
(f) RIV Test
(g) Creepage distance measurement test

N.B.: (i) The dielectric type tests should have been carried out on the Same transformer.
(ii) After the IVT was subjected to the dielectric tests, it should have been subjected to all routine tests as per relevant standards.
(iii) For Temperature Rise Test, the test must have been made with the appropriate rated burden, connected to each secondary winding.

For 400kV, 220kV & 132kV CVT.

Type Tests/Special Tests for 400kV, 220kV, 132kV CVT:

a) Lightning Impulse voltage test on complete CVT unit.
b) Power frequency over-voltage test on complete CVT unit.
c) Partial discharge test.
d) Radio interference voltage test.
e) Corona extinction voltage test.
f) Temperature rise test on complete CVT unit.
g) Ferro resonance test on the complete C.V.T. unit.

h) Transient response tests.
i) Determination of Temperature Co-efficient test.
j) High frequency capacitance and equivalent resistance measurement test (as per IEC-358)
k) Stray capacitance and stray conductance test (as per IEC-358).
l) Accuracy tests.
m) Thermal stability test.
n) Thermal Co-efficient test (as per IEC-358)
o) Fast transient test.
p) Seismic withstand test.
q) IP-55 test on secondary Terminal Box.
r) Magnetization and internal burden tests.
s) Effectiveness of sealing tests.
t) Mechanical Terminal load test on Bushing.
u) Dielectric loss angle test (Tan Delta Test).
v) Switching impulse withstand test
w) Critical impulse with stand voltage of insulator housing

N.B: 1. The dielectric type tests should have been carried out on the same CVT.
2. After the CVT was subjected to the dielectric tests, it should have been subjected to all routine tests as per relevant standards.
3. The ratio errors, phase displacements before, during and after the temperature rise test on complete CVT unit should have been determined with stipulated burdens and the same should comply with the designated accuracy class for each winding of the CVT.

3.7.2 Routine Tests:

The following routine tests shall be conducted on each VT in the presence of Purchaser's representative for which no charges will be payable by AEGCL. No sampling is allowed.

(a) Verification of terminal markings.
(b) Power frequency withstand tests on primary windings/capacitor voltage divider for IVT/CVT
(c) Partial discharge measurement for 132kV IVT & 400kV, 220kV & 132kV CVT.
(d) Power frequency withstand tests on secondary windings/Low voltage terminal of the capacitor divider for 400kV, 220kV & 132kV CVT.
(e) Power frequency withstand tests between sections.
(f) Determination of errors on complete IVT/CVT.
(g) Measurement of Insulation resistance.
(h) Oil leakage test.
(i) Measurement of capacitance and dielectric dissipation factor before and after dielectric tests (as per IEC-358)
(j) Power frequency tests on electromagnetic unit for 400kV, 220kV & 132kV CVT.
(k) Any other test as per relevant national & international standards.

N.B.: Determination of errors shall be performed after the other tests. The standard reference VT to be used during testing for determination of ratio error and phase angle error should of 0.05 accuracy class or better as per standard practice, presently adopted by AEGCL.

3.8. INSPECTION:

3.8.1. The Purchaser shall have access at all times to the works and all other places of manufacture, where the IVTs/CVTs are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the supplier's works, raw materials, manufacturer of all the accessories and for conducting the necessary tests.

3.8.2. 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 at the discretion of the Purchaser.

3.8.3. No material shall be dispatched from its manufacture unless the material has been satisfactorily inspected, tested and dispatch clearance issued. However, the Purchaser reserves the right to alter the dispatch schedule attached to this Specification.

3.8.4. 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.

3.8.5. Clear 15 (Fifteen) days' notice shall be given to this office for deputing officer(s) for inspection. The Voltage Transformers shall be dispatched only after the inspection is conducted by a representative of AEGCL and release order, issued from this office after approval of Routine Test Certificates. The shop routine test certificates in triplicate for all the Voltage Transformers along with the calibration certificates of all the meters and equipments to be used during testing (as per Annexure-B of the Specification) should be furnished along with the Inspection Offer. The Inspecting Officer will be authorised for inspection of the Voltage Transformers subject to the condition that the routine test certificates and calibration certificates of the testing equipments/meters will be found to be in order.

3.9. QUALITY ASSURANCE PLAN:

3.9.1. 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 materials in presence of Bidder's 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 tests and inspection.
(vi) Special features provided in the equipment to make it maintenance free.
(vii) List of testing equipments, meters 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 as per the Technical Specification.

3.9.2. 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 name of Sub-suppliers selected from those, furnished along with the offer.
(ii) Type test certificates of the raw materials and bought out accessories.
(iii) Quality Assurance Plan (QAP) withhold points for the Purchaser's possible inspection. The QAP and hold points shall be discussed between the Purchaser and the Supplier before the QAP if finalised.

3.9.3. The Supplier shall submit the routine test certificates of bought out items and raw materials at the time of acceptance testing of the fully assembled equipment.

3.10. DOCUMENT:

The supplier shall furnish four sets of following drawings/documents along with his offer.

(a) General outline and assembly drawings of the Inductive Voltage Transformers/ Capacitive Voltage Transformers.
(b) Sectional views showing:
  i) General constructional features.
  ii) Materials/gaskets/sealing used.
  iii) The insulation of the winding arrangements, method of connection of primary/ secondary winding to the primary/secondary terminals etc.
(c) Schematic drawing.
(d) Rating & diagram plate as per relevant IEC/ISS
(e) Secondary Terminal Box.
(f) Assembly Sectional view of Primary terminal/capacitor voltage divider
(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.
(k) All type test reports relating to the tests as specified in Clause-8.1 of the above.

(l) Ratio and phase angle error curves for IVTS/ CVTS
(m) Magnetization characteristic curves such as B-H curves and Sp. Loss vs. Flux density curves for core material, used for IVT & EMU unit of CVT.
(n) Sectional view of EMU unit of 220KV&132KV CVT.
(o) Schematic diagram showing the working of CVT in PLCC.

3.11. TEST REPORTS:

(i) Four copies of type test/special test reports shall be furnished to the Purchaser with the tender offer.
(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 dispatched.
(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.
(v) The necessary galvanized flanges, bolts etc. for the base of the Inductive/Capacitive Voltage Transformers shall be supplied without any extra cost to the purchaser.

3.12 APPENDIX – I.

TECHNICAL REQUIREMENTS FOR 220kV INDUCTIVE VOLTAGE TRANSFORMERS

Sl. No.	Particulars	220 kV IVT
I	II	IV
1	Type	Single phase, 50Hz, oil filled, self-cooled, hermetically sealed, outdoor porcelain type.
2	Nominal system voltage.	220kV
3	Highest system voltage.	245kV.
4	Frequency.	50Hz± 5%
5	System earthing.	Effectively solidly earthed
6	Number of phases.	3 [single phase]
7	(i) Number of secondary windings. (ii) Purpose of windings.	3 [three] Metering.
8	Rated primary voltage.	220/1.732kV
9	Rated secondary voltage.	Winding-I, II &III- 220/1.732V (Metering)
10	Ratio	220kV/1.732: 110V/1.732
11	Rated burden.	Winding-I(M)- 100VA Winding-II(M)-100VA Winding-III(M)-100VA
12	Accuracy class	0.2/0.2/0.2
13	Rated voltage factor at rated frequency.	1.2 continuous. 1.5 for 30second.
14	Temperature rise at 1.2 times the rated primary voltage, rated frequency & rated burdens.	As per IEC-186.
15	Temperature rise at 1.5 times the rated primary voltage for 30 seconds, rated frequency & rated burden.	As per IEC-186.
16	One-minute power frequency dry withstands test voltage for primary winding.	275kV[rms]
17	1-minute power frequency wet withstands test voltage for primary winding.	275kV[rms]
18	1.2/50 micro second impulse withstand test voltage for primary winding	650kV[peak]
19	One-minute power frequency withstands test	3kV[rms]

Sl. No.	Particulars	220 kV IVT
I	II	IV
(i) (ii)	voltage for Secondary winding Between LV(HF) terminal & earth terminal	-
20	Class of insulation.	'A'
21	Material of the conductor of primary and secondary windings.	Copper.
22	Fault level of the bus to which PTs will be connected.	50 kA [rms] for 3 second.
23	Minimum creepage distance.	4495mm
24	Quality of oil.	EHV Grade As per IS-335.
25	Radio interference voltage at 1.1 times maximum rated voltage at 1.0 MHZ.	500 micro volts.
26	Partial discharge level.	Less than 10 picocoulombs.
27	Seismic acceleration Horizontal – Vertical –	0.5g. 0.6g.
28	Accuracy class of standard V.T. to be used during testing towards determination of ratio errors and phase angle errors for metering windings.	0.05 or better.
29.	Capacitance (Pf)	-