

TECHNICAL SPECIFICATION FOR 33 KV SINGLE PHASE POTENTIAL TYPE TRANSFORMERS OUTDOOR

1:0 TYPE/ RATING The potential transformers should have the following ratings.

NOMINAL SYSTEM VOLTAGE	33 KV
HIGHEST SYSTEM VOLTAGE	36 KV
FREQUENCY	50 HZ
EARTING OF THE SYSTEM	EFFECTIVE
BASIC IMPULSE LEVEL	170 KV

Voltage rating	Transformation ratio	Cores	Rated output	Class of accuracy	Remark
33 KV	33 / $\sqrt{3}$ KV/ 110/ $\sqrt{3}$ V	Core –I Core-II	50 VA 50 VA	0.2 3P	Metering Protection

Note: Rated outputs should be guaranteed on both the ratios.

1.1 **STANDARD**

The potential transformers shall comply with the latest issue of following Indian Standard and amendments thereof except where specified otherwise.

1. IS 3156 (Part I to III) Specification for PTs & IEC 60444-1
2. IS 2099 Specification for High Voltage porcelain bushing
3. IS 3347 & IS 8603 Specification for dimensions for porcelain T/F bushings
4. IS 335 Specification for Insulating oil for T/F & switchgear
5. IS 3202 Code of practice: climate proofing of electrical Equipment. Or any other related amended IS & IEC.

2.0 **GENERAL**

The separately mounted PTs outdoor type shall be of single phase oil immersed, hermetically sealed and self cooled suitable for installation at secondary sub-station and complete in all respects conforming to the modern practice of design and manufacture.

The protection core shall be of high grade, non ageing, electrical silicon laminated steel of low hysteresis loss and high permeability to ensure high accuracy at both normal and over currents. The PTs shall be hermetically sealed to entering the tank. These shall be provided with the oil level gauge and pressure relieving device capable for releasing abnormal internal pressures.

3.0 **WINDINGS**

The instrument security factor of the PTs core to be used for metering shall be low enough not to cause any damage to measuring instruments. PTs core to be used for protective relaying purposes shall be of accuracy class specified.

The primary winding of voltage transformers should be connected in phase to neutral point solidly earthed. The neutral of the system is also solidly earthed.

The secondary winding of voltage transformers should be rated for 110/ $\sqrt{3}$ Volts for connection in star and delta separately. The star connection is to be used for metering and shall be of accuracy class specified. The rated burden of this winding shall not be less than the values specified. The star connection is to be used for protection relaying (directional relays) should be of accuracy class specified. The secondary of the PTs should be capable of simultaneous loading at their individual rated capacities.

The secondary terminal box should have the provision of sealing & locking of the metering terminals. "METERING" & "PROTECTION" should be clearly indicated on each terminal over respectively by engraving or by providing the metallic plate.

4.0 SPECIAL FEATURES OF PTs:

The protection cores should be of high grade non-aging electrical silicon laminated steel of low hysteresis loss and high permeability to ensure high accuracy at both, normal and over current. The PTs should be hermetically sealed to eliminate breathing and prevent air moisture from entering the tank. These should be provided with the oil level gauge and pressure relieving device capable of releasing at normal internal pressure.

5.0 INSULATION

The PTs shall withstand satisfactorily the dielectric test voltage corresponding to basic impulse level of 170 KV for 36 KV PTs.

6.0 TEMPERATURE RISE:

The PTs should be designed to limit the temperature of windings and other parts as specified in the Indian Standard but owing to maximum ambient temperature being 50 degree C, instead of 40 degree C specified in Note 1 of Table-3 of IS: 3156(Part-I) 1965 the corresponding temperature rise should be reduced by 10 degree C. The maximum attainable temperature of the windings, cores etc. thereof should not exceed 95 degree C while the maximum temperature of oil at the top should be limited to 85 degree C. The temperature rise at 1.1 times rated primary voltage when applied continuously at rated frequency and simultaneous rated burden on the secondary shall not exceed the above specified limits and the temperature rise at 1.5 times rated voltage when applied for 30 seconds starting from previous stable operating condition at rated frequency and simultaneous rated burden on secondary should not exceed the above temperature limits by more than 10 degree C.

7.0 INSULATION OIL

The oil shall conform to the requirement of IS-335, 1983 and amendments thereof.

8.0 TYPE OF MOUNTING

(a) The PTs shall be suitable for mounting on steel structures. The necessary flanges, bolts etc. for the base of the PTs should be supplied and these should be hot-dip galvanised. 4 nos. mounting holes (15 mm) are required at rectangular spacing of 370x250 mm.

(b) The structures are not included in the scope of supply.

9.0 CABLE GLANDS AND PLATE

Necessary cable glands alongwith a gland plate for the cable are to be provided. The sizes of glands are given below:

CABLE GLANDS FOR CABLE SIZE

a) 33 KV PTs – 6X2.5 mm² cu conductor PVC control cable

10.0 TERMINAL CONNECTORS

Two nos. bi-metallic terminal connectors suitable for ACSR 'PANTHER' conductor for PTs shall be supplied with each Potential transformers. Means are to be provided for earthing of the base frame of PT.

11.0 DESIGN :

The design of the connectors shall be such as to give intimate contact between connector and conductor and offer protection to contact surfaces against effects of electrolytic (between two dissimilar metals) and atmospheric corrosion. The connector shall have sufficient mechanical strength and shall completely enclose the conductor and terminal. The connector shall hold the conductor and terminal very tightly so that the connector withstands the mechanical stresses set up by vibration, wind and short circuit current. The conductivity of connectors shall be high to minimise power loss.

The connectors should be designed with the large factor of safety and should comply in all respects of temperature rise resistance and tensile strength withstand capacity as per ISS 5561-1970 or amendment thereof.

The steel bolts nuts, washers and check nuts shall be hot dip-galvanized. Steel bolts and nuts shall conform to IS-1365-1967 and IS-1367-1961 or amendment thereof. Bolts and nuts shall be of reputed make (as GKW or TATA etc).

12.0 TEMPERATURE RISE

The maximum temperature attained by any part of the equipment when in service at site under continuous full load condition and exposed to the direct rays of sun shall not exceed the permissible limits fixed by approved specification.

13.0 BUSHING / INSULATORS

The basic impulse level of the bushings and insulators shall be as specified and they shall be suitable for installation in heavily polluted atmospheres having creepage distance (minimum) of 900 mm and protected creepage distance shall not be more than 50% of total creepage distance. The porcelain used shall be homogeneous and free from cavities or other flaws. Bushing shall be designed to have ample insulation, mechanical strength and rigid for satisfactory operation under the condition specified. The puncture strength of bushing shall be greater than the flash over value. The bushing shall be entirely free from external and internal corona.

Oil filled bushing shall be free from oil leakage and designed to prevent accumulation of explosive gases and to provide adequate oil circulation to remove internal heat. Adequate means shall be provided to accommodate conductor expansion and there shall be a due stressing of any part due to temperature changes. The PT shall be equipped with liquid level indicators and means for sampling and drawings oil from the busing.

14.0 MATERIAL AND WORKMANSHIP

All material to be used in the manufacture or requirement shall be selected as best available for the purpose for which used, considering strength and durability and test engineering practice.

All equipment supplied shall be manufactured in a thorough workman like manner and shall follow the modern practice. All equipment supplied under this contract shall be capable of satisfactory operation and performance when exposed to tropical sun-atmosphere conditions and heavy rainfall.

15.0 IDENTIFICATION DETAILS

A name plate carrying the following information shall be fixed on the PT:

- i) Specification No.
- ii) Order No and date.
- iii) Property of PVVNL.
- iv) Manufacturer details
- v) Year of Manufacture
- vi) Rated Primary & Secondary Voltage
- vii) Rated Frequency
- viii) Rated output & accuracy class

A rating plates as per clause IS:3156 (Part-I)-1992 or amendment thereof shall also be fixed showing the rating, ratio and connections arrangements etc. All the marking on name/rating plate should be made by engraving.

16.0 TESTS

The following tests shall be carried out on PT at the manufacturer cost at their works/other institute of repute, before dispatch.

16.1 ROUTINE TESTS

- i) Verification of terminal marking & polarity (9.2)
- ii) High voltage power frequency test on primary windings (9.3)

- iii) High Voltage power frequency wet test on secondary windings (9.4)
- iv) Induced Over Voltage withstand test (9.3.2)
- v) Determination of error according to the requirements of appropriate accuracy class (as per relevant parts of the standard).

16.2 **TYPE TESTS**

The offered equipment must be of proven design through successful type testing as per IS:3156 (or amended thereof) during last 5 years counted from the date of opening of tender. The type tests required to be conducted on the equipment offered shall be as given below:-

- a) Verification of terminal marking and polarity (9.2)
- b) High Voltage power frequency wet withstand voltage test (9.3 & 9.7)
- c) High Voltage power frequency dry test on secondary windings (9.4)
- d) Induced Over-voltage withstand test (9.3.2.2)
- e) Determination of error according to the requirements or appropriate accuracy class (as per relevant parts of the standard).
- f) Temp. rise test (9.5)
- g) Lightning Impulse voltage test (9.6)

Test on outdoor type oil immersed PT shall be applicable.

16.3 **SPECIAL TEST**

High voltage power frequency wet withstand voltage test an outdoor potential transformer (9.7): If the bushing has already been tested at Govt. laboratory for this test separately, then full assembly need not be tested. The testing report should be shown to the inspecting officers at the time of inspection of the potential transformer.

16.4 Copies of all type test detailed reports (excluding routine tests) alongwith tender, the relevant approved drawing from the test house of the equipment shall necessarily be enclosed with the tender to prove the successful type testing of PT, failing which it will be presumed that the prequalifying condition of type testing is not fulfilled and offer may be rejected.

16.5 Purchaser at his discretion may consider relaxation in type testing if the PT with similar parameters as mentioned in tender, has already been type tested within last five years from the date of opening of the tender.

16.6 The design of the PT having passed successfully through above mentioned tests shall be considered as acceptable design. The physical dimensions of these PT as measured at CPRI or any approved test house and if necessary, supplemented by purchaser's representative shall form lines for the supply of subsequent pieces.

16.7 The purchaser reserves the right to conduct different tests including type test as per IS by his authorized representative/agency on any piece during the currency of the contract. In such cases actual test house charges shall be reimbursed by the purchaser. However TO & FRO transportation shall be to tenderers account. In the event of failure of potential transformer in such tests, the testing charges shall also be to suppliers account. The failed unit will not be accepted for supply to the Discom even after repairs.

16.8 In case the PT fails in any of the above tests, the purchaser shall be at liberty to take any action including cancellation of contract, debar/blacklist the firm and forfeiture of performance security etc.

17. **INSPECTION & TESTING OF TESTING INSTRUMENTS, RAW MATERIALS & STAGE INSPECTIONS.**

17.1 All the measuring instruments i.e. wattmeter, Volt meter, evometer, CT, PTs and other instruments used in inspection & testing shall be properly calibration and sealed once a year. Calibrations certificates when demanded by the inspection officer shall be produced for verification purpose. In case of dispute regarding calibration of instruments, instruments shall be sealed and signed by the

representative of supplier and purchaser and will be sent to institution/lab. of repute or its own lab for calibration at the cost of supplier. The result of such testing shall be binding on the supplier.

- 17.2 The purchaser reserves the right to draw required number of supplies of raw materials. These samples shall however be drawn and sealed in the presence of the contractor. These samples shall be tested from the Govt. test house/lab or any Govt. recognized test house. The supplier shall have to produce requisite test certificates for major raw materials/accessories used in the voltage transformers.
- 17.3 The purchaser reserves the right to depute his representative/ agency for carrying out stage inspections at any stage of manufacturing process for ensuring quality of manufacture be also the raw materials. The contractor shall offer all reasonable facilities for such inspection. The contractor shall furnish detailed production schedule including different phases of material procurement, manufacture and fabrication to facilitate the purchase for de-putting his representative/agency for carrying out stage inspection, if necessary.
- 17.4 Records shall be maintained of all the tests carried out by the supplier on voltage transformer offered for inspection and testing and shall produce when demanded by the inspection officer to satisfy that the voltage transformers are being offered after carrying out all the necessary tests by the supplier.
- 17.5 The purchaser reserves the right of having other expenses either before dispatch or at site to ensure that the voltage transformer complies with the requirements of this specifications.
- 17.6 During inspection, the contractor may be required to produce acceptance and type test reports of the manufacturer of all the bought out items to satisfy the inspecting officers that it conform to the standard contained in technical specification and guaranteed technical particulars.