

Technical Specifications for PR No: 6000003091

S.No	Brief Description of the Material	Material Code	Qty
I	132 KV, 1-ph, Outdoor, Oilfilled, dead tank type CTs for metering of ratio 150/1A Core: 5VA/0.2S, ISF<=5, STC: 15KA for 1 sec, creepage: 3625 mm	CG3500208533	15 Numbers

1. Technical Specifications for 132KV Current Transformers (CG3500208533)

S.No	Description of the Material	Requirement	Vendor to Confirm/specify
1	Type of tank/ installation	Dead Tank/ Outdoor	
2	Applicable standards	IEC 60044-1/ IS 2705	
3	Class	0.2S	
4	Burden	5 VA	
5	ISF	<= 5	
6	System Operation Voltage	132 kV	
7	Maximum Operating Voltage of the system (RMS)	145 kV	
8	Rated Frequency	50 Hz	
9	No. of phase	3	
10	Rated Insulation levels		
11	Full wave impulse withstand voltage (1.2/50 micro sec.)	650 kVp	
12	Switching impulse withstand voltage (250/2500 micro sec.) dry and wet	Vendor to Specify	
13	One minute power frequency dry and wet withstand voltage (rms.)	275 kV	
14	Corona extinction voltage	156 kV	
15	Max. radio interference voltage	Less than 500 mV	
16	Minimum creepage distance	25 mm/kV (3625 mm)	
17	Min clearances		
a	Phase to Phase	1200 mm	
b	Phase to earth	1100 mm	

c	Sectional clearances	3500 mm	
18	Rated short circuit current for 1 sec. Duration	50 kA	
19	System neutral earthing	Effectively earthed	
20	Partial Discharge	Not exceeding 10 PC	
21	Rated Primary current	150 A	
22	Rated continuous thermal current	1.2 times rated primary current	
23	Rated short time thermal current	50 kA for 1 sec.	
24	Rated dynamic current	100 kA (peak)	
25	One minute power frequency withstand voltage secondary Terminal & Earth	Vendor to Specify	
26	Type of insulation	Class A	
27	Maximum temperature rise over design ambient temperature	As per IEC : 60044-1	
28	No. of poles	1	
29	Design ambient temperature	50 °C	
30	Core	High-grade non-ageing silicon laminated steel of low hysteresis loss and high permeability. Core lamination shall be of cold rolled grain oriented silicon steel or other equivalent alloys.	
31	Max. radio interference Voltage (microvolts)	Less than 500 V	
32	Pollution class	class III Heavy (as per IEC 91)	
33	Mounting	Pedestal and shall be suitable for mounting on steel structure or concrete pedestals	
34	Windings	All windings shall be made of double paper covering insulation and the manufacturing of the units shall be done in completely closed and air-conditioned room, otherwise fiber glass insulation sleeves are to be provided for primary winding. The primary winding shall be of copper conductor of appropriate purity.	
35	Insulation Oil	Insulating oil required for first filling of the Instrument transformer shall be covered in Bidder's scope of supply. The oil shall meet the requirements of latest edition of IS:335.	
36	Oil Level Indicator	It shall have oil level indicator with minimum/maximum oil level marks. The top	

		cover and terminal box cover should be such that rain water does not enter even through the gaskets. Instrument Transformers supplied with nitrogen cushion for compensation of oil volume variation shall be provided with prismatic type oil sight window at suitable location so that the oil level is clearly visible with naked eye to an observer standing at ground level. If metal bellow is used for the above purpose, a ground glass window shall be provided to monitor the position of metal bellow.	
37	Lifting Arrangement	Instrument Transformer shall be provided with suitable lifting arrangement to lift the entire unit. The lifting arrangement shall be clearly shown in the general arrangement drawing. Lifting arrangement (lifting eye) shall be positioned in such a way as to avoid any damage to the porcelain housing or the tanks during lifting for installation/transport. Necessary removable type string guides shall be provided.	
38	Insulation coordination	The insulation of the Instrument transformers shall be designed that the internal insulation shall have higher electrical withstand capability than the external insulation.	
39	Porcelain Housing	The porcelain housing shall be in single piece only, without any metallic joints. The housing shall be made of homogeneous, vitreous porcelain of high mechanical and dielectric strength. Glazing of porcelain shall be of uniform brown or dark brown color free from blisters, burns etc., with a smooth surface arranged to shed away rain water or condensed water particles (fog). The profile of porcelain shall be aerodynamic type as per IEC-815 .	
40	Metal Tanks	The metal tanks shall have bare minimum number of welded joints so as to minimize possible locations of oil leakage. The metal tanks shall be made out of mild steel/stainless steel/aluminum alloy, depending on the requirement. Welding in horizontal plane is to be avoided as welding at this location may give way due to vibrations during transport resulting in oil leakage.	

41	Surface Finish	The CT Tank shall be hot dip galvanised. All the ferrous hardware, exposed to atmosphere, shall also be hot dip galvanized. All other fixing nuts, bolts, washers shall be made out of stainless steel only The Vendor shall ensure that the sealing of Instrument Transformer is properly achieved. In this connection the arrangement provided by the Bidder at various locations including the following ones shall be described, supported by sectional drawings. i)Locations of emergence of primary and secondary terminals. ii)Interface between porcelain housing and metal tanks. iii)Cover of the secondary terminal box.	
42	Entry of Moisture	Nuts and bolts or screws used for fixing of the interfacing porcelain bushings for taking out terminals, shall be provided on flanges cemented to the bushings and not on the porcelain. For gasket joints wherever used, nitrite butyl rubber gaskets shall be used. The gasket shall be fitted in properly machined groove with adequate space for accommodating the gasket under compression.	
43	Earthing	Metal tank of the Instrument Transformer shall be provided with two separate Earthing terminals for bolted connection to 50 x 8 mm MS flat.	
44	Bushing/ Insulator	Instrument transformers shall be of 145 kV class, oil filled with shredded porcelain/Insulators suitable for outdoor service and upright mounting on steel structures. The bushing/insulator for CT shall be one piece without any metallic flange joint. Bushings shall be provided with oil filling and drain plugs, oil sight glass of CT etc. The bushing/insulator of instrument transformer shall have a cantilever strength of not less than 600 kg for 145 kV Instrument transformers. Instrument transformers shall be hermetically sealed units. Bidder/Manufacturer shall furnish details of the arrangements made for the sealing of instrument transformers along with the bid.	

		Vendor/Manufacturer shall also furnish the details of site tests to check the effectiveness of hermetic sealing for approval. Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.	
45	Name Plate details	Name plate shall conform to the requirements of IEC incorporating the year of manufacture. The rated current, extended current rating in case of current transformers shall be clearly indicated on the name plate. The rated thermal current of CT shall also be marked on the name plate.	
46	Arrangement	Current transformers shall have single primary either ring type, or hair pin type and suitably designed for bringing out the secondary terminals in a weather proof (IP 55) terminal box at the bottom. These secondary terminals shall be terminated to stud type non disconnecting terminal blocks inside the terminal box. In case "Bar primary" inverted type current transformers are offered the manufacturer will meet following additional requirements: • The secondary's shall be totally encased in metallic shielding providing a uniform equipotential surface for even electric field distribution. • The lowest part of the insulation assembly shall be properly secured to avoid any risk of damage due to transportation stresses. • The upper part of insulation assembly resting on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly & top dome. • Nitrogen gas used for hermetic sealing in case of live tank design should not come in direct contact with oil. • Vendor/Manufacturer shall recommend whether any special storage facility is required for spare CT.	

		The primary winding shall be of copper/Aluminium conductor of appropriate purity.	
47	Tests	Current Transformers should have been type tested and shall be subjected to routine tests in accordance with IEC: 60044-1/IS:2705. The test reports of the following additional type tests shall also be submitted: Current Transformers : • Thermal stability test, i.e., application of rated voltage and rated extended thermal current simultaneously by synthetic test circuit as per Annexure-A • Thermal co-efficient test i.e. measurement of tan delta as a function of temperature (at ambient and between 80 °C & 90 °C) and voltage (at 0.3, 0.7, 1.0 and 1.1 Um/√3) as per Annexure-A The current transformer shall be subjected to the following routine tests in addition to routine tests as per IEC / IS. ROUTINE TESTS: • Measurement of Capacitance • High voltage power frequency withstand test on Secondary Winding • High Voltage Power frequency dry withstand test on primary winding • Over-voltage inter turn test as per BS : 3938/IEC 44-1 • Oil leakage test • Tan-Delta to be measured at 5kV, 10 kV and Um/√3 as per IEC 44-1 • Measurement of partial discharge shall be carried out as per IEC 44-1 • Temperature coefficient test on 50% of the sample quantity of the lot offered. • Thermal stability test on balance 50% of the sampling quantity of the lot offered	

48	Testing & Commissioning	An indicative list of tests for Current Transformers is given below. • Insulation Resistance Test for primary and secondary. • Polarity test • Ratio identification test – checking of all ratios on all cores by primary injection of current • Dielectric test of oil (wherever applicable) • Magnetizing characteristics test. • Tan delta and capacitance measurement • Secondary winding resistance measurement	
49	Clamps & Connectors	All power clamps and connectors shall conform to IS : 5561. Shall be designed such that R.I.V shall not be more than 1000 microvolts at the test voltage. Clamps and connectors should be type tested as per IS : 5561 and shall also be subjected to routine tests as per IS : 5561. Following type test reports similar type shall be submitted. Temperature rise test (maximum temperature rise allowed is 35 degree Celsius over 50 degree Celsius ambient) • Short time current test • Corona (dry) and RIV (dry) test (for 145kV and above voltage level clamps) • Resistance test and tensile test	
50	Climatic Conditions	Max. ambient air temp. (°C) – 55 Min ambient air temp. (°C) – 5 Average daily ambient air temperature (°C) 35 Maximum Relative humidity (%) 74 Average annual rainfall (mm) 925 Max. wind pressure (Kg/sq.m.) 200 Max. altitude above mean sea level (Metres) 1000 Average No. of thunder storms days/year 40 Average No. of rainy days/year 90 Average No. of months/tropical monsoon condition per year 3 Noise level (db) 45	
51	Hot Dip Galvanising	All metal surfaces shall be subjected to treatment for anti-corrosion protection. All	

		ferrous surfaces for external use unless otherwise stated elsewhere in the specification or specifically agreed, shall be hot-dip galvanized after fabrication. High tensile steel nuts & bolts and spring washers shall be electro galvanized to service condition 4. All steel conductors including those used for earthing/grounding (above ground level) shall also be galvanized according to IS: 2629.	
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ANNEXURE – A

TEMPERATURE RISE

The temperature rise on any part of equipment to be supplied shall not exceed the maximum temperature rise specified below under the conditions specified in test clauses. The permissible temperature rise indicated is for a maximum ambient temperature of 50° C.

Sl. No	Nature of the Part or of the liquid	Temp. (° C)	Max. Temp.rise at a ambient air temp not exceeding 50°C
1	Contacts in air, silver-faced copper, copper alloy or aluminum alloy (see notes I and iii)	105	55
	Bare copper or tinned aluminum alloy	75	25
2	Contacts in Oil : Silver-faced copper, copper alloy or aluminum alloy (see note (ii)).	90	40
	Bare copper or tinned aluminum alloy	80	30
3	Terminals to be connected to external conductors by screws or bolts silver faced (see note[iii])	105	55
	Bare	90	40
4	Metal parts in contact with insulation of the following classes : Class Y : (for non-impregnated materials)	90	40
	Class A: (for materials immersed in oil or impregnated)	100	50

	Class E: in air	120	70
	In oil	100	50
	Class B : in air	130	70
	In oil	100	50
	Class F: in air	155	105
	In oil	100	50
	Enamel : oil base	100	50
	Synthetic, in air	120	70
	Synthetic, in oil	100	50
5	Any part of metal or of insulating material in contact with oil except contacts	100	50
6	Oil	90	40

Notes:

- i) When applying the temperature rise of 55 ° C, care should be taken to ensure that no damage is caused to the surrounding insulating materials.
- ii) The quality of the silver facing shall be such that a layer of silver remains at the point of contact after the mechanical endurance test. Otherwise, the contacts shall be regarded as “care”.
- iii) The values of temperature and temperature rise are valid whether or not the conductor connected to the terminals is silver-faced.
- iv) The temperature shall not reach of value where the elasticity of the materials is impaired. For pure copper, this implies a temperature limit of 75 ° C.

TEST PROCEDURES

1.0 THERMAL STABILITY TEST:

Application of rated voltage and rated extended thermal current simultaneously by synthetic test circuit. (This is not applicable to SF₆ filled CTs)

2.0 TEMPERATURE COEFFICIENT TEST:

The capacitance and tan-delta of the CT must be measured at 30%, 70%, 100% & 110% of $U_m/\sqrt{3}$ at ambient temperature. Then the complete CT is to be put in a chamber and heated to approximately 90°C for 24 hours. After 24 hours Capacitance & Tan-delta must be measured again at 30%, 70%, 100% & 110% of $U_m/\sqrt{3}$.

The temperature co-efficient is calculated as:

$$\text{Temperature coefficient} = \frac{(\text{Tan-Delta 2} - \text{Tan Delta 1})/(\text{Tan-Delta 1})}{(T2 - T1)}$$

Tan-delta 2 = Tan-Delta in hot condition.

Tan-delta 1 = Tan-Delta in ambient temperature.

T2 = 90°C

T1 = Ambient temperature.

S.No	Brief Description of the Material	Material Code	Qty
II	132 KV, 1-ph, Outdoor, Oil filled PTs (for metering) of ratio 132KV/√3/110V/√3 Wdg 1: 10VA/0.2, RVF: 1.2 cont & 1.5 for 30 sec, Creepage: 3625 mm	CG3500208576	12 Numbers

2. Technical Specifications for 132KV Potential Transformers (CG3500208576)

S.No	Brief Description of the Material	Requirement	Vendor to Confirm/Specify
1	Climatic Conditions	Max. ambient air temp. (°C) – 55 Min ambient air temp. (°C) – 5 Average daily ambient air temperature (°C) 35 Maximum Relative humidity (%) 74 Average annual rainfall (mm) 925 Max. wind pressure (Kg/sq.m.) 200 Max. altitude above mean sea level (Metres) 1000 Average No. of thunder storms days/year 40 Average No. of rainy days/year 90 Average No. of months/tropical monsoon condition per year 3 Noise level (db) 45	
2	Core	The core shall be high grade non-ageing electrical silicon laminated steel of low hysteresis loss and high permeability to ensure high accuracy at both normal and over current/ voltage. The secondary terminals shall be brought into a compartment on one side of Instrument transformer for easy access. The secondary terminals shall be provided with short circuiting arrangements in case of Potential Transformers. The secondary taps shall be adequately reinforced to withstand normal handling without damage. The ratio taps shall be on secondary side. Details of Core shall be furnished.	
3	Mounting	The mounting of instrument transformers shall be pedestal type and shall be suitable	

		for mounting on steel structures or concrete pedestals. The necessary flanges, bolts etc., for the base of instrument transformers shall be supplied and they shall be galvanized.	
4	Winding	All windings shall be made of double paper covering insulation and the manufacturing of the units shall be done in completely closed and air-conditioned room, otherwise fiber glass insulation sleeves are to be provided for primary winding. Details of winding shall be furnished.	
5	Insulation Oil	Insulating oil required for first filling of the Instrument transformer shall be covered in Bidder's scope of supply. The oil shall meet the requirements of latest edition of IS:335.	
6	Type of installation	Outdoor, Single Phase, Oil immersed and self-cooled	
7	Type of mounting	Bottom Tank	
8	Confirming to	IS-3156 : 1992	
9	Suitable for system Frequency	50 Hz+/- 5%	
10	Nominal System Voltage (kV rms)	132	
11	Highest System voltage (kV rms)	145	
12	Insulation Level (Primary)	275 kV	
13	Method of earthing	Effectively Grounded Neutral System	
14	Temperature rise at 1.1 times rated voltage with stand burden (deg .C)	As per IS 3156 as per latest amendments	
15	1.2/50 microsecond lightning impulse withstand voltage (kVp)	650	
16	1 minute dry Power frequency over-voltage withstand voltage for secondary winding(kV rms)	275	
17	Rated Voltage Factor	1.2 times continuous and 1.5 for 30 seconds.	
18	Min. total creepage distance of porcelain housing (mm)	3625	
19	Confirming to standard	IS-3156 as per latest Amendments	
20	No. of secondary windings	One	

21	Rated secondary voltage	110/v3	
22	Rated Burden (VA)	10 VA	
23	Class of accuracy	0.2	
24	Tests	Type Tests for PTs: PTs of each voltage class offered in the bid shall be fully type tested as per the relevant standards. The date of type tests will not be earlier than ten years as on the date of bid opening. If any change in design was made latest type tests shall be furnished along with approved drawing. The Bidder shall furnish two sets of the following type test reports as per IS-3156 along with offer. • Temperature rise test. • Lightning impulse test. • High voltage power frequency wet withstand voltage test. • Determination of errors. The offers received without these type test reports shall be treated as Non-Responsive. Acceptance and Routine Tests: All acceptance and routine tests for Instrument Transformers as stipulated in the relevant standards and partial discharge test and tan delta tests, mechanical loading test on primary terminals shall be carried out compulsorily shall be carried out by the Vendor in the presence of Purchaser's representative. Immediately after finalization of the program of acceptance /routine testing, the Bidder shall give sufficient advance intimation to the Purchaser, to enable him to depute his representative for witnessing the tests.	
25	Oil Level Indicator	It shall have oil level indicator with minimum/maximum oil level marks. The top cover and terminal box cover should be such that rain water does not enter even through the gaskets. Instrument	

		Transformers supplied with nitrogen cushion for compensation of oil volume variation shall be provided with prismatic type oil sight window at suitable location so that the oil level is clearly visible with naked eye to an observer standing at ground level. If metal bellow is used for the above purpose, a ground glass window shall be provided to monitor the position of metal bellow.	
26	Lifting Arrangement	Instrument Transformer shall be provided with suitable lifting arrangement to lift the entire unit. The lifting arrangement shall be clearly shown in the general arrangement drawing. Lifting arrangement (lifting eye) shall be positioned in such a way as to avoid any damage to the porcelain housing or the tanks during lifting for installation/transport. Necessary removable type string guides shall be provided.	
27	Insulation coordination	The insulation of the Instrument transformers shall be so designed that the internal insulation shall have higher electrical withstand capability than the external insulation.	
28	Porcelain Housing	The porcelain housing shall be in single piece only, without any metallic joints. The housing shall be made of homogeneous, vitreous porcelain of high mechanical and dielectric strength. Glazing of porcelain shall be of uniform brown or dark brown color free from blisters, burns etc., with a smooth surface arranged to shed away rain water or condensed water particles (fog). The profile of porcelain shall be aerodynamic type as per IEC-815 .	
29	Earthing	Metal tank of the Instrument Transformer shall be provided with two separate Earthing terminals for bolted connection to 50 x 8 mm MS flat.	
30	Bushing/ Insulator	Instrument transformers shall be of 145 kV class, oil filled with shredded porcelain/Insulators suitable for outdoor service and upright mounting on steel structures.	

S.No	Brief Description of the Material	Material Code	Qty
III	Rigid type bimetallic terminal connectors suitable for ACSR conductor for 132KV CTs/PTs	CG3500208541	42 Numbers

S.No	Brief Description of the Material	Requirement	Vendor to Confirm/Specify
1.	For connecting equipment terminals made of copper with ACSR conductors	Bimetallic connectors made from aluminum alloy casting, conforming to designation 6 of IS 617 with 2mm thick bimetallic liner and all test shall conform to IS:617. Should conform with IS: 5561 & NEMA CC1. The conductor terminations of equipment shall be single Zebra Conductor. Clamps and connectors should be type tested as per IS : 5561 and shall also be subjected to routine tests as per IS : 5561. Following type test reports similar type shall be submitted. • Temperature rise test (maximum temperature rise allowed is 35 degree Celsius over 50 degree Celsius ambient) • Short time current test • Corona (dry) and RIV (dry) test (for 145kV and above voltage level clamps) • Resistance test and tensile test	

S.No	Brief Description of the Material	Material Code	Qty
IV	132KV CTs Marshalling Box	CG3500208550	5 Numbers

S.No	Brief Description of the Material	Requirement	Vendor to Confirm/Specify
1.	Marshalling Box	All types of boxes, cabinets etc., shall generally conform to & be tested in accordance with IS-5039 / IS-8623, IEC-439 Marshalling boxes shall be made of sheet steel or aluminum enclosure and shall be dust, water and	

		vermin proof. Sheet steel used shall be atleast 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminum enclosed box the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness. Cabinet/boxes shall be pedestal mounting type as per requirements. A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes to prevent ingress of rainwater.	
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S.No	Brief Description of the Material	Material Code	Qty
V	132KV PTs Marshalling Box	CG3500208576	4 Numbers

S.No	Brief Description of the Material	Requirement	Vendor to Confirm/Specify
1.	Marshalling Box	All types of boxes, cabinets etc., shall generally conform to & be tested in accordance with IS-5039 / IS-8623, IEC-439 Marshalling boxes shall be made of sheet steel or aluminum enclosure and shall be dust, water and vermin proof. Sheet steel used shall be atleast 2.0 mm thick cold rolled or 2.5 mm hot rolled. The box shall be properly braced to prevent wobbling. There shall be sufficient reinforcement to provide level surfaces, resistance to vibrations and rigidity during transportation and installation. In case of aluminum enclosed box the thickness of aluminum shall be such that it provides adequate rigidity and long life as comparable with sheet steel of specified thickness. Cabinet/boxes shall be pedestal mounting type as per requirements. A canopy and sealing arrangements for operating rods shall be provided in marshalling boxes to prevent ingress of rainwater.	

Pre Qualification & Other Terms and Conditions

S.No	Other Terms and Conditions	Vendor Remarks
1.	Prequalification Criteria Vendor shall have successfully supplied 132 KV CT's or PT's atleast 3 numbers (3 numbers of CT's or 3 Numbers of PT's) to AP/TS TRANSCO (or) to Industries with AP/TS TRANSCO metering facility. Vendor shall submit proof for the same. Along with the above Commissioning/Performance certificate of the equipment from AP/TSTRANSCO/Industries needs to be Submitted.	
2	After receipt of the order the successful bidder shall submit within two weeks two copies of all the above drawings/documents and any other drawings/documents considered necessary in addition to the drawings stated above to be approved by the BHEL. One print of such drawings/documents will be returned to the supplier marked approved/approved with corrections. After approval of the drawing the Supplier shall furnish to BHEL, Six prints and one reproducible original of the drawings after incorporating all corrections.	
3	Vendor shall offer inspection of the above material to TSTRANSCO officials and BHEL officials. Only after clearance from TSTRANSCO official's material will be accepted.	
4	Third party testing charges are to be quoted separately by vendor and shall be conducted as per TSTRANSCO norms. (NABL accredited labs only)	
5	4 sets of test reports of each item to be submitted.	