Specification of 33 KV Out Door Potential Transformer

1 . **Scope** : This Specification covers the design, manufacture, assembly, testing at Manufacturer's Works, supply and delivery at site of Potential Transformers in three phase 33 KV system.
These Potential Transformers will be used as Bus P.T. for voltage indication , and supply of voltage to meters, high speed Directional / Non Directional relays etc. for feeder protection.

2 . Standards : The Potential Transformers and accessories covered by this specification shall comply with the requirement of the latest edition of the following standards unless otherwise stated in this specification :

IS : 3156 Part (I-IV)	:	Specification for Voltage Transformer.
IS : 4146	:	Application guide for Voltage Transformers.
IS : 2099	:	Specification for Bushings for alternating voltages above 1000 Volts.
IS : 5621	:	Specification for porcelain hollow insulator.
IS : 335	:	Specification for Insulating Oil.
IS : 3024	:	Specification for Core Materials.
IS : 8603	:	Specification for Dimension for Porcelain Transformer Bushing for use in heavily polluted area.
IS : 3347	:	Specification for Dimension for Porcelain Transformer Bushing for use in normal and lightly polluted area.
IS : 2633	:	Specification for method for testing uniformity of coating on Zinc coated articles.
IS : 5561	:	Specification for Electrical Power Connectors.
IS : 2147	:	Specification for Degree of Protection

3 . GENERAL CLIMATIC AND ISOCERAUNIC CONDITION OF SITE :

The climatic and isoceraunic conditions at site are given below :

(a)	Max. Ambient temp	: 45 ^{0}C
(b)	Minimum ambient temp.	: 4 ^{0}C
(c)	Maximum relative humidity	: 100%
(d)	Average number of thunderstorm day per annum.	: 75
(e)	Max. No. of rainy days/annum	: 120 days
(f)	Average Rainfall	: 1000 mm. to 3000 mm.
(g)	Max. Wind pressure/wind speed	: 150 Kg. Per Mtr. sq
(h)	Height above sea level not exceeding	: 1000 meter
(i)	Earthquake acceleration horizontal seismic co-efficient	: As per IS:1893(1984) For Class-III & IV Zones

4 . **DESIGN & CONSTRUCTION OF POTENTIAL TRANSFORMERS :**

The design features and construction details of Potential Transformers shall be in accordance with the requirement as stipulated hereunder :-

4.1 . The Potential Transformers shall be complete in all respects and shall conform to the modern practice of design and manufacture.

4.2 . The Potential Transformers shall be electromagnetic, outdoor type, single phase, oil filled, self cooled, having shaded porcelain bushing as per IS: 2099, suitable for operation under

the service conditions without protection from sun, rain and dust.

4.3 . The maximum temperature rise at 1.1 times rated primary voltages, rated frequency and rated burden, will be within the limits of relevant IS/IEC, considering ambient temperature 40 º Celsius for design purpose.

4.4 . The Potential Transformer shall be capable to withstand line discharge effect and also the ferro resonance effect.

4.5 . The Potential Transformers shall be suitable for up right mounting on steel structures. Necessary flanges, bolts, clamps fittings etc. for base of P.T. are within the scope of the supplier.

4.6 . The P.T. shall be complete with all accessories like Primary Terminals, Terminal Connectors, suitable for ACSR 'DOG' weather proof Terminal Box for secondary connection, lifting lugs, grounding terminals, oil sight glass, pressure relief device, filling and draining plugs and name plate.

4.7 . The P.T. shall be oil immersed type provided with class A insulation. It shall be of hermetically sealed type construction to prevent air & moisture from entering the tank.

4.8 . The core of the PTs shall be high grade non-aging, silicon laminated steel of low hysteresis loss and high permeability to ensure high accuracy at both normal and over voltages conforming to IS:3024.

4.9 . PT Characteristics shall be such as to provide satisfactory performance for burdens ranging from at least 25% to 100% of rated burden over a range of at least 5% to 100% & 190% rated voltage in case of protective cores and a voltage range of 80% to 120% (0.8 pf lagging) in case of measuring cores.

4.10 . The P.T. secondary terminals shall be brought out through fuse of suitable rating in a weather proof terminal box for easy access. The primary neutral to be earthed through a detachable link separately in the secondary terminal box having a partition from the secondary terminals.

4.11. PT Stud sizes shall be as follows :

a) Primary Terminal : Primary Stud of the PT will be of plain solid round (threading is not required) with Tin Plated Electrolytic Copper having minimum Diameter of 16 mm (negative tolerance is not allowed) and minimum outside length of 80 mm.

b) Secondary Terminal : M8 type with 70 mm long Nickel Plated Brass with suitable size along with suitable nuts & washers.

5 . <u>BUSHING</u> :

5.1. Porcelain bushing conforming to latest edition of IS:8603 & IS:3347 shall be used for the PT.

5.2. Cast metal end caps for the bushing shall be of high strength & made of brass. They shall have smooth surface to prevent discharge taking place between the metal parts and porcelain as a result of ionisation.

5.3. The insulation of bushings shall be co-ordinated with that of the Potential Transformer such that the flashover, if any will occur only external to the PT.

5.4. Primary terminals shall be complete with suitable rigid type terminal connector suitable for PT Stud to ACSR Dog conductor.

5.5. Each of the porcelain bushing/hollow insulator shall have Creepage distance for specified voltage class.

5.6 Oil level gauge and convenient means of oil and nitrogen filling, sampling and draining of oil is to be provided in Tank.

6 **. INSULATING OIL :**

The insulating oil to be used for PT shall comply in all respect with the provisions of the latest edition of IS : 335.

7 . GROUNDING TERMINALS :

Two grounding terminals on diagonally opposite sides of adequate size suitable for Connecting MS Flat of size 50 mm. x 6 mm. shall be provided. HV Neutral Terminal earthing and body earthing should be marked distinctly and be physically well separated. 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 arrangement.

8 . TERMINAL CONNECTORS :

8.1. The primary terminal connector shall be made of Aluminium alloy.
8.2. All castings of connectors shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges or corners shall be rounded off.
8.3. No part of the connectors shall be less than 10 mm. thick.
8.4. All ferrous parts shall be hot dip galvanised conforming to IS:2633.
8.5. Bi-metallic strips and sleeves, if require, shall be provided loose of about 2 mm. thickness as a part of connector.
8.6. All current carrying parts of the connectors shall have minimum contact resistance.
8.7. Connectors shall be corona controlled and shall conform to IS:5561.
8.8. Connectors shall conform to type test as well as to routine test as per IS:5561.
8.9. Connectors shall be suitable for connection with ACSR 'DOG' to PT terminal along with suitable nuts bolts & washers.

9 . SECONDARY TERMINAL BOX :

9.1. All secondary terminals shall be brought out in a compartment on one side of each Potential Transformer for easy access.
9.2. The exterior of this terminal box shall be hot-dip galvanized / painted with weather proof paint.
9.3. The secondary terminal box shall be provided with a removable cable gland plate at bottom for mounting cable glands of 1.1 KV grade steel wire armored, PVC insulated PVC sheathed 4 core (4 sq.mm.) stranded copper conductor cables. The cable glands shall be included within the scope of supply. The number of cable glands are equal to number of cores in the PT.
9.4. The terminal box shall be provided with a detachable cover plate in front so as to have easy access of secondary terminals. The cover shall have a sealing arrangement and shall be suitable to prevent ingression of moisture and rain water. The sealing arrangement shall be done by drilling holes in the tightening bolts of the cover. The degree of protection shall be not less than IP-55 as per IS- 2147.
9.5. All terminals shall be clearly marked with identification number to facilitate connection to external wiring with sufficient space in between.

10 . PAINTING :

10.1. P.T. Tank wherever applicable, along with top metallic shall be either hot dip galvanized or painted. All steel surfaces shall be cleaned by sand blasting or chemical process as required to produce a smooth surface, free of scale, grease and dirt. Steel surfaces in contact with

insulating oil shall be painted with heat resistant oil insoluble insulating varnish.

10.2. External surfaces shall be given a coat of high quality red or yellow chromate primer and finished with two coats of synthetic enamel paints (Battleship gray as per IS:5) / Epoxy paint. The paints shall not scale off or crinkle or be removed by abrasion due to normal handling.

11. DEVIATION :

Normally the offer should be as per Technical Specification without any deviation. But any deviation felt necessary to improve performance, efficiency and utility of equipment must be mentioned in the Deviation Schedule with reasons duly supported by documentary evidence. Such deviations suggested may or may not be accepted by the WBSEDCL

12 . RATING PLATE / NAME PLATE PARTICULARS :

The name plate shall be fixed in non detachable portion of the PT. It shall contain the following data engraved / painted on it :

a . Name of the manufacturer.
b . Purchase order reference.
c . Electrical diagram of PT.
d . Ratio, Class, Burden, HSV etc.
e . Serial number
f . Year of manufacturer
g . Guarantee for Five Years
h . Any other information as deem feet.

The name plate diagram shall be submitted along with the drawing for approval.

13. PROPERTY PLATE :

a . Property label " Property of WBSEDCL"
b. " PT Supplied with Terminal Connector "

14. DRAWINGS :

The bidder shall submit to WBSEDCL the following tender purpose drawing drawings along with tender documents. The drawings in line with tender specification shall also to be submitted after issuance of order for approval :

14.1. General outline dimension drawing of Potential Transformers furnishing front and side elevation top and bottom plan views, showing all accessories, mounting arrangement on steel structures, spacing and size of the bolts, details of expansion chamber, total and protective creepage distance of bushing, electrical diagram for primary and secondary windings with polarity mark, technical arrangement for secondary terminal box, size of primary terminals, grounding terminals and lifting lugs, quantity of insulating oil, net and shipping weight, shipping dimension, fixing hole centre dimensions etc.

14.2 It should be noted that :

14.2.1. All notes and legends of the drawings shall be furnished in English and all dimensions shall be marked in metric units. Purchase Order No. shall be mentioned in the drawings.

14.2.2. Equipment shall be manufactured as per approved drawings.

14.2.3. Terminal Connectors & Bushings.

14.2.4. Four sets of approved drawings shall be submitted for our record. One set of drawing to be sent to each Consignee.

15 . TYPE TESTS :

Copies of following type test report as per latest IS / IEC, carried out within five (5) years, from due date of tender, from CPRI, NABL accredited/ government recognized test house or laboratory on tendered item of identical design shall be submitted along with tender documents as pre- requisites failing which their offer may not be technically acceptable.

a. High voltage Power frequency wet withstand voltage test.
b. Lightning impulse voltage withstand test
c. Temperature rise Test
d. Determination of error.

Each Type Test Report shall comply with the following information with Test results :

a) Complete identification, date and serial no.

b) Method of application where applied, duration and interpretation of each Test

The Type Test Certificates should, however, bear the Logo of NABL accreditation.

16 . TESTS AT FACTORY AND TEST CERTIFICATES

16.1. Each PT shall comply with the requirements of Type Tests & Routine Test as specified in relevant IS 3156.

16.2. All routine test at manufacturer's works on all PTs shall be carried out and Test Reports are to be submitted to CE, Procurement & Contract Dept. WBSEDCL.

17 . ACCEPTANCE TEST :

The following Acceptance tests shall be carried out at manufacturer's works on every lot offered for inspection as per relevant IS in presence of the WBSEDCL's and Contractors' representatives. Selection of samples for acceptance test as well as rejection and retesting shall be guided by relevant IS. In addition to above, all routine tests are also to be carried on the tendered items as per relevant IS. The entire cost of acceptance and routine test that to be carried out shall be treated as included in the quoted price of tendered items.

(i) Visual checking and verification of dimension including verification of terminal marking and polarity.

(ii) Determination of errors and other characteristics as per specification

(iii) Power Frequency voltage withstand test on both primary & secondary winding.

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Six copies of test reports duly signed by the inspecting officers, shall be submitted to the Chief Engineer, Procurement & Contract Department , Bidyut Bhavan (4^{th} floor) Salt Lake, Kolkata -700091.

18. TYPE TESTS (after issuance of order) :

Besides submission of Type test Report, carried out within five years as per tender specification, Type Test at the discretion of ordering authority, shall have to be arranged by the successful Bidder from any lot offered for inspection, sample chosen at random after successful routine test by our inspection team, as per relevant ISS from CPRI/ NABL accredited/ Government recognized Test House or Laboratory in presence of WBSEDCL'S representative.

However the necessary cost of the type test charges will be reimbursed to the party on production of necessary supporting documents.

MANDATORY PARTICULARS OF 33 KV O/D POTENTIAL TRANSFORMER

Description	Particulars
Equipment	33 KV, Out Door, Single Phase, Oil Cooled Potential Transformer
Reference Standard	IS : 3156
Type	Dead tank
Rated voltage	33 KV
Highest voltage	36 KV
Frequency	50 Hz.
Basic Insulation Level	Primary : 36 KV / 70 KV / 170 KV(p) Secondary : 3 KV for 1 minute
Class of insulation	Class A
Creepage distance	900 mm (minimum)
Ratio	$33000/\sqrt{3} : 110/\sqrt{3} – 110/\sqrt{3}$ Volt
Class of accuracy	Core - I : 0.5, Core - II : 3P
Burden	Core - I : 100 VA, Core - II : 100 VA
Voltage factor	1.2 Continuous, 1.5 times for 30 Sec.
Core identification	Core - I : Metering, Core - II : Protection
Place of installation	Out Door, Structure mounted
Primary terminal connector	Rigid type suitable for PT Stud to Dog ACSR
Fixing hole dimension	330 mm both X & Y direction
Painting	Paint shed : Battleship gray as per IS 5 Paint thickness : 60 micron (minimum)
Secondary terminal box	IP 55
Suitability	Should be suitable for upright mounting on Steel Structure in outdoor Switch yard with matching to WBSEDCL's Standard base structure.
Guarantee	5 (five) years from the date of last dispatch of any integral part of the equipment.

GTP to be submitted by the Bidder

Description	Particulars	
Name of the manufacturer		
Factory address		
Equipment		
Reference Standard		
Type		
Rated voltage		
Highest voltage		
Frequency		
Basic Insulation Level		
Class of insulation		
Creepage distance		
Ratio		
Class of accuracy	Core - I : , Core - II :	
Burden	Core - I : , Core - II :	
Voltage factor		
Core identification	Core - I : , Core - II :	
Place of installation		
Material & size of Primary Stud		
Material & size of Secondary Stud		
Primary terminal connector		
Fixing hole centre distance		
Painting process		
Paint shed		
IP of Secondary Terminal Box		
Weight of oil		
Volume of oil		
Height of PT		
Total weight of PT		
Guarantee		
Type Test Report	Tested at	Date of Test
a. High voltage Power frequency wet withstand voltage test		
b. Lightning impulse voltage withstand test		
c. Temperature rise Test		
d. Determination of error.		