

TECHNICAL SPECIFICATION OF 33 KV CT-PT UNITS (OUTDOOR TYPE)
(Accuracy 0.2s)

1.0 SCOPE:

This specification covers the design, manufacture, assembly, testing and supply of 33 KV copper wound metering equipment (combined CT-PT unit) (Accuracy 0.2s) for metering purpose comprising of one number three phase oil cooled Potential Transformer and three numbers single phase oil immersed Current Transformer to suit the requirement of 33 KV three phase four wire metering. The CT, PT metering unit shall be supplied complete with meter box, GI pipe through which the secondary winding of CTs and PT shall run from the CT, PT unit to the meter box.

2.0 STANDARDS:

Unless otherwise modified elsewhere in this specification the 33 KV metering equipment shall comply with the latest version of the following Indian Standard Specifications:

IS: 2705-1992	-	Specification for Current Transformers
IS: 3156-1992	-	Specification for Potential Transformers
IS: 3347-1986	-	Specification for Insulator/ Bushing
IS: 2099-1986	-	Specification for Insulator/ Bushing
IS: 5621-1980	-	Specification for hollow bushings.
IS: 335-1986	-	Specification for new insulating oil

Equipment conforming to any other international standard(s), which ensures equal or better quality than the standard (s) mentioned above, shall also be acceptable and in such case, a copy of standards (English version) adopted should be provided along with the bid.

3.0 REQUIREMENTS:

The metering equipment shall be installed in the system with nominal system voltage 33 KV and frequency of 50 Hz. The P.T. of the metering equipment shall be 3 phase star connected with H.V. neutral floating. The design of C.T.-P.T. unit (Metering equipment) should be suitable for single phasing operation of the system when voltage is increased in the other phase. **No fuse on HV and LV sides of PT are to be provided in the equipment.**

- 3.1** The metering equipment shall comprise of one no. 3 phase potential Transformer and three nos. Single phase current transformers contained in a fully weather proof outdoor, pole mounting type M.S. tank. The tank shall be fitted with 6 nos. bushings with brass studs as per rating of the metering unit. Out of these bushings 3 No bushings are mounted on incoming side and 3 Nos. for outgoing side. The metering equipment shall have one built in secondary terminal box located on the length side of the vertical wall of the tank on outgoing side of the metering equipment. This location should be such that it is convenient to make a through of secondary connections, with primary terminals of metering equipment remaining energized. The metering equipment should have compact construction with a suitable size of conservator with oil filling hole with cap and oil level indicator. It should be fitted with two nos. base channel across the width of the tank for mounting on double pole structure. Contractor shall have to make proper arrangement so that this unit can be mounted on DT double pole along with metering equipment. The top cover of the tank should have sideward slope to drain rainwater.
- 3.2** The tank shall be of rectangular shape round edges and be fabricated from tested quality of mild steel of adequate thickness i.e. minimum 3.0 mm for side walls and 5.00 mm for top & bottom. The painting of the tank shall be carried out with powder coating or epoxy

base weather resistant coating. The exterior of the tank & other ferrous fitting shall be thoroughly cleaned, scrapped and given three coats of priming coat of antirust primer and finished with two coats of dark admiral gray colour which shall not turn dim or black in due course of time.

- 3.3 The internal surface of the tank shall be given a coating of Zinc chrome, which shall not cause any chemical reactions with the Insulating oil or deteriorate the insulating properties of oil. Suitable arrangement shall be provided with the metering equipment to facilitate expansion and contraction of oil due to changes in temperature. The extra oil space is provided by giving proper shape of the top cover with central portion projected outside and side sloping. The top cover is bolted with the tank with minimum 3 mm thick oil and heat cork sheet bonded with resistant nitrile / neoprene gasket of best quality.
- 3.4 The tank body shall be welded with 2 No Lifting lugs of adequate strength at suitable diagonal locations for balanced lifting of the tank. Similarly 2 No lifting lugs / hooks be welded on the top cover for lifting top cover with bushings as and when required. Four No 5 mm holes one each corner of tank flange and on top cover flange are provided so as to match each other. The same shall be sealed by sealing wire and tablet after testing the equipment by PVVNL representatives. All the welded joints in the tank should be leak proof and pressure tested. After the testing of equipment by PVVNL representatives, the top cover plate should be permanently welded through 'U' shape M.S. clamp with tank body.
- 3.5 The connection between the CT and PT inside the metering equipment shall have adequate clearance and reinforced insulation to avoid flashover between the two inside the unit.
- 3.6 The high voltage winding of CT/PT unit shall have paper insulation integrated with oil under vacuum. The paper used for electrical insulation shall be of high insulation grade.
- 3.7 The 33 KV CT/PT set shall be hermetically sealed type (should not communicate with atmospheric air).
- 3.8 Adequate electrostatic & electromagnetic sealing should be provided to eliminate the effect of electro magnetic induction/electrostatic charge between the C.T and the P.T secondary windings. The minimum electrical clearance between phases and phase to earth as specified in the ISS shall be maintained.
- 3.9 The windings of instrument Transformers shall be oil-cooled type. The paper used for insulation shall be of high insulation grade. The Insulating materials for winding between HV and LV & between interlayer of the winding and for end turn shall be as per relevant I.S. However, end turns have to be provided with reinforced insulation and lead connecting the bushing shall be provided with extra insulation. The Conductor in the secondary winding of CT shall be so designed to carry 120% of rated secondary current. The primary winding shall be of adequate cross section area to carry 120% of full load current continuously without harming the insulation due to over heating.
- 3.10 The core material of C.T. & P.T. set shall be of high grade non aging electrical silicon steel (CRGO/ Amorphous) of first quality having low hysteresis loss and high permeability to ensure accuracy at both normal and over current / voltage.
- 3.11 The metering equipment shall be filled with first filling of EHV grade insulating oil conforming to IS: 335 (including latest amendment).

The metering equipment shall be of compact design and the completeness of the equipment shall be the responsibility of the supplier.
- 3.12 The firm should have eligibility type test of the offered equipment as elaborated in the relevant clause of PQR, as per relevant ISS and/or any other specified international

standards during the last 5-year period issued from CPRI/ERDA. Photocopy of such type test reports/ certificates must be submitted along with tender bid. The type test certificates of prototype manufactured and tested by foreign collaborators of the tenderer at their works shall not be acceptable for indigenously manufactured equipment.

- 3.13 If the firms do have the eligibility type test as per Sl. No. 3.12 above but do not have valid type test report as per current technical specification with revised technical parameters as prescribed by PVVNL for cross sectional area of conductor, core, current density, shall have to give undertaking to submit valid type test report of offered equipment issued by CPRI/ERDA within maximum period of three months' time. Keeping in view of the timely completion of projects, supplies shall be accepted with the provision that 50% payment shall only be released and the balance 50% may be released only after submission of valid type test report.

3.14 **INSPECTION:**

(a) The material shall be offered for inspection to SE (Quality Cell), PVVNL, Meerut. At least 15 days advance notice about the readiness of the material inspection commensurate with contractual delivery schedule, shall be given by the supplier to SE (Quality Cell), PVVNL, Meerut along with copies of routine test report & packing list, so as to enable the purchaser to depute his representative (s) for inspection at your works.

(b) Purchaser reserves the right to get CT/PT unit type tested before dispatch by any independent inspection agency at the cost of purchaser in case the equipment withstand the test, otherwise the supplier has to bear entire cost of testing in addition to the any other action by purchaser deemed to appropriate.

- 3.15 One CT-PT set of each rating in each offered lot shall be opened for verifying the diameter and cross sectional area of primary coil conductors including verification of GTP. The verification of diameter of primary coil conductor shall be carried out for any ratio of one CT-PT set in each lot at stores also. If CT-PT set fails in above verification at stores, entire lot shall be rejected and the supplier shall lift the rejected lot. In case it founds within specific limits, the supplier at his own cost shall reassemble/replace the physically opened CT-PT set at works/stores.

- 3.16 One sample of oil shall be taken from each ratio in each lot and shall be tested for (a) break down voltage (b) Tan delta at 90 deg. C. The oil supplied with CT-PT set shall be of EHV grade transformer oil suitable for insulation and coding of the electric transformer of extra high voltage and shall conform to IS 335(with latest amendments). If CT-PT set fails in any of the above tests/verification at works, entire lot shall be rejected.

4.0 **CURRENT TRANSFORMER:**

Three nos. single Phase copper wound C.T. of specified ratio shall be paper impregnated oil immersed type and are to be properly fitted with in the tank of the metering equipment on 'R' phase 'Y' Phase and 'B' phase. The C.T. secondary winding will have suitable insulation cover. The primary winding shall be of adequate cross-section to carry continuously the rated current plus 20% overload continuously.

The 33 KV Current Transformers shall have the following technical characteristics/parameters: -

S.No.	TYPE		paper impregnated oil immersed type
1	Ratios		10/1A, to 400/1A
2.	Nominal system voltage (KV rms.)	:	33
3.	Highest system voltage (KV rms.)	:	36
4.	Frequency	:	50 Hz.
5.	Rated output (V.A burden)	:	15 VA
6.	Current density at rated current(Max)	:	1.5 Amp. Per sq. mm
7.	Current density at STC for 1 second(max)	:	165 Amp. Per sq. mm
8	Cross sectional area of primary As per current density	:	Should be as per rated current density or as per current density at STC (for 1 second) whichever is higher
9.	Class of accuracy	:	0.2 S
10.	Rated continuous thermal current	:	1.2 times of rated primary current.
11.	Short time thermal current rating	:	10/1 to 20/1-7.8KA for 0.5 sec 25/1 to 40/1-7.8 KA for 1.0 sec 50/1 to 400/1-13.1 KA for 1.0 sec
12.	Rated dynamic current rating	:	2.5 times of short time thermal current rating
13.	Instrument Security factor	:	< 5
14	All other characteristics and test parameter	:	As per IS: 2705/1992 (latest version)
15	Max temperature rise over ambient temp of 50° at rated continuous thermal current at rated frequency rated bush.	:	45°c

5.0 **POTENTIAL TRANSFORMER:**

The metering equipment shall contain one no, three phase copper wound potential transformer connected in star with the HV neutral floating. These shall be paper impregnated oil immersed type and conforming in all respect to IS: 3156/1992 and latest amendment thereof. The primary winding has to be designed for unearthed neutral i.e. for the highest system voltage of 36 KV. The P.T winding shall have uniform insulation.

The 33 KV potential transformers shall have the following technical characteristics/ parameters:

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|-----------------------------------|---|
| 1. Nominal system voltage (rms) | 33 KV |
| 2. Highest system voltage (rms) | 36 KV |
| 3. Transformation ratio of P.T. | 33000 KV/110V |
| 4. Frequency | 50 Hz. |
| 5. Rated output (VA burden) | 50 VA per phase |
| 6. Rated voltage factor and time | 1.2 times continuous and 1.5 times for 30 seconds |
| 7. Winding connections | Star/Star |
| 8. No. of Phases | Three |
| 9. Class of accuracy | 0.2s |
| 10 Material of winding | Copper |
| 11 Insulating material of winding | Insulating Craft paper |
| 12 Cross sectional area | |
| (i) Primary | 0.015 sq. mm(Min) |
| (ii) Secondary | 1.6 sq. mm(Min.) |

13. All other characteristics and test parameters As per IS: 3156 (Part-II) (latest version)

14. Max temperature rise over ambient temp of 50° at rated continuous thermal current at rated frequency rated bush. 45°

6. The final layer of primary winding of potential transformer should be re-reinforced with extra insulation and then an equipotential /electro static shielding is to be provided.

7.0 The 33 KV metering equipment shall also have the following common technical characteristics/ parameters:

A.	Impulse withstand voltage on assembled metering equipment.	170 KV (peak)
B.	One-minute power frequency dry withstand voltage test on assembled metering equipment.	
i)	Primary (rms)	70 KV
ii)	Secondary (rms)	3 KV
C.	One-minute power frequency (wet) withstand voltage test on assembled metering equipment.	70 KV

8.0 **BUSHINGS:**

The metering equipment shall be supplied with at least 6 Nos. 36 KV weatherproof bushings (3 Nos. bushings on incoming and 3 Nos. on outgoing side) with brass studs as per rating of the metering units. The bushing should be type tested and conform to latest version of IS: 3347-1986(part III)/IS: 5621-1980 and IS: 2099-1986. The creepage distance must correspond to heavily polluted atmosphere with creepage distance of not less than 25 mm per KV.

9.0 **TERMINAL BOX**

The secondary terminal box is fabricated built in with the tank with same 3.00 mm thick M.S. sheet. The dimensions of the terminal box should be such that adequate space is available for tightening the secondary cable connections on the secondary terminals provided in the box. The secondary terminals in the terminal box shall have proper marking with polarity indications. The box is provided with one no. brass gland on the bottom plate suitable to accommodate 10 core 2.5 sq mm armoured copper cable. The terminal box is provided with approximately 25 mm wide collars/flange for holding its cover plate made of 16 SWG (1.6mm) M.S. Sheet. The 15 mm wide portion of the three sides (except bottom side) of the terminal box cover sheet is to be bent inside by 180° to make 'U' shape groove enabling this sheet slide down over the flange/collars of the terminal box and completely cover all the collars of the terminal box. This will protect the entry of rain water inside the terminal box and will not need nut & bolts for its clamping. However 2 No 3 mm diameters holes one each in middle of the top and bottom collar/ flange are to be drilled. Similar holes are drilled in the cover plate and its top bend also so that the corresponding holes match and align when cover plate is slide down on the terminal box collars. These holes shall serve the purpose of sealing the terminal box by the commissioning staff after making all secondary connections.

10.0 **FITTINGS AND ACCESSORIES:**

The metering equipment shall have the following: -

a) Riveted 'Rating and connection Diagram plate' shall be fitted besides the

terminal box on the same face of the metering equipment. This shall indicate Name of manufacturer, voltage, C.T. Ratio class of accuracy burden etc and shall be embossed/ engraved on the rating plate.

- b) 2 No base mounting channels duly welded to the bottom of the tank.
- c) No oil drain valve is to be provided.
- d) 2 No earthing terminals (stud and bolts should be properly galvanized and conform to latest version of IS: 1363 and IS: 1367).
- e) 1 no. air release plug on the top cover.
- f) 2 nos. lifting lugs to lift the metering equipment.
- g) 2 nos. lifting lugs/hooks to lift the top cover.
- h) 1 no. oil filling hole with cap on the top of conservator tank.
- i) 5 nos. bimetallic clamps fitted on the bushing stud suitable for holding ACSR Dog conductor.
- j) Serial no. of metering equipment, year of manufacture and CT ratio are to be punched clearly on the side wall of the equipment at location below the terminal box.
- k) Plain oil level gauge / indicator with minimum, max., avg., marking of oil level on conservator.
- m) Explosion vent with diaphragm
- n) Conservator of adequate size having filling hole with threaded cap and pressure relief device

10.0 Apart from other information, following information shall essentially be provided on name plate of 33 KV CTPT Units.

(i) Name of Manufacturer (ii) Month/Year of Manufacture (iii) Guarantee Period 36 Months/ 42 Months.

10.1 The CT, PT and CT-PT metering equipment shall be successfully type tested as per IS: 2705 and IS: 3156 (or any latest amendment) respectively from any Govt. approved Test laboratory on the type of the equipment to be supplied against this specification before the commencement of the supply. The testing charges are to be borne by the supplier.

10.2 **Type Test:**

- 1. Short time current test of C.T.
- 2. Lightning Impulse test on combined C.T- P.T, metering equipment
- 3. Temperature rise test on any one selected sample of each ratio.
- 4. H.V. Power frequency (Wet) withstand voltage test.
- 5. Determination of errors according to requirements of accuracy class.
- 6. Instrument security factor (ISF) test.

10.3 **Routine:**

Each C.T.-P.T. Metering equipment shall be subjected to all the routine tests as specified in IS: 2705/1992 and IS: 3156/1992 for CTs and PTs respectively and the works test reports thereof shall be submitted along with the inspection call/offer. The routine tests shall comprise of following tests: -

- 1. Verification of terminal marking and polarity
- 2. Power frequency (dry) withstand voltage test on Primary
- 3. Power frequency (dry) withstand test on secondary winding.
- 4. Over voltage inter turn test on CTs
- 5. Determination of errors according to requirement of accuracy class.

10.4 **Acceptance:**

These tests are to be carried out by the representative of PVVNL at the works of the supplier on each offered lot in accordance to the relevant I.S. of C.T. and PTs mentioned earlier. In addition to the routine tests, the acceptance tests also cover the physical check of the dimensions & parameters as per the Technical specification, the Guaranteed

Technical Particulars and the approved drawing of the metering equipment.

10.4.1 High voltage power frequency test on primary winding at 70 KV for one minute and on secondary winding at 3 KV for one minute.

10.4.2 Current Transformers

- a) Verification of terminal markings and polarity
- b) High Voltage power frequency on primary windings.
- c) High Voltage power frequency on secondary windings.
- d) Determination of error according to the requirements of appropriate accuracy class
- e) Temperature rise test.
- f) Partial discharge test
- g) Instruments security factor test(IFS) as per IS:2705.

10.4.3 Potential Transformers

- a) Verification of terminal markings and polarity
- b) High Voltage power dry withstand test on primary windings.
- c) High voltage power dry withstand test on secondary windings.
- d) Determination of error according to the requirements of appropriate accuracy class.
- e) Temperature rise test
 - (i) At 1.2 times of rated voltage for continuous period.
 - (ii) At 1.5 times of rated voltage for 30 second.
- f) Partial discharge test

11.0 METER BOX, G.I. PIPE & SECONDARY WIRING:

The Meter box, G.I. pipe and secondary wiring shall be provided with 33 KV Metering Units. The Meter box shall be compact in size (approx.450hx350wx250dmm.) and shall be suitable to accommodate Electronic Meter. The Meter box shall have only front opening and the hinged door shall be provided with at least one locking and two nos. sealing arrangements. A fixed window fitted with acrylic transparent glass covered with wire mesh shall be provided on the front door.

A frame of slotted hanger shall be provided inside the Meter box on which the Meter shall be mounted. The hanger shall have horizontal and vertical movement so as to adjust the Meter to a suitable height enabling the Meter reader to note down the reading without any difficulty.

The Meter box shall have four nos. MS flat strips with 14mm dia holes welded at the four corners at the rear of Meter box for mounting of the Meter box on a cross arm or any other support. One number elbow of 40 mm OD shall be welded to the Meter box. On the other end of elbow a flange shall be welded which shall suitably match the flange provided on the G.I. pipe of identical outer dia. The Meter box shall be painted with two coats of light gray P.U. paint on external surface and two coats of white enamel paint on the inner surface of Meter box.

A G.I. pipe of 40 mm outer dia. and 3000 mm length with flanges welded at both ends is to be supplied with each CT-PT Metering Unit. One of the flange provided on either ends of the G.I. pipe shall be bolted to the bottom of secondary terminal box of the

CT-PT Metering Unit and the flange on the other end of G.I. pipe shall be bolted to the flange provided on Meter box for which the flanges shall be identical with their holes matching such that after the CT-PT Metering Unit is mounted on the pole and the Meter Box placed at eye level height and at a suitable location, the holes of flanges on G.I. pipe, Meter box and holes at the bottom of secondary terminal box of CT-PT Metering Unit are in line and can be bolted together. The bolts used for tightening the flanges shall have sealing arrangement.

PVC insulated armoured copper cable ($10 \times 2.5 \text{ mm}^2$) with colour coding and ferrules marking shall be provided from secondary terminal box to the Meter box running through the G.I. pipe. The wiring shall be neatly bunched together. Suitable size of lugs shall be used to tighten the wire with the equipment's secondary terminals.

The metering equipment shall be complete in all respect. Any fitting, accessories or apparatus which may not have been specifically mentioned in the specification for 33 KV metering set covered under the scope of this tender, but which are usual or necessary in the equipment of similar type shall be deemed to be supplied by the supplier without extra charges.