



GUJARAT ENERGY TRANSMISSION
CORPORATION LTD.

SARADAR PATEL VIDYUT BHAVAN,
RACE COURSE, BARODA – 390 007.

TECHNICAL SPECIFICATIONS

FOR

220KV, 4400Pf CVT WITH

HOLLOW PORCELAIN INSULATOR

GETCO/E/TS-220KV CVT 0802/R5, June 2022

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REQUIREMENT :

The equipment offered shall be highly reliable suitable to operate satisfactorily in hot humid and polluted climate. The equipments offered shall work satisfactorily within temperature range of 0°C to 50°C and relative humidity of 95% non-condensing. It shall be suitable for satisfactory working in normally polluted atmosphere.

1. SPECIFICATION :

The equipment is required for 220KV system. The system data is given as under:

2.1 SYSTEM PARTICULARS

Line Voltage	220 kV
Max. System Voltage	245 kV
Rated Power Frequency	50 Hz
Rated system continuous current	1250 A
Maximum Thermal short	
Current for 1 Sec.	31.5 kA
Dynamic Limiting Current	38.5 kA

2.2 STANDARDS :

The equipment shall meet the following ISS and IEC standards with latest amendment:

IS: 3156	-	Specification for voltage transformer.
IS: 5621	-	Specification for hollow insulators for use in Electrical equipment:-
IS : 335	-	Insulation Oil for transformers and switch Gears.
IEC : 186 & } IEC : 186 A }	-	Specification for voltage transformers.
IEC : 270	-	Partial Discharge Measurement
IEC : 358	-	Coupling capacitors and capacitor Dividers.
IEC : 60044-5	-	Capacitor Voltage transformer
IEC : 61869-1	-	Instrument transformer- Part 1: General requirements

Unless otherwise stated elsewhere in the specification, the rating as well as performance & testing of the instrument transformer shall confirm but not limited to the latest revision and amendments available at the time placement of order of all relevant standards listed above.

The design, manufacture and performance of the equipment shall comply with all currently applicable standards, regulation and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the supplier of his responsibility.

2.3 GENERAL :

The 220KV CVTs are required for PLCC, station metering, synchronisation and protection of 220KV Transmission Lines. The equipment is required for connecting high frequency equipment to high voltage line. It shall be suitable for operating from 40 KHz to 500 KHz. It shall have high frequency capacitance of 4400pF. HF terminal shall be provided for connecting PLCC equipment.

2.4 CONSTRUCTION :

CVT shall comprise of a capacitor divider unit and an electromagnetic unit so designed and interconnected that the secondary voltage of electromagnetic unit is substantially proportional to and in phase with the primary voltage applied to the capacitor divider units. If a carrier frequency coupling device is introduced into the earth lead of intermediate voltage capacitor the error introduced by this device shall be negligible at rated frequency in relation to the errors of CVT. The dielectric material shall be mixed type i. e. paper and polypropylene material. The material and construction and assembly of CVT shall be such that capacitance does not change with time and the effect of temperature is minimum.

The live metal surface, nuts and bolts used for the connection of two capacitor stacks shall be either of brass or tinned copper to provide good electrical connection. Corona shield and high voltage terminal studs shall be of copper/*Aluminum*.

The intermediate electromagnetic circuit of CVT shall be provided with necessary device like, series choke coil or reactance unit to minimise the draining of carrier signal through the electromagnetic unit. It will be provided with an over voltage suppressor to protect the electromagnetic unit. The HF terminal of CVT shall be brought out through a bushing rated for 11 kV-class minimum.

The internal insulation level of CVT shall be higher compared to external insulation to prevent damage to internal insulation. Material used in the insulation

and assembly of the winding shall be insoluble, non-catalytic, and chemically inactive in hot transformer oil and shall not be subjected to a shrinking and seasoning process to avoid further shrinking during service.

The capacitor stacks and windings shall be suitably supported and permanently secured at frequent intervals so that no shifting occurs due to dynamic forces developed by short circuit and that during transportation. All the winding shall be of electrolytic copper.

CVTs shall be hermetically sealed with non-breathing type of bellow arrangement with first filling insulating oil confirming to latest IS: 335 or better quality of oil. Suitable arrangements shall be provided for expansion and contraction of oil due to operating temperature variations, without affecting property of insulating materials, oil etc. In case, inert gas sealing is used, pressure relief device shall be provided. The arrangement provided shall be described in details.

All exposed ferrous parts like tank, expansion chamber, terminal box etc., shall be of high quality steel, and shall be hot dip galvanized confirming to IS: 2633. Steel surface coming in contact with oil shall be coated with oil resisting varnish. All fasteners shall be hot dip galvanised. The construction of the tank including fitting of capacitor unit shall be such that there shall not be any oil leakage. In case of any leakage, it should be possible to attend it on site.

The hollow porcelain insulators for CVTs shall confirm to IS: 5621. Porcelain shall be homogeneous, vitreous, the glazing of which shall be uniform brown or dark brown colour. The terminals for external connections shall be so mounted as to enable easy connection and disconnection. CVT with voltage terminal shall withstand static test load of 1250 N in any direction when applied to primary terminal.

Hollow porcelain insulators are intended for use with CVT filled with insulating oil for outdoor installation suitable for operation under following tropical conditions, with high temperature, humidity and rainfall.

The climatic and isoceraunic conditions at site are given below: (Table-1)

a.	Maximum ambient temperature in shade. (°C)	50
b.	Minimum ambient temperature in shade. (°C)	04
c.	Maximum average ambient temperature. (°C)	40
d.	Maximum yearly average ambient temp. (°C)	30
e.	Maximum relative humidity. (%)	95
f.	Average rainfall per annum. (Cm)	150
g.	Average number of thunder storm days per annum	15

h.	Height above Sea level. (Meters)	Not exceeding 1000
i.	Maximum wind pressure. (Kg / m ²)	150
j	Earthquake acceleration. (g)	0.08 x 2 g

The equipment offered shall be suitable for continuous operation at their full rated capacity under the above conditions.

Since the sub-station may be near the sea-shore and/or in an industrial area, the equipment offered shall be suitable for heavily polluted atmosphere.

CVTs including hollow insulators shall be sufficiently strong to withstand external stresses due to wind pressure up to 150 Kg/m², earthquake, short-circuit and conductor pulls at the terminals. The minimum creepage distance for insulator housing shall be i.e.25 mm/KV. CVTs shall be suitable for hotline washing.

Secondary terminals of CVTs shall be brought out in a weather proof outdoor terminal box having enclosure protection of minimum IP-55 as per IS: 2147. The terminal box shall be provided with gland plates of adequate size with glands for cable entry in metering terminal box as well as protection/HF cable terminal box. The secondary terminal box of CVT shall include necessary HRC fuses for protection of secondary circuits. For purpose of fuse supervision, both the sides of the fuse shall be terminated on terminal block. The terminals for metering core shall be brought out in separate sealable compartment/box.

Each CVT winding shall be provided auxiliary terminals on terminal block complete with necessary incoming connections.

HF Auxiliary bushing shall be provided suitably so that HF connection can be made without affecting main bushing. The arrangement for taking HF connection shall be described.

CVT s shall be provided with two secondary windings i.e. one for metering and one for protection, each having following particulars:

Winding	Purpose	Burden	Accuracy	Primary Voltage	Secondary Voltage
No. 1	Metering	50 VA	0.2	$\frac{220 \text{ kV}}{\sqrt{3}}$	$\frac{110 \text{ V}}{\sqrt{3}}$
No. 2	Protection.	50 VA	3 P	$\frac{220 \text{ kV}}{\sqrt{3}}$	$\frac{110 \text{ V}}{\sqrt{3}}$

The Simultaneous burden shall be 100VA at 0.2/3P class of accuracy.

The voltage factor shall be 1.2 for continuous and 1.5 for 30 Seconds rating.

CVTs shall be provided with necessary clamps complete in all respect for Single ACSR Moose Conductor for connecting to high voltage line.

CVT shall be fully protected against high voltage oscillations and lightening surges. The bidder shall provide complete write up for protection provided.

Steel pedestal for mounting the CVT if ask to supply for the Quantity shown in the Schedule, then the same shall be offered as per the technical specification of the structure and the drawing for given details of Base Plan, Top View & Foundation bolt . The pedestal shall have facility to mount Coupling Devices and Protective Device. The detailed drawing shall be furnished.

Along with Manufacturing Quality Plan, the Bidder shall have to submit following Type test reports.

2. TESTING

3.1 TYPE TESTS

3.1.1 TYPE TESTS FOR 220KV, 4400PF CVT:

The following tests from NABL accredited laboratory shall be carried out in accordance with latest / amended / up to date IS/IEC. The bidder has to submit the all type test reports as stated hereunder for the offered item along with the technical bid. The type test reports from NABL approved laboratory shall not be older than **Ten years**. Type Test shall be valid as on the last date of submission of bid.

1. Temperature rise test on EMU
2. Lightning impulse voltage withstand test
3. Chopped impulse withstand voltage test (Wet)
4. Power frequency withstand voltage test (Before & After SC)
5. Capacitance & dielectric dissipation factor measurement before and after HV test
6. Capacitance & dielectric dissipation factor measurement (Before & After SC)
7. Partial discharge test (Before & After SC)
8. Ferro resonance test (Before & After SC)
9. Short circuit withstand capability test
10. Transient response test
11. High frequency capacitance & equivalent series resistance test
12. Test for determination of Temperature coefficient (For Model capacitor to be used for offered CVT)
13. RIV
14. Visual corona
15. Accuracy Test (Before & After SC)

16. Discharge test
17. Measurement of stray capacitance & stray conductance
18. IP55 test on secondary terminal Box.
19. Tightness test on EMU
20. Tightness test of liquid filled capacitor voltage divider (Before & After SC)
21. Verification of terminal marking
22. Power frequency withstands test on electromagnetic unit (Before & After SC)
23. Power frequency withstands test on secondary terminals (Before & After SC)
24. Seismic & Mechanical withstand test (Special Test)

3.1.2 TYPE TESTS FOR CARRIER FREQUENCY ACCESSORIES

When a carrier frequency accessory is connected by the manufacturer into the earth lead of the intermediate voltage capacitor, it should be type tested for following tests.

1. Type tests for drain coil
 - a. Impulse voltage test
 - b. Voltage withstand test
2. Type test for voltage limitation device
 - a. Impulse voltage test

The equipment offered must have been type tested after manufacture in India. Equipment shall be again type tested if required by the purchaser in presence of purchaser or/and any third party. Measurement of HF capacitance and equivalent series resistance within the frequency range 40 to 500 kHz should have been carried out and it should meet IEC 358 Clause: 10. If required this test will be carried out again. The test report for high frequency measurement shall be enclosed with technical bid.

In case of non-submission/partial submission or type test reports of which validity is over, bidder shall submit pending type test report/s from NABL accredited laboratory, in the event of an order, before commencement of supply without affecting delivery schedule, free of cost to GETCO. Confirmation for above shall be invariably submitted along with technical bid.

3.2 FACTORY ROUTINE TESTS

3.2.1 FACTORY ROUTINE TESTING REQUIREMENT FOR CVT

Each unit of CVT's lot shall be tested for following tests before offering it for acceptance testing.

1. Capacitance and dielectric dissipation factor measurement before and after HV tests
2. Power frequency voltage withstands test
3. Partial discharge test
4. Power frequency voltage with stands test on NHF terminal
5. Power frequency voltage withstands test on secondary winding of EMU
6. Power frequency voltage withstands test on primary winding of EMU
7. Ferro resonance test (three times at 0.8 Um and three times at 1.5 Um) with wave form results
8. Sealing tests
9. Measurement of ratio and phase angle error
 - 9.1 Metering winding (0.2 accuracy class): For 25%, 100% & Simultaneous burden at each 80%, 100% and 120% of rated voltage
 - 9.2 Protection winding (3P accuracy class): For 25%, 100% & Simultaneous burden at each 5 %, 100% and 150% of rated voltage
10. Measurement of coupling capacitance and dielectric dissipation factor for both capacitor dividers as well as for CVT completely assemblies with EMU. The corresponding values measured for complete CVT shall be incorporated rating plate as CC= XXXX PF and Tan δ (With EMU in GST mode)
11. Terminal marking & polarity verification

3.2.2 FACTORY ROUTINE TESTING REQUIREMENT FOR CARRIER FREQUENCY ACCESSORIES

1. Routine tests for drain coil
 - a. Measurement of impedance at power frequency
 - b. AC test
2. Routine test for voltage limiting devices
 - a. Measurement of the spark-over voltage with power frequency (Air-gap arrester)
 - b. AC test with the continuous rated withstand voltage

3.3 ACCEPTANCE TESTING REQUIREMENT FOR CVT :

All the tests mentioned at 3.2 above shall be carried out, on selected samples of CVT as per approved MQP, in presence of purchaser's representative and/or any third party as decided by the purchaser.

4 DRAWINGS:

The following drawings indicating all the dimensions and weight etc. with complete technical details shall be enclosed together with technical bid:

1. General Arrangement Drawing
2. Rating & Diagram Plate for 245KV CVT
3. Secondary terminal Box having separate sealable compartment with locking arrangement for metering core having class of accuracy 0.2
4. Sectional view for 245KV CVT
5. Terminal connector suitable for Single moose ACSR conductor
6. Hollow porcelain insulator with detail of all dimensions and technical parameters

The offer without the above drawings and insufficient technical data, will not be considered to evaluate the bid technically

CD for the softcopy of the same shall be provided with the tender bid.

5. OIL LEAKAGE AND OIL FILLING :

The bidder shall indicate clearly whether oil leakage problem can be attended at site and topping of oil carried out.

In case of oil leakage during guarantee period, supplier shall attend the same free of cost. If CVT will require to be taken to works, supplier shall do so at his cost and arrange for replacement CVT if required by the user.

6. PACKING :

The CVTs shall be dispatched properly packed so that there is no damage during transportation. All warning and instruction shall be in Red Bold letters on outside of packing for handling the CVT during transportation. The rest of warning and instruction etc. shall be on CVT tank in Red Colour.

7. INSTRUCTION MANUAL :

One Erection and Commissioning Manual shall be provided for each CVT and shall be dispatched together with CVT. Two copies of instruction Manual with CD for soft copy shall be provided with the tender bid.

8. SCOPE OF SUPPLY :

The following items are included in the scope.

- (i) CVT complete in all respect with hollow porcelain insulator.
- (ii) Clamps & connectors
- (iii) Pedestal structures for mounting CVT (if required)
- (iv) O&M Manual along with drawings

The manufacturer's scope of supply covers design, manufacture, assembly, stage inspection, testing at supplier's works, packing for shipment and delivery of equipment to the store in safe condition in accordance with this specification. The Bidder shall have to provide all the 'Guaranteed Technical Particulars' as per Schedule-A (GTP) & details of 'Technical documents /Type tests for CVT to be submitted' as per Schedule-B.

The GTP submitted by the bidder in the offer, if not found as per the Schedule-A, then offer will be rejected without any prior confirmation. Also if any of the type test reports from the list given above not submitted then it shall be indicated clearly by the bidder in the schedule of deviation.

SCHEDULE – A
GUARANTEED TECHNICAL PARTICULARS FOR CVT
(To be submitted with the tender)

The bidder must fill up all the point of GTP for offered item/s. Instead of indicating “refer drawing, or as per IS/IEC”, the exact value/s must be filled in

<u>Sr. No.</u>	<u>Description</u>	<u>Details</u>
<u>GENERAL</u>		
1.	Manufacturer's name & address	
2.	Model No.	
3.	Mounting	
4.	Type	
5.	Installation	
6.	Suitable system Frequency	
7.	Applicable standards	
8.	Rated Primary voltage kV (rms)	
9.	Highest voltage kV (rms)	
10.	Maximum temperature rise above ambient temperature of 50 °C	
11.	Type of dielectric material	
<u>CAPACITOR DIVIDEER</u>		
1.	Capacitance values at rated frequency and at rated temperature for : (i) High voltage capacitor 'C ₁ ' (pF) (ii) Intermediate voltage capacitor 'C ₂ ' (pF) (iii) Total Equivalent capacitance (pF) (iv) Rated temperature at which above values are indicated (° C) (v) Capacitance temperature coefficient	
2.	1.2x50 micro sec. Lightning impulse withstand test voltage for capacitor unit (kVp)	
3.	1 minute power frequency withstand voltage kV (rms)	
4.	Radio interference voltage (max) at 156 kV (rms)	
5.	Visual corona extinction voltage (kV)	
6.	Variation in capacitance of total rated capacitance over entire range of carrier frequency	
7.	Tan delta value of capacitor unit	
8.	Total creepage distance of insulator (mm)	
9.	Rated intermediate voltage (kV)	
10.	Equivalent series resistance over entire range of carrier frequency (ohms)	
11.	Partial discharge level at rated voltage (pico col.)	

Sr. No.	Description	Details
<u>ELECTROMAGNETIC UNIT</u>		
1.	Rated primary voltage (kV)	
2.	Rated secondary voltages (i) First winding (volts) (ii) Second winding (volts)	
3.	Rated voltage factor (i) Continuous (ii) Short time (iii) Duration (Sec.)	
4.	Rated burden of secondary winding (i) First winding (VA) (ii) Second winding (VA) (iii) Simultaneous (VA) (iv) Rated power factor of burden	
5.	Accuracy class of secondary (i) First winding (ii) Second winding (iii) Phase angle error	
6.	Insulation withstand test voltages (i) Capacitor divider unit (kV) (ii) Earth terminal of capacitor Voltage device (kV) (iii) Primary winding of electromagnetic unit (kV)	
7.	earth terminal of the voltage divider (i) the rated voltage (ii) 1 minute power frequency withstand voltage (kV)	
8.	series reactance/choke/ compensating coil (i) Rated voltage (kV) (ii) 1 minute power frequency test voltage (kV)	
9.	Terminal box details (i) Degree of protection as per IS: 2147	
10.	Class of insulation.	
11.	Rated intermediate voltage (kV)	

SCHEDULE-B**‘Technical documents /Type test reports submitted’****(To Be filled up by Bidder & to be submitted with tender)**

Sr.No.	Particulars	YES	Remarks
1.	Certificate of OEM attached		
2.	Fresh certificate of chartered Engineer indicating manufacturing capacity submitted		
3.	List of order with details of Qty, value of the Order and Order No. Compulsory with date (Executed during last 5 years)		
	a) For same rated equipment supplied to GETCO		
	b) For higher rated equipment than offered to GETCO		
	c) Same rated equipment supplied to other utility with performance certificate		
4	All Type Test reports submitted are as per list given in TS & not more than 10 years old Type Test shall be valid as on the last date of submission of bid.		
5	List of performance certificate along with copy of performance certificate submitted.		
6.	Set of drawings as per the list given in TS along with the CD of Soft copy submitted.		
7.	Copy of the technical specification submitted with the seal of OEM & sign of CE		
8.	QAP Submitted for Offered equipment		
9.	GTP Provided as per Schedule-A		
10.	In case of oil leakage during guarantee period supplier shall attend the same free of cost & if require supplier shall have to take the CVT to works at his cost. (To be confirmed by bidder)		
11.	Your offer fully complies to meet all the requirements as per TS & documents to be submitted as above.		

I _____, the authorized signatory here by confirmed that the details pertain to Sr. No. 1 to 11 of Schedule-B submitted herewith the tender is correct in all respect and as per corporation's requirements. If any detail there in found incorrect or inadequate/insufficient by corporation then decision of corporation will be acceptable to us without any further clarification.

Signature of Authorized representative of Company

NAME: _____

STATUS: _____