

STANDARD TECHNICAL SPECIFICATION COVER SHEET

Specification No. : ENG-EHV-1014

Specification Name : Technical Specification for 33kV and 11kV Outdoor Potential Transformer

SWARUP NAYAK	Jyoti Ranjan Sahu	SHANTAPRIYA JENA	JYOTIPRAKASH MOHANTY	KHAJAN BHARDWAJ	POURUSH GARG
Prepared by	Reviewed by	Reviewed by	Reviewed by	Approved by	Released by
TPCODL	TPSODL	TPNODL	TPWODL	TPCODL	TPCODL
11-01-2023	13-01-2023	17-01-2023	17-01-2023	17-01-2023	19-01-2023

Property of TATA POWER ODISHA DISCOMs – Not to be reproduced without permission of TPCODL/TPNODL/TPSODL/TPWODL



Specification No: [ENG-EHV-1014](#)

Specification Name: Technical
Specification for 33kV and 11kV Outdoor
Potential Transformer

CONTENTS

- 1. SCOPE**
- 2. APPLICABLE STANDARDS**
- 3. CLIMATIC CONDITIONS OF THE INSTALLATION**
- 4. GENERAL TECHNICAL REQUIREMENTS**
- 5. GENERAL CONSTRUCTIONS**
- 6. MARKING**
- 7. TESTS**
- 8. TYPE TEST CERTIFICATES**
- 9. PRE-DISPATCH INSPECTION**
- 10. INSPECTION AFTER RECEIPT AT STORES**
- 11. GUARANTEE**
- 12. PACKING**
- 13. TENDER SAMPLE**
- 14. QUALITY CONTROL**
- 15. TESTING FACILITIES**
- 16. MANUFACTURING ACTIVITIES**
- 17. SPARES, ACCESSORIES AND TOOLS**
- 18. DRAWINGS AND DOCUMENTS**
- 19. SAMPLE DRAWINGS**
- 20. SCHEDULE "A" GUARANTEED TECHNICAL PARTICULARS**
- 21. SCHEDULE "B" DEVIATIONS**

1 SCOPE

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading at store/site of 11KV and 33 KV Voltage transformers units for metering & Protection purpose complete with all accessories for efficient and trouble free operation.

2 APPLICABLE STANDARDS

The equipment covered by this specification shall conform to the requirements stated in latest editions of relevant Indian/ IEC Standards and shall conform to the regulations of local statutory authorities.

- IS: 3156-1992 : Specification for Voltage transformer
- IS: 5621-1980 : Specification for hollow insulators for use in Electrical equipment
- IS: 2099-1986 : Specification for bushings for AC Voltages above 1000 Volts
- IS: 335-1983 : Specification for new insulating oil
- IS: 8603- 2008 : Dimensions for Porcelain Transformer Bushings for use in Heavily Polluted Atmospheres
- IS 11322-1985 : Method for partial discharge measurement in instrument transformers
- IEC 60044-2 Ed. 1.0 b : Instrument transformers - Part 2 Inductive voltage transformers

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

1	Maximum ambient temperature	50 deg C
2	Max. Daily average ambient temp	35 deg C
3	Min Ambient Temperature	0 deg C
4	Maximum Humidity	95%
5	Average Annual Rainfall	150cm
6	Average No. of rainy days per annum	120
7	Altitude above MSL not exceeding	1000m
8	Wind Pressure	300 Km/hr
9	Earthquakes of an intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
10	Earthquakes of an intensity in vertical direction	equivalent to seismic acceleration of 0.15g (g being acceleration due to gravity)

TPCODL/TPNODL/TPSODL/TPWODL service area has **heavy saline conditions along the coast and High cyclonic Intensity winds with speed upto 300 Kmph**. The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months.

4. GENERAL TECHNICAL REQUIREMENTS

SL. No	TECHNICAL PARAMETER	REQUIREMENTS	
		11 KV	33KV
1	Type	Single phase, Outdoor, Oil filled & hermetically sealed	Single phase, Outdoor, Oil filled & hermetically sealed
2	Rated Voltage	12 KV	36 KV
3	Service Voltage	11 KV	33 KV
4	Frequency	50Hz	
5	Rated One minute Power Freq Dry withstand Voltage	28 KV ON SECONDARY :3KV rms	70 KV
6	Rated One minute Power Freq Wet withstand Voltage	rt2 * 28 kVp	rt2 * 70kVp
7	Rated Lightning Impulse withstand voltage	75 KVp	170 KVp
8	Class of Insulation	Class A	
9	Creepage Distance	25KV/mm	
10	Ratio	11000/ $\sqrt{3}$: 110/ $\sqrt{3}$ Volt	33000/ $\sqrt{3}$: 110/ $\sqrt{3}$ Volt
11	Winding Connection for PT	Star-Star	
12	Class of Accuracy	3P/3P/0.2	3P/3P/0.2

13	Burden	100VA	100VA
14	Voltage factor	1.2 Continuous, 1.5 times for 30 Sec	
15	Application	Instrumentation, Metering and Protection	
16	Limit of Voltage (ratio) error	+/- 0.2	
17	Limit of Phase Displacement (Minutes)	+/- 10	
18	Max Temo rise over ambient Temp	55 deg C as per IS 3156 Part-1	
19	Place of installation	Out Door, Structure mounted, Dead Tank	
20	Primary terminal connector	Rigid type suitable for PT Stud to ACSR Panther Conductor	Rigid type suitable for PT Stud to ACSR Zebra Conductor
21	Fixing hole dimension	During Detailed Engineering	
22	Painting	Paint shed: Battleship gray as per IS 5 Paint thickness: 60 micron (minimum)	
23	Tank	Fabrication with GI (3mm)	
24	Secondary terminal box	IP 55	
25	Suitability	Should be suitable for upright mounting on Steel Structure in outdoor Switch yard with matching to TPCODL/TPNODL/TPSODL/TPWODL's Standard base structure	

5.0 GENERAL CONSTRUCTIONAL REQUIREMENTS:

5.1 Potential Transformer

Design and construction of potential transformer shall be sufficient to withstand the thermal and mechanical stresses resulting from the specified short circuit currents. The core lamination shall be of high grade steel or other equivalent alloy. The exciting current shall be as low as possible and the potential transformer shall be capable of maintaining its rated accuracy for burden and saturation limits specified in the technical requirement.

Potential transformers shall be of dead tank design. The material of the tank shall be GI with 3 mm thickness. PT shall be supplied complete with required quantity of insulating oil for installing at site. The insulating oil shall comply to IS: 335. P1 and P2 markings shall be permanently riveted. The alignment and centre line of PT primary terminals shall be correct

so as to avoid bending connections. The primary terminals of PT shall be of silver coated I tinned Copper.

Potential transformers shall be provided with a capacitance test tap in the HV lead to enable future monitoring of conditions of HV insulation. Suitable earthing arrangement to be provided for the tap point. Potential transformers shall be provided with nameplate showing the particulars and diagram of the connections. PTs shall be provided with suitable lifting arrangement on all the sides .

PT characteristics shall be such as to provide satisfactory protection for burdens ranging from 25% to 100% of rated burden in case of metering PTs and up to the accuracy limit factor/ knee point voltage in case, of protective PTs. PTs shall be complete with accessories such as grounding lugs, filing and drain plugs, oil sight glass (prismatic type), weather proof terminal box, wedge type terminal connector etc.

5.2 Terminal Box

The secondary terminals shall be brought in a weather proof terminal box with IP-55 protection. The terminal box shall be provided with glands suitable for 1100 V grade, steel wire armored and PVC sheathed multicore 6 sq. mm. stranded copper conductor cables. The secondary terminal box shall also include necessary HRC fuses for protecting the secondary circuit. Further for the purpose of fuse supervision on remote panel both terminals of fuse shall be brought to the terminal box. Polarity marks shall be indelibly marked on the primary terminals of the potential transformer and on the secondary lead terminations at the associated terminal block.

5. 3 Bushings:

Bushings shall be made of homogeneous, vitreous, porcelain of high mechanical and dielectric strength. Glazing of porcelain shall be of uniform brown or dark color, with a smooth surface arranged to shed away rain water. Suitable arrangement shall be provided for indicating oil level. The bushings shall be of Oil filled condenser type. Oil filled bushings shall be hermetically sealed to prevent ingress of moisture. Cast metal and caps for bushing shall be of high strength, hot dip galvanized malleable iron. They shall have smooth surface to prevent discharge taking place between the metal parts and porcelain as a result of ionization.

5. 4 Grounding terminals:

Two grounding terminals shall be provided on the tank of potential transformers on opposite sides, for connecting to station earthing grid with suitable marking. Earthing terminals on secondary junction box for secondary winding of PT shall be of link type. The earthing terminals shall be readily accessible and so placed that the earth connection of the voltage transformer is maintained even when the cover or any other movable part is removed. The earthing terminals shall be of adequate size, be protected against corrosion and shall be metallically clean. Under no circumstances shall a movable metal part of the enclosure be insulated from the part carrying the earthing terminal when the movable part is in place. The earthing terminal shall be identified by means of the symbol "3—" marked in a legible and indelible manner on case or frame to be earthed; adjacent to the terminals. The terminal of high voltage winding intended to be earthed shall be brought out through a bushing, insulated from case or frame to be earthed by a separate connection.

5. 5 Paint:

All interior and exterior of tanks, and other metal parts shall be thoroughly cleaned to remove all rust, corrosion, grease or other adhering foreign matter. All steel surfaces in contact with insulating oil as far as accessible shall be painted with not less than two coats of heat resistant, oil insoluble, insulating varnish. Steel surfaces exposed to the weather shall be

given a priming coat of zinc chromate and two coats of final paint of shade RAL 7032/ Shade 631 as per IS-5. All metal parts not accessible for painting shall be made of a corrosion resisting material. All machine finished or bright surfaces shall be coated with a suitable preventive compound and suitably wrapped, or otherwise protected. All paints shall be carefully selected to withstand tropical heat and extremes of weather. The paint shall not scale off or wrinkle or to be removed by abrasion due to normal handling. Bolts and nuts exposed to the atmosphere shall be of galvanized steel.

6.0 NAME PLATE AND MARKING:

Units shall have a name plate clearly visible and effectively secured against removal. Indelibly and distinctly marked with all essential particulars as per relevant standards along with the following.

- i) Manufacturer's name and Country
- ii) Serial Number and Type designation
- iii) Rated primary and secondary voltage
- iv) Rated frequency
- v) Rated output (burden) and corresponding accuracy
- vi) Highest system voltage
- vii) Rated insulation level
- viii) Rated Voltage factor and corresponding rated time
- ix) Number of phases and method of connection
- x) Earthed or unearthed
- xi) Month and Year of manufacture
- xii) Number of relevant standard

7.0 TESTS:

All routine, acceptance & type tests shall be carried out in accordance with the relevant IS/IEC. All routine/acceptance tests shall be witnessed by the purchaser/his authorized representative. All the components shall also be type tested as per the relevant standards. For bushings all the tests as defined in IS 2099 shall be conducted. Following tests shall be necessarily conducted in addition to the tests specified in IS/IEC:

7.1 Routine Test

- i) Verification of terminal marking and polarity
- ii) Power frequency dry withstand tests on primary windings
- iii) Power frequency dry withstand tests on secondary windings
- iv) Partial Discharge measurement
- v) Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class

7.2 Acceptance test:

- i) Verification of terminal marking and polarity
- ii) Power frequency dry withstand tests on primary windings
- iii) Power frequency dry withstand tests on secondary windings
- iv) Partial discharge measurement
- v) Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class

7.3 Type test:

- 1) Temperature rise test

- ii) Lightning impulse test for voltage transformers for service in electrically exposed installation
- Ur) High voltage power frequency wet withstand voltage tests on outdoor voltage transformers up to and including 245 kV
- iv) Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class

7.4 Optional tests:

The following optional tests where applicable, shall be carried out by mutual agreement between the purchaser and bidder.

- i) Chopped lighting impulse test as a type test
- ii) Short circuit withstand capability test as a type test
- iii) Commissioning test on non-earthed voltage transformers of up to and including 36 kV

8.0 TYPE TESTS CERTIFICATES:

The bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI / ERDA as per the relevant standards. Type test shall have been conducted in certified Test Laboratories during the period not exceeding 5 years from the date of opening the bid. In the event of any discrepancy in the test reports i.e. any test report not acceptable, same shall be carried out without any cost implication to the Purchaser.

9.0 PRE-DISPATCH INSPECTION:

Equipment shall be subject to inspection by a duly authorized representative of the Purchaser. Inspection may be made at any stage of manufacture at the discretion of the purchaser and the equipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection. Bidder shall grant free access to the places of manufacture to Purchaser's representatives at all times when the work is in progress. Inspection by the Purchaser or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by the Purchaser.

Following documents shall be sent along with material

- a) Test reports
- b) MDCC issued by the Purchaser
- c) Invoice in duplicate
- d) Packing list
- e) Drawings & catalogue
- f) Guarantee / Warrantee card
- g) Delivery Challan
- h) Other Documents (as applicable)

10.0 INSPECTION AFTER RECEIPT AT STORE:

The material received at Purchaser's store shall be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Project Engineering department.

11.0 GUARANTEE:

Bidder shall stand guarantee towards design, materials, workmanship & quality of process / manufacturing of items under this contract for due and intended performance of the same, as an integrated product delivered under this contract. In the event any defect is found by the

purchaser up to a period of at least 60 months from the date of commissioning or 66 months from the date of last supplies made under the contract whichever is later, Bidder shall be liable to undertake to replace/rectify such defects at its own costs, within mutually agreed time frame, and to the entire satisfaction of the Company, failing which the purchaser will be at liberty to get it replaced/rectified at bidder's risks and costs and recover all such expenses plus the Company's own charges (@ 20% of expenses incurred), from the bidder or from the " Security cum Performance Deposit" as the case may be.

Bidder shall further be responsible for free replacement for another period of THREE years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by the purchaser.

12.0 PACKING:

Bidder shall ensure that all material covered under this specification shall be prepared for rail/road transport (local equipment) and be packed in such a manner as to protect it from damage in transit.

13.0 TENDER Sample: NA

14.0 QUALITY CONTROL:

The bidder shall submit with the offer Quality assurance plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and fully assembled component and equipment after finishing. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished.

The Purchaser's engineer or its nominated representative shall have free access to the bidder's/manufacture's works to carry out inspections.

15.0 MINIMUM TESTING FACILITIES:

Bidder shall have adequate in house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards.

16.0 MANUFACTURING ACTIVITIES:

The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart shall be in line with the Quality assurance plan submitted with the offer. This bar chart will have to be submitted within 15 days from the release of the order.

17.0 SPARES, ACCESSORIES & TOOLS: Special Tools (if any) required for maintenance/ Troubleshooting in scope of customer .

18.0 DRAWINGS:

Following drawings & Documents shall be prepared based on the Purchasers specifications and statutory requirements and shall be submitted with the bid:

- a. Completely filled-in Technical Parameters.
- b. General arrangement drawing of the PT
- c. Terminal Block and connection drawing
- d. Foundation plan and loading details

- e. General description of the equipment and all components with makes and technical requirement
- f. Type Test Certificates
- g. Experience List
- h. Manufacturing schedule and test schedule

Drawings/documents to be submitted after the award of the contract:

S. No.	Description	For Approval	For Review Information	Final Submission
1	Technical Parameters	√		√
2	General Arrangement drawings	√		√
3	Terminal block and Connection drawings	√		√
4	Foundation plan and loading details	√		√
5	Manual/Catalogues		√	
6	Installation/Commissioning Manuals		√	
7	Instructions for use		√	
8	Transport/ Shipping dimension drawing		√	√
9	QA & QC Plan	√	√	√
10	Routine, Acceptance and Type Test Certificates	√	√	√

All the documents & drawings shall be in English language. Supplier shall furnish two softcopies (CD) and four (4) hard copies of nicely bound manuals covering erection and maintenance instructions and all relevant information and drawings pertaining to the main equipment as well as auxiliary devices.

19. SAMPLE DRAWING

20. GUARANTEED TECHNICAL PARTICULARS

SL No	Description	Units	As specified by the Bidder
1	Application		
2	Rated voltage	KV rms	
3	Service voltage	KV rms	
4	Rated Frequency	Hz	
5	Rated Lightning Impulse withstand voltage	KV peak	
6	Rated One minute power frequency dry		
	a) On Primary	KV rms	
	b) On Secondary	KV rms	

7	Rated One minute power frequency wet	KV Peak			
8	Rated Transformation				
9	Core details		Core-1	Core-2	Core-3
9.1	Rated Output (VA burden)	VA			
9.2	Accuracy Class				
10	Winding connection for PT				
11	Rated Voltage factor and time				
12	Minimum Creepage	mm/ KV			
13	Limit of Voltage (ratio) error				
14	Limit of phase displacement	minutes			
15	Maximum temperature rise over ambient temperature	Deg C			
16	Gauge of the tank	mm			
17	Both terminals of fuse shall be brought to the terminal box.				
18	Total weight of	Kg			
19	Dimensions of	mmXmmXmm			
20	Weight of core and winding of VT	Kg			
21	Resistance of winding at 75°C per phase at HV				
22	Resistance of winding at 75°C per phase at LV				
23	Bushing distance between metal part and earth	mm			
24	Clearance between HV to	mm			
25	Lifting				



Specification No: [ENG-EHV-1014](#)

Specification Name: Technical
Specification for 33kV and 11kV Outdoor
Potential Transformer

21.

SCHEDULE OF DEVIATIONS
(TO BE ENCLOSED WITH TECHNICAL BID)

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:

S. No	Clause No.	Details of deviation with justifications

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Signature

Designation