

**TECHNICAL SPECIFICATION FOR 33KV SINGLE PHASE POTENTIAL  
TRANSFORMERS 0.2 CLASS Accuracy with 10VA Burden**

**1. SCOPE :** The specification covers the design, manufacture, assembly , testing at manufacturer's works and supply and delivery at destination, of outdoor oil immersed 33KV/ $\sqrt{3}$  Single Phase Voltage transformers (metering) suitable for mounting externally at various sub-stations in APEPDCL.

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

1. Voltage Transformers	:	IS 3156 (Part I & II)
2. HV Porcelain Bushings	:	IS 2099
3. Oil	:	IS 335
4. Galvanisation	:	IS 2633
5. Primary Terminals	:	IS 10601
6. Insulation Coordination	:	IS 2165
7. Dimensions of porcelain Bushings	:	IS 3347
8. Method of high voltage rating	:	IS 2071

The tenderer shall go through the above IS thoroughly before making his offer.

**3. CLIMATE 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. Principal parameters for 33KV PTs :**

**TYPE :** The voltage transformers shall be outdoor oil immersed self cooled vacuum impregnation type suitable for operation in 3 Ph, 33KV 50 Hz solidly grounded system under the normal service conditions specified in IS 3156 and as indicated, in the Annexure 2 "Schedule of Requirements"

**The voltage transformers shall have the following ratings.**

- |    |                         |              |
|----|-------------------------|--------------|
| a) | Rated voltage           | 33KV         |
| b) | No. of phase/connection | Single Phase |

**c) INSULATION LEVEL :**

- |  |  |
|--|--|
| 1) Nominal system voltage                            | 33KV   |
| ii) Highest system voltage                           | 36 KV  |
| iii) Standard impulse withstand voltage              | 70KV <sub>P</sub> /170 KV <sub>P</sub>           |
| iv) One Minute power frequency withstand voltage     |  |
| a) Primary   | 70 KV  |
| b) Secondary   | 3 KV   |
|  |  |
| c) Rated voltage factor and Corresponding rated time | 1.2 times continuous<br>1.5 times for 30 Seconds |

- |                                |  |
|--------------------------------|--|
| d) Rated Transformation ratio: | As indicated in Annexure-2<br>“Schedule of requirements” |
|--------------------------------|--|

- |                          |   |         |
|--------------------------|---|---------|
| i) Class of Accuracy     | : | 0.2     |
| ii) Rated burden/Phase   | : | 10VA    |
| e) Type of Transformer   | : | Earthed |
| f) No. of windings/phase | : | 1       |

Each voltage transformer shall be capable of carrying without injury continuous burden of 25% above the rated burden in respect of 33KV PTs.. The PTs shall have adequate protection with fuses on secondary side.

**5. CONSTRUCTION :**

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

The secondary terminals shall be brought into a compartment on one side of voltage transformer for easy access. The secondary taps shall be adequately reinforced to withstand normal handling without damage.

The voltage transformers shall be suitable for mounting on steel structures or concrete pedestals. The necessary flanges, bolts & nuts etc., for the base of the PT shall be supplied and these shall be galvanized. **The tank and other metal parts shall be galvanized.**

All windings shall be of insulated high grade electrolytic copper wire and the manufacturing of the units shall be done in completely closed and air conditioned room otherwise fiber glass insulation sleeves are to be provided for primary winding. Details of winding and core shall be furnished.

The PTs shall be completed in all respects with first filling of oil conforming to IS-335 and with oil level indicator with minimum and maximum oil levels. The top cover and terminal base cover should be such that rain water does not enter even though the gaskets are damaged.

Potential Transformers tank MS sheet thickness required 3.15 mm (min) and secondary terminal shall be provided with nut & bolts.

**Primary and Secondary Terminals :** Primary terminals of PTs to which the line connections are to be made shall have dimensions as per IS –10601/1983. The secondary

terminals shall be brought out into suitable compartment which shall have a removable cover. The terminal box with the cover closed and tightened the cable/conduit in position when supplied shall have a degree of protection conforming to IP 54 of IS:2147.

**Terminal and earth connectors :** Terminal connectors suitable for panther ACSR conductor shall be supplied. Suitable earth connectors for earthing connections shall also be supplied.

Primary terminal diameter should be 20 mm (min), Primary brass terminal (External) lengths should be 50 mm (min) and Aluminum stud holder to be provided with bimetallic clamp.  
**5.4. Earthing:** The assembly comprising of the chassis, frame work and the fixed parts of the metal casing of the PT shall be provided with two separate earthing terminals. The earthing terminals shall be adequate size protected against corrosion and metallicly clean and identified by means of the sign marked in a legible and indelible manner on or adjacent to the terminals.

**Sealing Arrangement :** Provision for sealing secondary terminal compartment, primary ratio change strips (if any) and tank effectively such that no fraud such as tampering of the ratio or circuit (current/voltage) is possible. The holes provided for the above sealing provision shall be of adequate size and pass the sealing wire of about 14SWG.

**Name/Rating Plate :** Each PT shall have the following particulars indelibly marked on it or on a label permanently secured to it or its casing.

- a) Manufacturer's Name
- b) Year of manufacturer
- c) Manufacturer's Sl.No. and/ or type designation.
- d) Rated transformation ratio
- e) Rated frequency.
- f) Rated output and the corresponding accuracy class
- g) Highest system voltage
- h) Insulation level
- i) Rated voltage factor and corresponding rated time
- j) Type of Transformers
- k) No. of phases and method of connection
- l) Basic impulse level (BIL)
- m) Guarantee Period.
- n) P.O.No. with Date

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

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

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

## **6. TESTS :**

- a) 6.1 Potential Transformers :

**TYPE TEST :** The following type tests as per IS: 3156 (latest version) shall be conducted and type test certificates for the tests carried out at NABL Accredited laboratory on prototype of same specification shall be enclosed with the tender. The date of type tests will not be later than 10 years as on the date of opening of the bid.

- a) High voltage power frequency wet withstand voltage test.
- b) Determination of errors according to the requirements of the appropriate

accuracyclass.

- c) Temperature rise test.
- d) Impulse voltage test.

**ACCEPTANCE AND ROUTINE TESTS:** The following shall be conducted as per IS:3156(latest version)

- a) Verification of terminal marking and polarity
- b) Power frequency dry withstand tests on Primary windings.
- c) Power frequency dry withstand tests on Secondary windings.
- d) Determination of errors according to the requirements of the appropriate accuracyclass.

**7. 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 6.1 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.

**8. GUARANTEED TECHNICAL PARTICULARS :** The technical particulars as per IS (Latest version) shall be guaranteed and guaranteed technical particulars as per Annexure – 1 shall be furnished by the tenderer along with his offer.

**9. DRAWINGS & LITERATURE :** Drawings and Technical Literature of PTs shall be enclosed to the offer, Sectional view and dimensions for all parts to the extent possible, External & Internal clearances 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.

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

**11. SCHEDULE OF REQUIREMENTS DESIRED DELIVERY:**

11.1 The schedule of requirements and desired deliveries are indicated in Annexure – 2.

**Note :** The tenderer shall indicate the sources of all materials. He shall also indicate the name of the supplier and make of conductor, Transformer oil electrical steel laminations, construction steel etc.

**GUARANTEED TECHNICAL PARTICULARS.**

**33 KV Single Phase Potential Transformers, 10VA/0.2 Class accuracy**

<b>Sl.No</b>	<b>Details</b>	<b>APEPDCL requirement</b>	<b>As per bidder</b>
1.	Name and Address of Manufacturer.		
2.	Manufacturer's Type & Designation.		
3.	Nature of service	Outdoor	
4.	Type of Cooling.	Oil cooled	
5.	System Characteristics. a) Rates System Voltage. b) Highest System voltage. c) Rates system frequency. d) Nature of neutral earthing.	33KV 36KV 50HZ Earthed	
6.	Rated Voltage ratio.	$33KV/\sqrt{3}/110V/\sqrt{3}$	
7.	Winding connections.	Star/Star	
8.	Rated burden.	10VA	
9.	Class of accuracy.	0.2	
10.	Polarity.	Provided	
11.	Rated voltage factor and time.	1.2 Cont & 1.5 for 30sec	
12.	Limits of ration and phase angle error	As per IS:3156	
13.	Temperature rise of top oil at 1.1 times rated primary voltage with rated secondary burden.	Within the limit as specified in IS	
14.	Insulator characteristics. a) Type. b) Make c) Electrical Characteristics. d) Total Creepage distance.	Outdoor — As per IS 900mm(minimum)	
15.	One minute power frequency dry withstand test on primary winding.	70KV rms	
16.	One minute power frequency withstand test on secondary winding.	3KV rms	
17.	High Voltage impulse withstand test on primary windings.	170KV(peak)	
18.	Oil : a) Specification. b) Quantity for first filling.	IS-335 —	
19.	Total weight of PT with oil.	As per approved	
		drawings	
20.	Reference specification to which the equipment conform.	IS-3156/92	
21.	Outline dimensional drawing with mounting details.	As per approved drawings	
22.	The Potential transformers shall carry 25% above the rated burden continuously without injury in respect of 33 KV PTs	Should be complied	

**GUARANTEED TECHNICAL PARTICULARS FOR NEW TRANSFORMER  
OIL CONFIRMS TO IS-335/93 OR LATEST VERSION.**

Sl.No	Details	APEPDCL requirement	As per bidder
1.	Appearance	Clear and transparent and free from suspended matter and sediments	
2.	Density, gm/cm at 27 Deg. C	0.835	
3.	Kinetic viscosity at 27 Deg. C	25	
4.	Interfacial tension, N/m	0.04	
5.	Flash point, PMCC, OC, Min.	165	
6.	Pour point, OC	(-) 18	
7.	Neutralization value		
	a). Total acidity	0.01	
	b). Inorganic acidity	NIL	
8.	Corrosive sulphur	Non-Corrosive	
9.	Break down voltage, ms, Kv (Min.)		
	a) Non untreated	30	
	b) After treatment	60	
10.	Dielectric dissipation factor (Tan Delta at 90 Deg. C) (Max.)	0.002	
11.	Specific resistance (resistivity)		
	a) At 90 Deg. C (Min.) Ohm-Cm	$100 \times 10^{12}$	
	b) At 27 Deg. C (Min.) Ohm -Cm	$3000 \times 10^{12}$	
12.	Oxidation stability		
	a) Neutralization value after oxidation (Max.)	0.01	
	b) Total sludge, after oxidation (Mx.)	NIL	
13.	Ageing characteristics after accelerated ageing (open breaker method with copper catalyst) 96 Hrs. as per ASTM D 1934-1978		
	a) Specific Resistance (resistivity)		
	i) At 27 Deg. C (Min.) Ohm-cm	$2.5 \times 10^{12}$	
	ii) At 90 Deg. C (Min.) Ohm-cm	$0.2 \times 10^{12}$	
	b) Dielectric dissipation factor (Tan delta) at 90 De. C (Max.)	0.20	
	c) Total acidity (Max.)	0.05	
	d) Total sludge value (Max.)	0.05	
14.	Presence of oxidation inhibitor	NIL	
15.	Water content (Max.)	30 ppm	