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# SUPPLY CHAIN MANAGEMENT THIRUVANANTHAPURAM

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## SPECIFICATION

66KV POTENTIAL TRANSFORMERS

APPLICABLE TO KSEBL	Rev#0	DOC. NO.: <b>SCM-SPEC/XT/66kV PTs</b>
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Technical Specification and Evaluation Committee for Transmission Material



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Thiruvananthapuram

**TECHNICAL SPECIFICATION**

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**(i) Document Approval & Control Status**

	<b>Compiled by</b>	<b>Verified by</b>	<b>Approved by</b>
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Date	14/05/2021	14/05/2021	31/05/2021
Signature	<b>Sd/-</b>	<b>Sd/-</b>	<b>Sd/-</b>

**(ii) Amendments and History**

<b>Sec. #</b>	<b>Rev. #</b>	<b>Date</b>	<b>History of Change</b>



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**1. PURPOSE:**

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **66kV Potential Transformers** in a professional manner

**2. SCOPE:**

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL, Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of **66kV Potential Transformers** used in field by KSEBL

**3. RESPONSIBILITY:**

**The Executive Engineer (T), Office of Chief Engineer, Supply Chain Management** shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions

**4. PROCEDURE FOR REVISION:**

Modifications if any, in the technical specification will be incorporated as **Revisions**. Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev. No.0.1, 0.2 etc.**

A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev. No.1.0, 2.0 etc.**

All the details of regarding the revisions (both minor and major) will be incorporated in **“(ii)-Amendments and history”** above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by **Chief Engineer (SCM)**. Those who notice any discrepancy or have any suggestion regarding revision, may bring the matter to the attention of Chief Engineer (SCM) in writing or through e-mail id:**cescm@kseb.in**



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### TECHNICAL SPECIFICATION

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## TECHNICAL SPECIFICATION FOR 66kV POTENTIAL TRANSFORMERS

- Scope:-** This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, supply and delivery of Potential Transformers for metering and relaying service in 66 kV 3 phase system.
- Standards:-** Unless otherwise specified else where in this specification, the Potential transformers shall conform to all respect to the latest revisions and amendments to Indian standards IS-3156 part I to IV, IS: 3347, IS:4759, IS:2633, IS:5621 and IEC 60044. Equipment meeting any other authoritative standard, which ensures an equal or better quality than the standards, mentioned above, is also acceptable.
- Type and Rating:-** The Potential transformers shall be of outdoor type, single phase oil immersed self cooled suitable for operation in 3 phase solidly grounded system under the climatic condition specified.

Particulars	66 kV PT
1. Nominal system voltage	66kV.
2. Highest system voltage	72.5kV.
3. Frequency	50 Hz.
4. Earthing	Effective.
5. No of secondary windings	2 No.
6. Ratio	$\frac{66 \text{ kV}}{\sqrt{3}} / \frac{110 \text{ V}}{\sqrt{3}} / \frac{110 \text{ V}}{\sqrt{3}}$
7. Rated burden (not less than)	200VA for core I, 100VA for core II
8. Class of accuracy (as per IS:3156)	3P for core I 0.5 for core II
9. Basic insulation level	325kV <sub>p</sub>
10. Minimum creepage distance of porcelain housing (mm)	1850
11. One minute dry power frequency withstand primary voltage kV (rms)	140

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12.	Rated voltage factor	1.2 continuous
13.	Max. temperature rise over ambient of 50 <sup>0</sup> C	As per IEC 86
14.	Application	Protection and metering
15.	No. of terminals in secondary box	Secondary winding shall be properly terminated at the secondary boxes through fuses and links and box bottom to be fixed with removable type for fixing glands etc...
16.	Standard reference voltage for which accessories are valid	90% to 103% for protection 99% to 101% for metering

4. **Climatic Conditions:-** The climatic conditions prevailing at site are as follows:

Maximum temperature of Air in shade	:	40 <sup>0</sup> C.
Minimum temperature of air in shade	:	15 <sup>0</sup> C
Maximum relative humidity	:	100 %
Average no. of thunderstorm days per annum	:	50
Average no. of rainy days per annum	:	90
Average annual rainfall	:	3000mm
Maximum wind pressure	:	100kg/Sq.m
Altitude not exceeding	:	1000m

5. **General:-** The voltage transformers shall be of single phase, oil immersed and self cooled suitable for the service indicated complete in all respects conforming to the modern practice of design and manufacture. The core shall be of high grade, non-ageing, Electrical silicon laminated steel of low hysteresis loss and high permeability to ensure high accuracy of both normal and over voltages.

The voltage transformers shall be sealed to eliminate breathing and prevent air and moisture from entering the tank. These shall be provided with oil level gauge and shall be provided with pressure relieving devices capable of releasing abnormal pressure.

The oil filled bushing shall be provided with lifting arrangements, oil filling and drain plugs, oil sight glass etc. They shall ensure ample insulation, Mechanical strength and rigidity for operation under site conditions.

Polarity marks shall be indelibly be marked on each potential transformer and at the lead terminals at the associated terminal block. Secondary circuit shall be protected by HRC fuses and all the fuses shall be inside the terminal box.

Tan Delta test value shall be less than 1% at 20<sup>0</sup>C for 66kV Potential Transformer.

6. **Windings:-** The windings shall be made with electrolytic type copper
  - a) **Primary Winding:-**All primaries of voltage transformers will be connected in phase to neutral with the neutral point solidly earthed. The neutral of the system is also solidly earthed. The primary winding shall be of copper.
  - b) **Secondary Winding:-**All voltage transformers shall be provided with separate windings rated for 63.5V & 110V for connection in star & Delta respectively. The star winding (63.5V) to be used for metering and relaying shall be of accuracy class specified for appropriate class. The rated burden of this winding shall not be less than that specified for each core. The secondary coil shall be of copper.
7. **Insulation:-**The voltage transformers shall withstand satisfactorily dielectric test voltage corresponding to basic insulation level of 325kV for 66kV. The insulation resistance (IR) value should be more than 5000 MΩ at 5000VDC. After one year from the date of commissioning, the insulation resistance value should be more than 1000 MΩ.
8. **Temperature Rise:-** The Potential transformers shall be designed to limit the temperature of windings and other parts as specified in the standards IS:3156 when corrected for the difference between the temperature prevailing at site and temperature specified by the standards. The temperature rise at 1.2 times rated primary voltage when applied continuously at rated frequency and at rated burden shall not exceed the limits specified above and the temperature rise at 1.5 times rated primary voltage when applied for 30 seconds starting from previous stable operating condition at rated frequency and rated burden shall not exceed the above temperature limits by more than 10<sup>0</sup>C. Half year after commissioning, the the temperature limits shall not be above 15degree Celsius.
9. **Tank:-** The metal tank shall have minimum number of welded joints and shall be made of mild steel. The metal tank including top cover shall be coated with coats of Zinc rich epoxy painting of thickness 50 microns. All ferrous parts shall be hot dip galvanized. The dome shall be made of Aluminium or stainless steel in order to prevent corrosion. Expansion chamber at the top of the porcelain insulator should be suitable for expansion of oil and provision of primary terminals. Between expansion chambers of primary terminals leak proof and temperature resistant five play gasket shall be used.

10. **Gaskets:-** Gaskets of nitrile rubber or equivalent shall be used to ensure perfect oil tightness. All the gaskets shall be closed design (without open ends) and shall be of one piece only. Rubber gaskets used for flange type connections of the various oil compartments, shall be laid in grooves or in groove equivalent sections on bolt sides of the gasket, throughout their total length.
11. **Insulating Oil:-**The quantity of insulating oil for first filling of oil in each Potential Transformer and the complete specifications of the oil in each shall be stated. The Oil shall conform to the requirements of Indian standard 335. Subject to the requirements of the contractors specification being fulfilled the actual oil to be used shall be at the discretion of the purchaser.
12. **Type of Mounting:-**The Potential Transformers shall be suitable for mounting on galvanized steel structures. The necessary flanges, bolts etc. for the base of the voltage transformers shall be supplied and these shall be galvanized.
13. **Terminal Connections:-**Bimetallic Terminal connectors suitable for ACSR Kundah for 66kV shall be supplied. Suitable terminal earth connections shall also be supplied.
14. **Name / Rating Plate:-**Each potential transformer shall be provided with a name plate legibly marked with at least the following as per IS:
  - a) Name of manufacturer
  - b) Type, designation and serial no.
  - c) Rated voltage and frequency
  - d) P.O. No. and datee) Warrant period 36 / 30 months from date of acceptance
15. **Tests: -**
  - a) **Type Tests:** The following type tests are to be conducted within five years from the date of submission of the bid and the test reports of the 33kV and 66kV Potential Transformers shall be furnished along with the bid documents
    - i. Temperature-rise test
    - ii. Short-circuit withstand capability test
    - iii. Lightning impulse test
    - iv. Wet test for outdoor type transformers
    - v. Determination of errors



The following type test certificates for the make of hollow insulators as per IS: 5621 shall be submitted

- i. Visual inspection
  - ii. Electrical routine test
  - iii. Verification of dimensions
  - iv. Porosity test
  - v. Temperature cycle test
- b) **Routine Tests:** Routine tests shall be conducted on all 33kV and 66kV Potential Transformers and the report shall be furnished for verification
- i. Verification of terminal markings
  - ii. Power-frequency withstand tests on primary windings
  - iii. Partial discharge measurement
  - iv. Power-frequency withstand tests on secondary windings
  - v. Power-frequency withstand tests between sections
  - vi. Determination of errors (phase angle and ratio error)
- c) **Acceptance tests:** In addition to the routine tests conducted, the following tests are to be conducted while accepting the 33 and 66kV Potential Transformers
- i. IR Values
  - ii. Tan Delta Test
  - iii. Pressurization test for finding oil leakage
  - iv. Measurement of creepage distance on insulators

16. **Documentation:-**

- d) All drawings shall conform to International Standards Organisation (ISO) ' A ' series of drawing sheet / Indian Standards Specification IS:656. All dimensions and data shall be in S.I units.
- e) **List of Drawings and Documents:-** The bidder shall furnish four sets of following drawings / documents along with the offer.
- i. General outline and assembly drawing of the equipment.
  - ii. Name Plate.
  - iii. Schematic drawing, Typical.



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- iv. Terminal connector
- v. Insulator (Specify the make of insulator)

The supplier shall, within 2 weeks of placement of order, submit four sets of final versions of all the above said drawings for purchaser's approval. The purchaser shall communicate his comments / approval on the drawings to the supplier within two weeks. The supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for approval. IFC drawing will be issued within one month from the date of submitting the corrected drawing.

Copies of the type test reports, duly approved by the purchaser, shall be submitted by the supplier for distribution before commencement of supply. Adequate copies of acceptance and routine test certificates, duly approved by the purchaser, shall accompany the despatch consignment.

The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the supplier's risk.

Copies of nicely printed and bound volumes of operation, maintenance and erection manuals in English language, for each type and rating of equipment supplied shall be submitted by the supplier for distribution, prior to the despatch of the equipment. The manual shall contain all the drawings and information required for erection, operation and maintenance of the circuit breaker. The manual shall also contain a set of all the approved drawings, type test reports etc...

Approval of drawings / work by purchaser shall not relieve the supplier of his responsibility and liability for ensuring correctness and correct interpretation of the drawings for meeting the requirements of the latest revision of application standards, rules and codes of practices. The equipment shall conform in all respects to high standards of engineering, design, workmanship and latest revisions of relevant standards at the time of ordering and purchaser shall have the power to reject any work or materials which, in his judgment is not in full accordance therewith.

**ANNEXURE II - GUARANTEED TECHNICAL PARTICULARS FOR 66kV PT**

Particulars	66kV PT
1. Type	
2. Manufacturer's type designation	
3. Rated primary voltage (kV)	
4. Number of secondary winding	
5. Rated secondary voltage	
a) Winding- I Volts	
b) Winding-II Volts	
6. Rated burden	
a) Winding-I VA	
b) Winding-II VA	
7. Accuracy class	
a) Winding- I	

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Particulars	66kV PT
b) Winding- II	
8. Maximum phase angle error with rated burden and 5% normal primary voltage	
9. Maximum ratio error with rated burden and 5% normal primary voltage %	
10. Grade of oil as per IS:335	
11. Temp. rise at 1.2 times rated voltage with rated burden °C	
12. Rated voltage factor and time	
13. Temperature rise for (12) above 0° C	
14. One minute power frequency withstand test (Dry) voltage $kV_{rms}$	
15. One minute power frequency withstand test (wet) voltage $kV_{rms}$	
16. 1.2/50 micro second impulse wave withstand test voltage $kV_P$	
17. One minute power frequency withstand voltage on secondaries $kV_{rms}$	
18. Creepage distance mm	

Particulars	66kV PT
19. Type tests	
a) Temperature rise test	
b) Lightning impulse tests.	
c) High voltage power frequency withstand voltage tests	
d) Determination of error or other characteristics according to the requirements	
e) Type test on hollow insulator:	
1. Visual inspection	
2. Electrical routine test	
3. Verification of dimensions	
4. Porosity test	
5. Temperature cycle test	
2. Weight of oil kg	



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Particulars	66kV PT
3. Total weight kg	
4. Overall dimensions	
5. Mounting details	
6. Additional Information, if any	