

**TECHNICAL SPECIFICATION FOR 33KV, 0.2S ACCURACY CLASS 100/1A**  
**CURRENT TRANSFORMERS**

**1. SCOPE:**

This specification covers the design, manufacture, assembly testing at manufacturer's works and supply and delivery at destination of outdoor oil immersed 33KV, 0.2S class accuracy Current Transformers live tank (Protection & Metering).

**2. STANDARDS:-** The equipment shall conform in all respects to the latest version of relevant I.S. indicated below as applicable.

i) Current Transformers	: IS 2705 (Parts I to IV) (Latest version)
ii) H.V. Porcelain Bushings	: IS 2099
iii) Oil	: IS 335
iv) Galvanization	: IS 2633
v) Primary Terminals	: IS 10601
vi) Insulation coordination	: IS 2165
vii) Dimensions of porcelain Bushings	: IS 3347
viii) Method of high voltage rating	: IS 2071

The tender shall go through the above I.S. thoroughly before making his offer.

**3. CLIMATIC CONDITIONS:-** The materials to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions

<b><u>Location</u></b>	At various locations in the state of Andhra Pradesh
Max. ambient air temperature (deg.C)	50
Max. ambient air temperature in a closed box (deg.C)	60
Min. ambient air temperature (deg.C)	7.5
Average daily ambient air temp. (deg.C)	35
Max. Relative Humidity (%)	100
Max. altitude above mean sea level (m)	1000
Average Annual rainfall(mm)	925
Max. wind pressure(kg/sq. m.)	200
Isoceraunic level(days per year)	40 to 50
Seismic level(Horizontal acceleration)	0.3 g.
Permitted Noise Level	45 dB

Moderately hot and humid tropical climate is conducive to rust and fungus growth. The climatic conditions are also prone to wide variations in the ambient conditions, Smoke is also present in the atmosphere, Heavy lighting also occurs during June to October.

**4. 33KV & 11KV CTs:-**

**4.1 TYPE:-** The current transformers shall be outdoor type Live tank, single phase, oil immersed self cooled vacuum impregnated type suitable for operation in 3 phase 33 & 11KV, 50 Hz solidly ground system under the normal service condition as specified in IS 2705 and as indicated in the **Annexure - 2** "Schedule of Materials".

**4.2.** The current transformers shall have the following ratings.

a) Rated voltage:	33kV
<b>i) Nominal system voltage</b>	<b>33kV</b>
<b>ii) Highest systems voltage</b>	<b>36kV</b>
<b>iii) Standard Impulse withstand voltage</b>	<b>170kV</b>
<b>iv) One minute power frequency withstands voltage:</b>	
a) Primary	70kV
b) Secondary	3kV
c) Short time thermal current and its duration	25 KA for 3 sec.
d) Rated transformation ratio:	As indicated in Annexure-II – “Schedule of Materials”.

#### 33KV CTs

	Protection	Metering	Diff. Protection
i) Class of Accuracy	5P10	0.2S	-PS-
ii) Rated Burden / Phase	15VA	5VA	--
iii) Accuracy limit factor	10	$\leq 5$	--
iv) Min. knee point voltage (VK)	-	-	> 40 I (RCT+R L)
v) Max. Excitation current			< 30 mA at $V_k/4$
f) Frequency	----- 50 Hz -----		

#### 5. 33KV CTs:-

#### 6. GENERAL TECHNICAL REQUIREMENTS:-

##### Porcelain Housing:-

6.1. The porcelain housing shall be of single piece construction without any joint. The housing shall be made 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).

6.2. The clear height of porcelain bushing for 33KV instrument transformers shall be at least 520mm.

6.3. Details of attachment of metallic flanges to the porcelain pressure release valve and primary / secondary terminals shall be brought out in the offer.

6.4. The metal tank shall be fabricated from mild steel having thickness of minimum 5 mm.

6.5. The metal tanks shall be coated with at least two coats of zinc rich epoxy paint externally and inside shall be painted with oil resistant white enamel paint. All the ferrous hardware, exposed to atmosphere, shall be hot dip galvanized. All other fixing nuts, bolts, washers in the electric current path shall be made out of stainless steel.

6.5.1. CT top cover shall be Dome Shaped to avoid rain water stagnation.

## **6.6. OIL IMMERSSED EQUIPMENTS:-**

### **6.6.1. INSULATING OIL:**

Insulating oil required for first filling of the instrument transformers shall be covered in tenderer's scope of supply. The oil shall meet the requirements of latest edition of IS 335. Use of other insulating material such as quartz sand is not permitted.

### **6.6.2. PREVENTION OF OIL LEAKAGES & ENTRY OF MOISTURE:-**

The tenderer shall ensure that the sealing of instrument transformers is properly achieved, so as to avoid leakages of oil. In this connection the arrangement provided by the tenderer at various locations including the following ones shall be described supported by sectional drawings.

- i. Locations of emergence of primary and secondary terminals.
- ii. Interface between porcelain housing and metal tanks.
- iii. Cover of the secondary terminal box.

6.6.3. The primary studs shall be provided suitable nuts with washers and check nuts

6.6.4. If gasketed joints are 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.

### **6.6.5.OIL LEVEL INDICATORS:**

Each Instrument Transformer shall be provided with prismatic type oil sight window at suitable location so that oil level is clearly visible with naked eye to an observer standing at ground level.

Suitable measuring gauge indicated (Full), (Half) and empty positions of oil shall be provided.

6.6.6. For compensation of variation in volume of the oil due to temperature variation nitrogen cushion or stainless steel bellows shall be used. Rubber diaphragms shall not be permitted for this purpose.

6.6.7. The units shall be vacuum filled with oil after processing and thereafter hermetically sealed to eliminate air and moisture from entering the tank.

6.6.8. Oil filling and / or oil sampling cocks if provided to facilitate factory processing shall be permanently sealed before dispatch of the instrument transformers.

## **6.7. EARTHING:-**

Bottom Metal tank of the instrument transformer shall be provided with two separate earthing terminals of size 16mm dia. x 30 mm length H.D.G. with one plane washer and one nut for connection to station earth-mat. The earth terminal shall be marked with sign for indication.

## **6.8. LIFTING ARRANGEMENT:-**

Instrument transformers shall be provided with suitable lifting arrangement to lift the entire unit. Lifting arrangement (lifting eye) shall be positioned in such a way so as to avoid any damage to the porcelain bushing, primary terminals or the tanks during the process of lifting for installation / transport. The general arrangement drawing shall show clearly the lifting arrangements provided such as lifting eye guide etc.,

## **6.9. NAME PLATE:-**

The instrument transformer shall be provided with non-corrosive legible name plate with the information specified in relevant standards duly engraved / punched on it.

Cable entry glands suitable for entry of 2.5Sqmm 4Core Copper control cable flexible shall be provided. 2Nos. in case of metering & protection. 3Nos. in case of metering , protection & differential.

The purchase order No. and Date of the purchase order, the words “PROPERTY OF EASTERN POWER DISTRIBUTION COMPANY OF AP Ltd.” should be etched on the Name plate.

The name plate is to be welded to the tank after galvanization.

**6.10. MOUNTING DETAILS:-**

The Current Transformers shall be provided with 4 Nos. mounting support channels suitable for mounting on steel structures. The necessary flanges, bolts etc. for the base of CT shall be supplied and galvanized.

6.11. The terminal connectors suitable for panther ACSR conductors shall be supplied. Suitable earth connectors for earthing connections shall also be supplied.

6.12. Enamel, if used for conductor insulation, shall be either polyvinyl acetate type or amide type and shall meet the requirement of IS 4800. Polyster enamel shall not be used. Double cotton cover, if used shall be suitably covered to ensure that it does not come in contact with oil.

6.13. The C.T. shall be of Live tank design and shall be so constructed that it can be easily transported to site within the allowable transport limitation, and in vertical position. The C.T. shall be hermetically sealed and method of such sealing shall be detailed in the offer and shall be subject to the approval of the purchaser.

6.14. The secondary terminals shall be brought out in a weatherproof terminal box. The terminal box shall be provided with removable gland plate and glands. The cable glands shall be suitable for 1100 Volts glands, PVC insulated. PVC Sheathed multicore 6 sq.mm stranded tinned copper. The terminal box shall be dust and vermin proof. The dimensions of the terminal box and its openings shall be adequate to enable easy access and working space with use of normal tools.

6.15. Polarity shall be invariably 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.

The C.T. shall be provided with a rating plate with dimensions and markings as per IS – 2705 or equivalent international standards. The markings shall be punched metal photo and not painted.

6.16. The serial number and code of the supplier shall also be punched on tank to identify the unit in case of loss or damage to the rating plate.

6.17. The current transformer shall be vacuum filled with oil after processing and thereafter hermetically sealed to eliminate breathing and to prevent ingress of air and moisture from entering the tanks.

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

6.19. The instrument security factor of metering core shall be low enough but 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.

#### **6.20. CORE:-**

The Core shall be high grade non-ageing cold rolled grain oriented steel of low hysteresis loss and high permeability to ensure specified high accuracy, at both normal and over current. The flux density shall be limited so that there is no saturation during service. The internal security factor should be **low** enough not to damage the instrument in the event of short circuit over voltage.

#### **6.21. WINDING:-**

All windings shall be made of double paper insulated high conductivity rigid copper wire. For 33KV CTs the primary winding shall be hair pin type or wound type made out of high conductivity - copper. Conductors used for the primary winding shall be rigid. Unavoidable joints in the primary winding shall be welded type preferably lap type. The details of such welded joints shall be indicated in the drawings submitted with the offer. For primary winding current densities shall not exceed the limit of 1.6 Amp / mm<sup>2</sup> for normal current.

The design density for short circuit current as well as conductivity of the metal used for primary winding shall meet the requirement of IS 2705. The tenderer shall in his offer furnish detailed calculations for selection of winding cross sections.

#### **6.22. SECONDARY WINDING:-**

Suitably insulated copper wire of electrolytic grade shall be used for secondary windings. Type of insulation used shall be described in the offer. For multi ratio design, the multi ratio shall be achieved by reconnection of secondary winding.

The excitation current of the CT shall be as low as possible. The tenderer shall furnish along with his offer the magnetization curves for all the cores.

#### **6.23 PRIMARY TERMINALS:-**

Primary terminals of CTs to which the line connections are made shall have dimensions as per IS 10601 / 1983. For all 33KV CTs the primary terminals shall be of stud type of size of 30mm dia. x 80 mm length for all CTs. The primary terminals shall be of heavily tinned electrolytic copper of 99.9% conductivity. The minimum thickness of timing shall be 15 microns.

#### **6.24. SECONDARY TERMINALS:-**

Secondary terminal studs shall be provided with at least three nuts and two plain and two spring washers for fixing the leads. The studs, nuts and washers shall be of brass, duly nickel plated. The minimum out side diameter of the studs shall be 6 mm. The length of at least 15mm shall be available on the studs for inserting the leads. The horizontal spacing between centers of the adjacent studs shall be at least 1.5 times the outer dia. of the stud.

Current transformer characteristics shall be such as to provide satisfactory performance for burdens ranging from 25% to 100% of rated burden over a range of 10% to 120% of rated current.

The following accessories / fittings shall be supplied along with the instrument transformers.

- a) Pressure release device
- b) Oil level indicator
- c) Lifting lugs
- d) Provision for cable entry hole (3/4 inches) shall be provided at CT secondary terminal box.

## 7. SEALING:-

Sealing provision is to given for the secondary terminal box with holes on the four corners for passage 14 SWG sealing wire.

## 8. TESTS:-

### 8.1. CURRENT TRANSFORMERS:

8.1.1. TYPE TESTS:- The following type tests as per IS 2705 ( latest version ) shall be conducted and type test certificates for the tests carried out on prototype of same specification shall enclosed with the tender.

- a) Short time current test.
- b) Temperature rise test.
- c) Lightning Impulse test.
- d) High voltage power frequency wet withstand voltage test.
- e) Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class.
- f) All the nuts & bolts shall be Hot dip galvanized.

8.1.2. ACCEPTANCE & ROUTINE TESTS:- The following tests shall be conducted as per IS 2705 –1992..

- a) Verification of terminal marking and polarity.
- b) Power frequency withstand test on primary & secondary windings.
- c) Over voltage interterm test.
- d) Knee – Point voltage and exciting current ( for class PS CTs only)
- e) Secondary winding resistance { }
- f) Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class.

9. INSPECTION:- :- All acceptance tests shall be conducted at the time of inspection and at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities without charges to satisfy him that the material is being furnished in accordance with the specification.

The purchaser has the right to have the tests carried at supplier's cost by an independent agency whenever there is a dispute regarding the quality of supply.

The purchaser reserves the right to insist for witnessing the acceptance/routine testing of the bought out items. The supplier shall give 15 days for local supply/30 days (in case of foreign supply) advance intimation to enable the purchaser to depute his representative for witnessing the acceptance and routine tests.

The lot will be accepted into stock only if the materials satisfy the above tests as shown in clause 8.1.2. and will be rejected if fails to conform to the standards. The same process will be followed for II-consignment (in case of rejection of I-lot) and if the materials fail in 2<sup>nd</sup> time also the total order will be cancelled. If the material is rejected by the inspection authority, you have to offer fresh inspection of material duly attending the remarks of the inspection authority and all the inspection charges in this connection shall be borne by supplier only.

## 10. PACKING AND FORWARDING:-

The equipment's shall be packed in crates suitable for vertical / horizontal transport as the case may be and suitable 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. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

10.2. Each consignment shall be accompanied by a detailed packing list containing the following information.

- 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 material indicating contents of each package.

10.3. The supplier shall ensure that the packing list and bill of material are approved by the purchaser before dispatch.

**11. GUARANTEE TECHNICAL PARTICULARS:-** The technical particulars as per IS (Latest version) shall be guaranteed and guaranteed technical particulars as per Annexure shall be furnished by the tenderer along with his offer.

11.1. Warranty: The material offered shall have a warranty of 18 months. The warranty clause 53 of GTC shall be followed.

**12. DRAWINGS & LITERATURE:-** Drawings and technical literature of CTs shall be enclosed to the offer. Sectional view and dimensions for all parts to the extent possible shall be indicated in the drawings. Tenders not accompanied by the above are liable to be rejected. These drawings and literature are to be supplied @ 2 copies along with each unit in the event of order.

**13. OVERALL DIMENSIONS AND FOUNDATION DETAILS:-** The manufacturer shall give the necessary information as regards the overall dimensions of the transformer and foundation details.

**14. SCHEDULE OF REQUIREMENTS DESIRED DELIVERY AND PRICES:**

14.1. The schedule of requirements and desired deliveries are indicated in Annexure - 2

14.2. The schedule of prices shall indicated as per price schedule form of Annexure – 2

**15. DEPARTURE FROM SPECIFICATION:** If the tenderer wishes to depart from this specification in any respect, he shall draw the attention to such points of departure explaining fully the reasons there for. Unless this is done the requirements of this specification will be deemed to have been accepted in every respect.

**NOTE:** The tenderer shall indicate the source of all materials. He shall also indicate the name of the supplier and make of Conductor, Transformer Oil Electrical Steel Laminations and Construction Steel etc.