

Meghalaya Power Transmission Corporation Limited

Bidding Document

For

Re-Conductoring and Strengthening of the 132
kV Single Circuit Transmission Line by High
Temperature Low Sag (HTLS) conductor and
Related Services (Line length 28.96 CKM)



(E Tender)

Supplementary Technical Specifications to Vol-II

BID IDENTIFICATION No:

MePTCL/CE(T)/HTLS/2026

SECTION - 7

TECHNICAL SPECIFICATIONS

1. TECHNICAL SPECIFICATION FOR CAPACITIVE VOLTAGE TRANSFORMER (CVT)
2. TECHNICAL SPECIFICATION FOR WAVE TRAP
3. TECHNICAL SPECIFICATION FOR CURRENT TRANSFORMER (CT)
4. TECHNICAL SPECIFICATION OF LINE MATCHING UNIT (LMU) / COUPLING DEVICE

1.0 TECHNICAL SPECIFICATION OF CAPACITOR VOLTAGE TRANSFORMER (CVT)

1.1 GENERAL:

The 132 KV CVTs are required for PLCC, station metering, synchronisation and protection of 132 KV 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 4400 pF. HF terminal shall be provided for connecting PLCC equipment.

1.2 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 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.

The intermediate electromagnetic circuit of CVT shall be provided with necessary device like, series choke coil or reactance unit to minimised the draining of carrier signal through the electromagnetic unit. It will be provided with an over voltage suppressor to protect the electromagnetic unit. Earthing 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. 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 galvanised 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.

CVTs including hollow insulators shall be sufficiently strong to 2 withstand external stresses due to wind pressure upto 150 Kg/m, earthquake, short-circuit and conductor pull at the terminals. The

minimum creepage distance for insulator housing shall be as per IEC: 358 for normally polluted atmosphere. 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 IP55 as per IS: 2147. The terminal box shall be provided with blank gland plates of adequate size. 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	10 VA	* 0.2	$\frac{132 \text{ kV}}{\sqrt{3}}$	$\frac{110 \text{ V}}{\sqrt{3}}$
No. 2	Protection.	50 VA	* 3P	$\frac{132 \text{ kV}}{\sqrt{3}}$	$\frac{110 \text{ V}}{\sqrt{3}}$

* Simultaneously.

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

CVTs shall be provided with necessary clamps/connectors complete in all respect for HTLS 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.

1.3 LIST OF TYPE TEST REPORTS FOR 132KV, 4400PF CVT:

1. Temperature rise test on EMU
2. Lightning impulse voltage withstand test
3. Switching impulse withstand voltage test (Wet)
4. Partial discharge test
5. Ferro resonance test
6. Short circuit withstand capability test
7. Transient response test
8. High frequency capacitance & equivalent series resistance
9. Temperature coefficient test
10. RIV
11. Visual corona
12. Power frequency withstand voltage test
13. Discharge test
14. Measurement of stray capacitance & stray conductance
15. IP55 test on secondary terminal Box.

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 No. 358 Clause: 10. If required this test will be carried out again.

This test report for high frequency measurement shall be enclosed with technical bid.

1.4 ROUTINE TEST:

All the tests shall be carried out in presence of purchaser's representative and/or any third party as decided by the purchaser as mentioned under above standards.

1.5 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 is required to be taken to works, supplier shall do so at his cost and arrange for replacement CVT if required by the user.

1.6 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.

1.7 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.

1.8 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 145KV 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 145KV CVT
5. Terminal connector suitable for single HTLS conductor

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

1.9 SCHEDULE OF DEVIATION:

Bidder shall bring out all the deviation from specification in separate schedule of deviation.

1.10 SCOPE OF SUPPLY:

The following items are included in the scope.

CVT complete in all respect.
Clamps & connectors
Pedestal structures for mounting CVT (if required)

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 test reports submitted' as per Schedule-B.

The GTP submitted by the bidder in the offer if found to be not provided as per the Schedule-A & if any of the type test reports from the list given above found to be more than 5 Years old on the date of opening of the tender, 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.

1.11 ERECTION, TESTING AND COMMISSIONING

The purchaser may at his discretion ask the bidder to do either the complete erection or supervision of erection at site of the equipment covered by this specification. The bidder shall, therefore, quote their charges separately for (i) erection and (ii) rates for supervision of erection.

However, if it is decided to do the erection of the above equipment departmentally, the bidder shall furnish full and detailed instructions complete with drawings and leaflets to enable the satisfactory erection and commissioning of the equipment by the purchaser. Such instructions shall reach the purchaser well in advance so that there is no delay in commencement of erection. The successful bidder shall supply all special tools necessary for erection. Details of such tools and the price thereof shall be stated in the tender separately.

Bidders should note that under the scope of this bid, the Current Transformer shall be supplied, erected and commissioned in respective substations.

Bidders should also note that, equipment covered under this bidding document shall be used in replacing old and obsolete equipment in existing substations. As far as possible the equipment shall be installed in existing foundations by retrofitting. All necessary supports shall be provided by the successful bidder in this regard.

The Supplier/manufacturer shall be given a prior 15 (fifteen) days notification when an equipment is ready for installation, testing and commissioning. If the supplier/manufacture fails to turn up by the appointed date, the Purchaser may go ahead with the task of erection, testing & commissioning on its own. However, the Supplier/Manufactures shall bear all the responsibilities and cost of any consequences that may arise due to his absence.

ANNEXURE-I
GAUARANTEED TECHNICAL PARTICULARS
 (To be submitted by bidder with the tender)

Sr. No	Description	Details .
GENERAL		
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	
CAPACITOR DIVIDER		
1.	Capacitance values at rated frequency And at rated temperature for: High voltage capacitor 'C ₁ ' Intermediate voltage capacitor 'C ₂ ' Total Equivalent capacitance Rated temperature at which above Values are indicated Capacitance temperature coefficient	pF pF pF ° C
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) volts	
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.

ELECTROMAGNETIC UNIT

1.	Rated primary voltage kV	
2.	Rated secondary voltages	
	First winding	volts
	Second winding	volts
3.	Rated voltage factor	
	continuous	
	short time	
	Duration	sec.
4.	Rated burden of secondary winding	
	First winding	VA
	Second winding	VA
	Simultaneous	VA
	Rated power factor of burden	
5.	Accuracy class of secondary	
	First winding	
	Second winding	
	Phase angle error	
6.	Insulation withstand test voltages	
	Rated voltage class of primary	kV
	Capacitor divider unit	kV
	Earth terminal of capacitor voltage device1	kV
	Primary winding of electromagnetic unit	kV
7.	Whether the earth terminal of the voltage divider provided	Yes/No
	If yes, the rated voltage	
	1 minute power frequency withstand voltage	kV
8.	Whether series reactance/choke/requencying coil provided	Yes/No
	If yes, Rated voltage	kV
	1 minute power requency test voltage	kV

9.	Terminal box details	
	@ Degree of protection as per IS: 2147	
	@ Whether cable glands provided	Yes/No
10.	Rated secondary winding Voltages:	
10.1	First winding	Volts
10.2	Second winding	Volts
11.	Method of connections:	
11.1	Primary	
11.2	Secondary windings	
11.3	First winding	
11.4	Second winding	
12.	Rated voltage factor:	
12.1	Continuous	
12.2	Short time	
12.3	Duration	Sec.
13.	Rated burden of secondary Windings:	
13.1	First winding	VA
13.2	Second winding	VA
13.3	Total burden	VA
14.	Rated power factor of the burden	
15.	Accuracy class of secondaries	
15.1	First winding	
15.2	Secondary winding	
15.3	Phase angle error	
16.	Class of insulation.	
17.	Rated intermediate voltage	kV
18.	Rated primary voltage of Electro-Magnetic unit.	kV
19.	Insulation withstand test voltages	

SCHEDULE-B

‘Technical documents /Type test reports submitted’

(To Be filled up by Bidder & to be submitted with tender)

Sl. No.	Particulars	YES	NO	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 MePTCL b) For higher rated equipment than offered to MePTCL c) Same rated equipment supplied to other utility with performance certificate			
4.	All 15 Nos. of Type Test reports submitted are as per list given in TS & not more than 5 years old.			
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 hereby confirmed that the details pertain to Sl. 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: _____

2.0 WAVE TRAP

Wave traps are used in high voltage transmission line to minimize undue loss of the carrier signal in the power station networks. Its impedance shall be negligible at power frequency (50HZ) so as not to disturb the power transmission but must be relatively high over any frequency band appropriate to carrier transmission.

The coil of line trap shall be designed to tolerate the short circuit current of the line for a short period and shall withstand the mechanical stress resulting from it. HF tuning elements shall be placed in a separate sealed unit.

Line traps are to be tuned for a carrier frequency band which will depend upon the operating carrier frequency pair. Line traps are to be supplied of broad band tuned type.

A resistor shall be added in the tuning elements of the Trap. The resistive component of impedance of the line trap within its bandwidth shall not be less than 570 ohms for lines with single conductor per phase (132KV lines).

The line trap shall be provided with a protective device which will be designed and arranged so that neither significant alternation in its protective function nor physical damage shall result from either temperature rise of the magnetic field of the main coil at continuous rated current or rated short time current. The protective device shall neither enter into operation nor remain in operation following transient actuation by the power frequency voltage developed across the line trap by the rated short time current. The protective devices in the form of lightning arrestor shall be shunt connected to the main coil and the tuning device.

For proper co-ordination with the lightning arrestors installed in the substation the line traps shall be provided with protective device with normal discharge current of 10 KA.

Short duration current rating of the wave trap is the maximum rms. values of the current in KA whose thermal effect, the wave trap shall withstand for a period of one second following a continuous loading at normal rating under standard thermal conditions. The asymmetrical peak value of the first half wave of the rated short time current shall be assumed to be 2.55 times the rms. value. Line traps should conform to the following short time ratings: -

132KV

<i>(a) Normal rating in Amps.</i>	<i>1250</i>
<i>(b) Short duration current in KA</i>	<i>40</i>
<i>(c) First current amplitude in KA</i>	<i>100</i>

The line trap should be outdoor type suitable for being suspension mounted for 132KV lines. This should be mechanically strong to withstand the stresses due to maximum wind pressure of 1500 pa. The insulated structure for suspension mounting arrangement for 132KV lines should be included in offer.

Linetraps shall also conform to the following technical particulars:

132KV

(a)	Normal system voltage(KV)	132
(b)	Maximum system voltage on which linetraps are to be used(KV)	145
(c)	Rated continuous current(Amps)	1250
(d)	Minimum resistive components of Impedance within the Bandwidth(ohms)	570
(e)	Rated inductance (nett) in mH.	0.5
(f)	Visual corona Extinction Voltage (KVrms).	97kV to 105kV (rms)
(g)	Radio Interference voltage	Not exceeding 500 micro Volt
(h)	Carrier Frequency Range	(40-500 KHz)
(i)	Protective Device	10KA surge arrester
(j)	Mounting	Suspension type for PLCC applications

The bidder shall provide clamps suitable for connecting the line trap to the appropriate HTLS conductor of the H.T. line and substation equipment.

The bidder shall provide clamps suitable for connecting the line trap to the appropriate HTLS conductor of the HT line and substation equipment.

The bidder shall offer 0.5 mH line traps and shall specify various band width for minimum resistive component of impedance being not less than 570 ohms.(for 220 KV& 132KV lines).

The bidder shall also specify the bandwidth of the untuned line traps within which the tapping loss shall not exceed 2dB.For this tapping loss the characteristic impedance of the H.T. line (phase to earth of a single conductor line) maybe assumed to be 570 ohms for 132KV lines.

The tuning device shall bear ranged to permit interchange without removing the linetraps. The line trap shall be equipped with bird barrier.

The linetraps shall conform to I.E.C.Publication No.353 and I.S.Publication No.8792.

Suitable terminal connectors as per layout requirement shall be provided for Line Traps. The terminal connectors shall conform to IS: 5561.

If there is a deviation in value of 'Minimum Guaranteed resistive Component of impedance' for require Blocking Frequency range Band-I and Band-II as above then clearly indicate the same

2.1 GENERAL TECHNICAL REQUIREMENTS:

A line trap, consisting of a main coil in the form of an inductor, a tuning device and a protective device, is intended for insertion in a high voltage power transmission line between the point of connection of carrier frequency signals and adjacent power system elements such as busbar, transformers etc. The

tuning device connected across the mail coil ensures, with proper adjustment, that the line trap presents relatively high impedance at one or more carrier frequencies or carrier frequency bands, whereas the impedance of the line trap at power frequencies is negligible.

A line trap may also be used to limit the loss of carrier-frequency at a power system tee point.

2.1.1 Main Coil:

An inductor which carries the power frequency current of the high voltage transmission line.

2.1.2 Tuning Device:

The combination of capacitor, inductor and resistors connected across the main coil. All of these components may not be present at any one time, depending on the carrier frequency requirements of the line trap.

2.1.3 Protective Device:

The device connected across the main coil and tuning device which prevents the line trap from being damaged by transient over voltages which may occur across it. The protective device shall be so designed and arranged that neither a significant alteration in its protective function nor physical damage shall result either from the temperature rise or magnetic field of the main coil at continuous rated current, rated short-time current or from emergency overload current. It shall neither enter into operation as a result of the power frequency voltage developed across the line trap by rated short-time current nor shall it remain in operation after a response to a transient over voltage which is immediately followed by the power frequency voltage developed across the line trap by rated short-time current.

2.2 DESIGN REQUIREMENTS:

Ability to withstand rated short-time current:

The line trap so designed shall be capable to withstand the mechanical forces produced by asymmetrical peak value I_{km} of the short-time current and the heating effect of the rated short-time current I_{kN} .

Insulation level:

The insulation level for the insulation between the terminals of a line trap is governed by the rated voltage of the protective device. The insulation of the mail coil and the tuning device shall be adequately rated for:

- a. The voltage developed across the line trap at the rated power frequency by the rated short-time current. The rated voltage of the protective device shall be higher than this voltage developed across the line trap.
- b. The front of wave impulse spark over voltage or the residual voltage caused by the nominal discharge current of the protective device, whichever is higher.

System voltage insulation:

The system voltage insulation of a line trap is provided by insulator strings or post insulators. The line trap system voltage insulation shall be consistent with the other equipment in the associated high voltage transmission network.

Tensile strength of suspension system:

The suspension system of a line trap shall be designed for a tensile stress of at least twice the mass of the line trap in kilograms, multiplied by 9.81 to convert to newtons, plus 5000 N.

Accessories:

Bird barriers:

The bird barrier design shall be such that no entrance to the line trap shall admit a sphere having

a diameter of 16mm.

Terminal clamp/connectors:

The clamp shall be suitable for HTLS conductor. The clamp, connectors, nuts, bolts and hardware shall be of non-magnetic material and shall conform to IS: 5561. The clamp shall be fitted on incoming and outgoing pad of Line Trap with four Nos. of Nuts & Bolts. The incoming and outgoing conductor shall be on other side of the clamp fitted with the help of six bolts and nuts arrangements. The clamps shall be suitable for horizontal and vertical take off with conductor diameter 28.62 mm.

The clamp shall be designed to carry the continuous load of 630 Amp at 132KV and shall withstand a dynamic short circuit current of 20KA for 3second. The temperature rise shall not exceed 35 °C over 50 °C ambient. All the castings shall be free from blowholes, surface blisters, cracks and cavities. All sharp edges shall be blurred, rounded off and buffed.

Clamp and connectors shall be designed so as to avoid corona formation. The visual corona extinction voltage shall not exceed 97 KV (rms.). All nuts and bolts shall be suitably shrouded. Radio interference voltage for clamp and connectors shall not exceed 500 microvolt at 97 KV (rms.). No current carrying parts of the Clamps and connector shall be less than 10mm thickness.

2.3 RATING PLATES:

The main coil, the tuning device and the protective device shall be provided with rating plates of weatherproof material fitted so that they are readily visible. The inscriptions shall be indelibly marked and include the following data:

Rating plate of the main coil:

- i. Manufacturer's name & year of manufacture.
- ii. Type.
- iii. Serial number
- iv. Rated inductance (mH)
- v. Power frequency inductance (mH)
- vi. Rated continuous current (A)
- vii. Rated power frequency (Hz)
- viii. Rated short time current (kA) and duration (s)
- ix. Total weight (kg)

Rating plate of tuning device:

- i. Manufacturer's name & year of manufacture.
- ii. Type
- iii. Serial number
- iv. Frequency band(s) (KHz)
- v. Blocking impedance (minimum value) (Ohm)
- vi. Blocking resistance (minimum value) (Ohm)
- vii. Rated impulse protective level (kV)
- viii. Belonging to main coil with rated inductance (mH) and serial number

Rating plate of protective device:

- i. Manufacturer's name & year of manufacture
- ii. Type
- iii. Serial number
- iv. Nominal discharge current (kA)

- v. Rated voltage of protective device
- vi. Minimum value of power frequency spark over voltage (Dry & wet) of protective device

Special name plate:

- i. Manufacturer's name & year of manufacture
Or
- ii. Name of EPC Contractor if order for EPC project
 - a. Name of Customer
 - b. Name of Project (In case of EPC project)
 - c. A/T No.

The Line Traps shall be of outdoor suspension type. Necessary suspension device together with all accessories including insulators shall be supplied along with line trap. The Line Trap shall be lightweight suitable for hanging on the gantry of Sub station without creating any clearance problem due to large diameter, length & weight of the Line Trap. The bird barrier shall be fitted on both the sides of Line Trap.

Line trap shall be provided with single point single insulator string suspension type arrangement only.

The Line Trap shall be supplied with fitted tuning pot and Lightning arrester.

All the type test reports as per relevant IS/IEC of the Line Trap offered shall be invariably enclosed with the offer. The offer without type test report shall not be considered.

The Line Trap shall be fitted with top and bottom clamp with Connector etc. complete in all respect for connecting line trap to line side and equipment side respectively. The clamp, connector, nut, bolts, etc. which is affected by magnetic field of line trap shall be of non-magnetic material. All iron parts shall be hot dip galvanized.

The arrangement of minimum three nos. of tie rod assembly shall be required to avoid shearing from thread of tie rod assembly.

2.4 GENERAL REQUIREMENTS FOR BIDDERS:

- 1) The bidder shall furnish the full technical details, O&M manual, QAP & drawings for the Line Trap offered.
- 2) The bidder shall have the experience of at least 10 years of manufacture & supply of similar type of Line Trap.
- 3) The bidder shall furnish the full details of the orders executed.
- 4) Any deviation shall be clearly indicated separately.
- 5) The MePTCL reserves right to increase or decrease the quantity at the time of placing the order.
- 6) The MePTCL reserve right either to accept or reject any of the offers without assigning the reason.

2.5 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 for Line Trap indicating dimensions, technical parameters, weight etc.
- 2) Suspension arrangement indicating dimensions.
- 3) Name plate for line trap
- 4) Name plate for tuning pot
- 5) Name plate for protective device
- 6) Special Name plate

- 7) Tuning pot ckt arrangement
- 8) Details of terminal clamp/connectors suitable for HTLS conductor.
- 9) Suspension fittings (hardware) for line trap
- 10) Disc Insulator with general technical specification
- 11) Lightning Arrestor as protective device for Tuning Pot
- 12) Bird barriers
- 13) Other accessories of Line Trap.
- 14) Any other components/drawings not covered.

The offer without the above drawings and insufficient technical data will be evaluated accordingly or shall be liable to be rejected. Along with the drawings bidder shall have to submit the QAP with following details for the equipment offered.

- Title page with details
- Manufacturer Name & Address
- Item
- QAP No.
- Rev. No.
- Date & Total No. of Pages
- Project
- Customer
- Order No. Or A/T No.
- Name of Contractor (only in case of EPC project)

Standard Quality Assurance PLAN for Line Traps with complete details about Raw-Material and Bought out Items to be used in manufacturing of wave trap and list of routine/ acceptance test (all that acceptance test mentioned at Sr. No. 12 here under). Also the QAP shall have details of Agency and type of function (perform or witness or verification) to be conducted by agency for each individual component and operation details given in the table.

2.6 TYPE TESTS:

The Bidder shall have to submit following valid Type test reports.

The offer without Valid Type test reports shall be liable to be rejected.

LIST OF TYPE TEST REPORTS FOR 132KV, 0.5 mH, 630A Wave Trap:

- 1) Measurement of inductance of mail coil
 - power frequency inductance
 - Rated inductance
- 2) Temperature rise test
- 3) Short Time Current Test for both Mechanical & thermal behavior.
- 4) Blocking impedance Measurement test
- 5) Measurement of blocking resistance
- 6) Tapping loss Measurement
- 7) High Voltage test
 - Corona inception / Extinction test
 - Radio Interference Voltage test
 - Lightning impulse voltage withstand test.
 - Power frequency voltage withstand test.

LIST OF TYPE TEST REPORTS FOR PROTECTIVE DEVICE:

Insulation withstand tests on the arrester housings

1. Residual voltage test
 - a. Steep current impulse residual voltage test
 - b. Lightning impulse residual voltage test
 - c. Switching impulse residual voltage test
2. Long-duration current impulse withstand test
3. Operating duty test
 - a. High-current impulse operating duty test
 - b. Switching surge operating duty test
4. Short circuit
5. Arrester disconnect/fault indicator (when fitted)
6. Polluted housing test
7. Internal partial discharge test
8. Bending moment
9. Environmental tests
10. Seal leak rate
11. Radio interference voltage (RIV)
12. Power frequency Voltage Versus Time characteristics
13. Standard lightning Impulse spark over test
14. Front of Wave Impulse spark over test
15. Power Frequency spark over voltage test (dry & wet)
16. Moisture ingress test
17. Weather ageing test

LIST OF TYPE TEST REPORTS FOR TERMINAL CLAMP/CONNECTOR

(Suitable for HTLS conductor):

1. Short time current test
2. Corona Inception/Extinction test
3. Radio Interference Voltage test
4. Tension Load test (Tensile test)
5. Resistance test
6. Temperature rise test
7. Galvanizing test on Bolt, Nut & plain washer
8. Dimensional Check

2.7 ACCEPTANCE TESTS:

1. Measurement of blocking resistance & blocking impedance
2. Power frequency voltage test on tuning unit
3. Measurement of rated inductance of main coil
4. Measurement of Power frequency inductance of main coil
5. Measurement of tapping loss & tapping loss based on resistance
6. Dimensional & Visual check

2.8 SCOPE OF SUPPLY:

The bidder shall have to supply the wave trap offered with

- Tuning pot
- Lightning arrestors
- Single point suspension arrangement type insulator string assembly
- Clamps & Connectors suitable for HTLS conductor.
- Bird barriers
- Suspension hardwares & accessories
- O&M manual
- Any other accessories necessary for installation of wave trap.

The Guaranteed technical particulars of Line Trap shall be furnished in separate schedule-A. Technical data for protective device in annexure- A1, Technical data for tuning device in annexure-A2, Line trap construction data in annexure-A3 and deviation in annexure-A4 shall be brought out separately.

2.9 GUARANTEED TECHNICAL PARTICULARS

(To be furnished by the bidder)

Sl No.	Particulars	To be furnished by bidder
Schedule - A		
1	Name of Manufacturer and Country	
2	Type / Model	
3	System voltage rating	
4	Continuous current rating at 50 deg centigrade	
5	Maximum symmetrical short circuit current rating for 3 sec. Duration	
6	Asymmetrical peak value of first half wave of rated short time current	
7	Rated inductance	
8	Blocking range	
9	Minimum Guaranteed resistive component in blocking frequency range	
	a) Centre Frequency	
	b) Over Blocking Range	
10	Type of tuning	
11	Variation in 50Hz impedance over degree centigrade variation in ambient temperature.	
12	Variation in resonant frequency band per degree centigrade variation in ambient temperature.	
13	Impedance at tuned frequency.	
14	Change in impedance per degreeCentigrade change in ambient temp.	
15	Attenuation in Tuned FrequencyBand.	
16	Attenuation at the distance of 10 kHz from the tuned frequency band.	
17	Maximum Tapping los	

18	Type of Mounting	
19	Class of insulation of line trap	
20	Temperature rise in line trap under rated continuous current (Specify the value)	
21	Visual corona Inception volt	
22	Visual corona Extinction voltage	
23	Radio interference voltage	
24	Type of incoming & outgoing terminal	
25	Maximum working stress	
26	Ultimate tensile strength	
Annexure – A1 : Technical data for protective device		
1	Type of Protective device provided for protection of capacitors and coil against voltage surges & type of class	
2	Basic Insulation level	
3	Standard nominal discharge current of protective device for 8/20 micro second wave impulse	
4	Rated voltage of the protective device (Arrester)	
5	Minimum value of power frequency spark over voltage (dry & Wet) of protective device	
6	Impulse spark over voltage of protective device	
7	Virtual steepness and maximum front of wave impulse spark over voltage of protective device	
8	Maximum residual discharge voltage of protective device for 8/20 micro second impulse discharge current of a) 5000 A b) 10000 A	
Annexure – A2 : Technical data for Tuning device		
1	Power frequency withstand voltage for 5 sec	
2	Tuning band (Blocking band)	
Annexure – A3 : Line trap construction data		
1	Material of main coil	
2	Material of terminal connector	
3	Material of suspension link	
4	Material of mounting hard wares	
5	Net weight	
6	Whether corona rings are provided?	

7	Whether Bird barriers are provided?	
8	Overall diameter	
9	Total height	
10	No. of turns in Line trap main coil	
11	Type of conductor whether solid or stranded	
12	Cross sectional area of conductor	
13	Overall conductor size	
14	Type of construction i.e. No. of coils and whether open type or covered with insulating material	
15	Type and material of spacers between turn to turn	
16	No. of tie rods in tie rod Assembly	
Annexure – A4 : Deviation if any from technical requirement		

3.0 TECHNICAL SPECIFICATION OF CURRENT TRANSFORMER

3.1 GENERAL REQUIREMENTS

The current transformers shall be single phase, oil immersed and self cooled type, suitable for the services indicated and conforming to the best modern practice of design and manufacture. The design of current transformers shall be such that its accuracy shall not be affected by the presence of pollution on the external surface of its insulators.

The locations for installation of current transformers are situated in seismic zone - V. The design and construction shall be such as to provide necessary protection against the earthquake forces. Dampers and/or additional supporting structures may be provided with the current transformers, if necessary, to cater for their operation in the seismic zone.

3.2 CORES:

The cores for the current transformers shall be of 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.

The cores to be used for metering and indicating instruments shall have a saturation factor low enough not to cause any damage to meters and instruments in the event of maximum short circuit currents.

The cores to be used for distance protection and differential protection shall have a high saturation factor. Magnetisation characteristics curves of these cores shall be furnished along with the bid.

3.3 WINDINGS:

Primary winding consisting of suitable number and size of conductors shall be insulated with special paper having high mechanical strength, high electrical withstand properties and good ageing qualities. The primary winding shall be of suitably insulated electrolytic copper wire.

The rating of the secondary windings shall be one Ampere. The secondary terminal shall be brought out in a compartment for easy access. The secondary terminals shall be provided with shorting arrangements. The secondary taps shall be adequately reinforced to withstand the normal handling without damage. Suitably insulated copper wire of electrolytic grade shall be used for secondary windings.

3.4 TANK:

Each current transformer shall be of Live Tank type to be supplied filled with insulating oil and shall be hermetically sealed to prevent atmosphere from coming into contact with oil, avoid filtration and change of oil. In case, the tenderer intends to use nitrogen or any other inert gas above the oil level as to permit expansion and contraction of oil, the same shall be stated in the tender.

Both expansion chamber and tank of the current transformer shall be made of high quality steel and shall be able to withstand full vacuum and pressure occurring during transit, and thermal and mechanical stresses resulting from maximum short circuit current during operation.

All interiors or exteriors of tanks, secondary box and other metal parts shall be thoroughly cleaned to remove

all rust, scales, corrosion, grease or other adhering foreign matters. All steel surfaces in contact with insulating oil as far as accessible shall be painted with not less than two coats of heat resistant oil insulating varnish. Steel surface exposed to atmosphere if not hot dip galvanised shall be given a priming coat of zinc chromate and two coats of light grey rust preventing paint. Other ferrous parts shall be hot-dip galvanised as per relevant standard.

The metal tank shall have bare minimum number of welded joints so as to minimize possible locations of oil leakage.

Metal tank of the current transformer shall be provided with two separate earthing terminals for bolted connection to 50 x 6 mm m.s. flat to be provided by the purchaser for connection to the station earth mat. The earthing terminals shall be provided complete with adequate size washers, nuts and bolts.

The current transformer shall be provided with suitable lifting arrangement for lifting of the entire unit. The lifting arrangement (lifting eye) shall be positioned such that the porcelain bushings and tank shall not be damaged during lifting for transportation/installation.

3.5 TERMINAL CONNECTORS:

Appropriate number of terminal connectors suitable for HTLS conductor shall be supplied. Suitable terminal connectors for earth connections shall also be supplied.

3.6 BUSHINGS:

The bushing and terminal insulator, where provided for the current transformer shall conform to the latest edition of IS: 2099. The bushings shall be made of homogeneous, vitreous porcelain of high mechanical and dielectric strength. Glazing of porcelain shall be of uniform brown or dark brown colour with smooth surface, arranged to shed away rain water or condensed water particles.

The bushings shall have ample insulation, mechanical strength and rigidity for the conditions under which they will be used and shall be designed to prevent accumulation of explosive gases and to provide adequate oil circulation to remove internal heat. There shall be no undue stressing of any part of the bushings due to temperature changes and adequate means shall be provided to accommodate conductor expansion.

The bushings shall be so designed that when operating at the specified highest system voltage there will be no electric discharge between the conductors and bushings. No corrosion or injury would be caused to conductor, insulation or supports by the formation of substances produced by chemical action. The insulation of bushing shall be coordinated with that of the current transformer such that flash-over will occur only externally to the current transformers. The bushing should not cause radio disturbances when operated at rated voltage.

3.7 TERMINAL BOX AND JUNCTION BOX:

All secondary terminals shall be brought out in a weatherproof terminal box on one side of each current transformer. The exterior of this terminal box shall be hot dip galvanised. A terminal board for short circuiting of secondary terminals shall be provided.

Cable box along with necessary glands for receiving control cables suitable for mounting on the bottom plate of the terminal box shall be included in the scope of supply.

A door with locking arrangements shall be provided in the front of the terminal box so as to permit easy access to the secondary terminals. The door shall have suitable arrangement to check ingress of moisture into the terminal box.

All terminals shall be clearly marked with identification number to facilitate connection to external wiring.

Polarity shall be indelibly marked on each primary and secondary terminal.

In addition to terminal box on each current transformer, tenderer shall also supply a common junction box for each set of three current transformers of each circuit. The junction box shall be weather proof type suitable for mounting on the steel structure.

The terminal boxes and junction boxes shall be suitable for outdoor installation and shall conform to IP55 protection class.

3.8 OIL LEVEL GAUGE:

An oil level gauge shall be provided to indicate the oil level in the current transformer. The oil gauge shall be mounted in such a way that the oil level can be seen from the ground level.

3.9 PRESSURE RELIEVING DEVICES:

Each current transformer shall be provided with a pressure relieving device so as to prevent bursting of current transformer even under unfavourable conditions.

3.10 OIL DRAIN COCK:

An oil drain cock along with a stop cock shall be provided in the bottom flange so as to permit taking of oil samples for testing.

3.11 OIL FILLING COCK:

An oil filling cock along with a stop cock shall be provided for filling the oil in the current transformer.

3.12 MOUNTING STRUCTURES:

The current transformers shall be mounted on steel structures, at a height of 2.5m from ground level. The tenderer shall ensure that the CTs supplied can be mounted on the existing steel (galvanized) structures. Necessary connecting materials, such as clamps, bolts, nuts, washers, etc. as well as foundation bolts for the supporting structures shall be supplied by the tenderer.

3.13 RATING PLATE:

Each current transformer shall be provided with a non-corrosive rating plate in accordance with latest edition of IS: 2705 Part-I. Following additional particulars shall also be marked on the rating plate of each current transformer.

- a) Purpose (measurement or protection), rated output at 0.9 PF lagging, rated accuracy factor and rated class of accuracy of each secondary winding in terms of IS: 2705.

- b) Terminal numbering of each secondary winding.
- c) Knee point voltage.
- d) Maximum exciting current at knee point voltage.
- e) Secondary winding resistance at 75°C.
- f) Rated instrument security factor in respect of winding meant for measurement and metering.

3.14 INSULATING OIL:

The quantity of oil for first filling of each CT and the complete specifications of oil proposed to be used shall be stated. It would be desirable to use oil conforming to the provisions of latest IS: 335.

3.15 TESTS:

3.15.1 ROUTINE TESTS:

Each current transformer shall be subjected to routine tests as specified in the latest edition of IS: 2705 (Part I to IV). If the purchaser wishes to have a representative, tests shall be performed in his presence so as to be witnessed by him.

The routine tests shall consist of the following:

- (a) Verification of terminal markings and polarity
- (b) Power frequency dry withstand tests on primary winding
- (c) Power frequency dry withstand test on secondary windings
- (d) Over voltage inter-turn test
- (e) Partial discharge tests
- (f) Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class as per individual parts of IS: 2705.
- (g) Knee-point voltage and exciting current for PS Class cores
- (h) Secondary winding resistance for PS Class cores
- (i) Turns ratio for PS Class cores

3.15.2 TYPE TESTS:

The bidder shall furnish four sets of all the type test reports from CPRI or other accredited laboratories along with the offer. The type tests must have been conducted less than five years from the date of opening of bid. The Purchaser reserves the right to repeat the type tests in the presence of a representative at the cost of the Supplier.

The type tests shall be in accordance with the latest edition of IS: 2705 (Part I to IV), and shall consist of the following:

- (a) Short-time current test

- (b) High voltage power frequency wet withstand test
- (c) Determination of errors or other characteristics according to the requirements of the appropriate designation or accuracy class as per individual parts of IS: 2705.
- (d) Temperature rise test
- (e) Lightning impulse voltage test
- (f) Degree of protection tests of secondary terminal, junction box

All the test reports shall be submitted and got approved by the purchaser, before despatch of the equipment.

3.15.3 SPECIAL TESTS:

The special tests shall consist of the following:

- a. Chopped lightning impulse test as a type test
- b. Measurement of dielectric dissipation factor for oil immersed current transformers
- c. Mechanical test

3.16 DRAWINGS AND INSTRUCTION MANUALS:

The tenderer shall submit, with the tender, all the drawings enumerated in this specification to enable to purchaser to assess the suitability of equipments.

As soon as possible after the award of the contract, the manufacturer shall supply six copies of the following drawings which shall describe the equipment in full details for approval and shall subsequently provide eight complete sets of final approved drawings, one of which shall be autopoitive/soft copy suitable for reproduction.

- i. Outline dimensional drawings.
- ii. Assembly Drawings.
- iii. Cross sectional view of the current transformer.
- iv. Drawings giving details of supporting structures and foundation.
- v. Drawing showing the details of terminal connectors.
- vi. Magnetising curves.
- vii. Wiring diagram with polarity mark.

In addition to the above drawings, the tenderer may supply any other drawing, which in his opinion is required to describe the equipment in full details.

After the completion of the erection work, the contractor shall furnish seven sets (including one reproducible on soft copy) of the completion drawings. Six copies of instruction manuals covering instruction for installation and maintenance check tests shall be supplied by the contractor as a part of this contract.

3.17 SPARE PARTS:

A list of spare parts recommended for five years operation for the current transformers shall be furnished with the tender. The purchaser shall decide the actual quantity of spare parts to be ordered on the basis of the list and the item-wised prices of spare parts called for in Schedule-V.

3.18 COMPLETENESS OF EQUIPMENT:

The tenderer shall be complete in all respect and include all accessories which may not be specifically mentioned in this specification but which are essential for the completeness of equipment ordered.

3.19 DEVIATIONS FROM SPECIFICATIONS:

All deviations from the specification shall be separately listed as per proforma given in Schedule-III, in the absence of which it shall be presumed that the provisions of the specification are complied with by the tenderer.

3.20 ERECTION AND SUPERVISION:

The purchaser may at his discretion ask the tenderer to do either the complete erection or supervision of erection at site of the equipment covered by this specification. The tenderer shall, therefore, quote their charges separately for (i) erection and (ii) rates for supervision of erection.

However, if it is decided to do the erection of the above equipment departmentally, the tenderer shall furnish full and detailed instructions complete with drawings and leaflets to enable the satisfactory erection and commissioning of the equipment by the purchaser. Such instructions shall reach the purchaser well in advance so that there is no delay in commencement of erection. The successful tenderer shall supply all special tools necessary for erection. Details of such tools and the price thereof shall be stated in the tender separately.

3.21 GUARANTEED TECHNICAL PARTICULARS:

Guaranteed technical particulars as called for in Schedule-I shall be furnished alongwith the tender. Any tender lacking the complete information in this respect is likely to be rejected. Particulars which are not subject to guarantee shall be clearly marked.

3.22 PACKING & FORWARDING:

The equipment shall be packed in suitable crates so as to withstand handling during transport and outdoor storage. The supplier must be responsible for any damage to the equipment during transit due, to improper and inadequate packing. Any material found short/damaged shall be replaced by the supplier at no extra cost to the purchaser.

3.33 TECHNICAL DATA SHEET FOR CURRENT TRANSFORMER

APPENDIX-I

TECHNICAL REQUIREMENT FOR 132 KV CURRENT TRANSFORMERS

The Current Transformers under this specification shall conform to the parameters given below:-

Sl.	Item	Specification
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No.		132 KV
1	Type of CT/Installation.	Single phase, dead tank, oil filled, hermetically sealed, outdoor, self-cooled.
2	Type of mounting.	Pedestal type
3	Suitable for system frequency.	50 HZ $\pm$ 5 %
4	Rated voltage (KV rms)	132
5	Nominal system voltage (KV rms)	132
6	Highest system voltage (KV rms)	145
7	Current ratio (A/A)	800-400 /1/1/1/1A
8	Method of earthing the system where the current transformer will be installed.	Solidly effectively earthed.
9	Rated continuous thermal current (A)	120 % of rated primary current
10	Acceptable limit of temperature rise from ambient temperature for continuous operation at rated continuous thermal current.	
(a)	Winding	45°C
(b)	Oil	40°C
(c)	External surface of the core, metallic parts in contact with or adjacent to, insulation.	45°C
11	Acceptable partial discharge level	Less than 10 pico coulombs
12	Maximum radio interference voltage at 1.1 times the maximum rated voltage.	Less than 500 micro volts
13	1.2/50 micro second lightning impulse withstand voltage (KVP) (dry)	650
14	1 minute dry power frequency withstand voltage primary (KV rms)	275
15	Switching Impulse with stand and voltage (KVP)	
16	1 Minute dry power frequency withstand voltage secondary (KV rms)	3
17	Minimum creepage distance of porcelain Housing (mm)	3625
18	Rated short time withstand current for 1 second at all ratios (KA rms)	31.5 KA
19	Instrument security factor at all ratios for metering core.	Less than 3.5
20	Minimum rated short time thermal current density of the primary winding at all ratios (A/mm ²)	As per clause No9.6.3-Note of IS: 2705 (Part-I)/1992
21	Application, current ratio, output burden, accuracy class, minimum knee point voltage, secondary winding resistance, maximum	Enclosed in separate sheets

	excitation current at minimum knee point voltage etc.	
22	Type of core	Torroidal type
23	Seismic acceleration	0.15g (Vertical) 0.3g (Horizontal)
24	Dielectric dissipation factor at 145/1.732KV (for 132 KV C.T.) at ambient temperature	0.005 or less
25	Accuracy class of standard C.T. to be used during testing towards determination of ratio errors and phase angle errors for metering cores.	0.05 or better

The current transformers of shall have the following characteristics.

Voltage Rating	Rated transformation ratio/core	Accuracy class at all ratios	Rated Burden at all ratios	Accuracy limit factor/instrument security factor at all ratios	Knee point voltage at all ratios	Purpose.
132KV	800-400 /1/1/1/1A					
	Core-I	0.2s	30 VA	$ISF \leq 3.5$	-	Metering
	Core-II	0.2s	30 VA	$ISF \leq 3.5$	-	Metering
	Core-III	5P	30 VA	ALF : 10	-	O/C & E/F protection.
	Core-IV	PS	-	-	$40R_{CT} + 155$	Differential protection
	Core-V	PS	-	-	$40R_{CT} + 155$	Differential protection

4. TECHNICAL SPECIFICATION OF LINE MATCHING UNIT (LMU) / COUPLING DEVICE

4.1 The coupling devices shall be interposed between the capacitor voltage transformer and coaxial line to the PLC transmitter/receiver, and in conjunction with the capacitor voltage transformer shall ensure :

- a) Efficient transmission of carrier frequency signals between the carrier frequency connection and the power line.
- b) Safety of personnel and protection of the low voltage parts and installation, against the effects of power frequency voltage and transient over voltages.

4.2 The coupling device, in conjunction with the CVT shall form an electric filter of band pass type :

- a) It shall match characteristic impedance of H.T. line to impedance of the carrier frequency connection.
- b) Galvanic isolation between primary and secondary terminals of the coupling device shall be performed by the above-mentioned transformer.
- c) Power frequency currents derived by the CVT may be drained to the earth by a separate inductance termed drain coil of suitable rating.
 - c) Voltage surges coming from the power line at the terminals of the coupling device shall be limited by a non-linear surge arrester of suitable rating in the primary side. Requirement of a gas type voltage arrester in secondary side of the coupling device shall have to be fully justified,
 - d)
 - e) but in any case, the input circuit of PLC. equipment shall have protective devices in the form of zener diodes and surge suppressers. The surge arrester shall have power frequency spark over voltage coordinated with the equipment ahead of it.
- e) For direct and efficient earthing of its primary terminals, the coupling device shall be equipped with an earthing switch. The Earth Switch shall be available for earthing of CVT-HT terminals, when the coupling filter units are removed from circuit for maintenance/ replacement. The design shall take due regard of requirements for safety in accordance with the Indian Electricity Rules.

4.3 Two numbers 'phase to earth' type coupling filters shall be used to achieve 'phase to phase'/'inter-circuit coupling'. Connection between secondaries of the two phase to earth type coupling device shall be through a balancing transformer/hybrid such that reliable communication shall be ensured even when one of the coupled phase is earthed or open circuited on the line side.

4.4 Coupling device shall conform to IEC-60481 and shall have the following carrier frequency characteristics as applicable to a phase to earth type coupling device:

- a) Nominal line side
 - i) 240 ohms for 765kV and 400 kV Quad/triple impedance bundle conductor line.
 - ii) 320 ohms for 400kV twin bundle conductor line.
 - iii) 570 ohms for 220/132 kV line
- b) Nominal equipment 75 ohms (unbalanced) side impedance
- c) Composite loss Not more than 2 dB
- d) Return Loss Not less than 12 dB

- e) Bandwidth Shall suit the frequency plan between 36 and 500 kHz
- f) Nominal peak Not less than 650 Watt.envelope power (for Inter-modulation product 80 dB down)

4.5 The coupling device shall be suitable for outdoor mounting. Temperature of metallic equipment mounted outdoor is expected to rise upto 65 deg. C during the maximum ambient temperature of 50 deg. C specified. The equipment offered by the Bidder shall operate satisfactorily under these conditions.

4.6 The H.T. Terminal of coupling device shall be connected to H.F. Terminal of the CVT by means of 6 mm sq. copper wire with suitable lugs & taped with 11 kV insulation by the contractor.

4.7 Coupling device shall have at least two terminals for carrier equipment connection. Bidder shall confirm that such a parallel connection to coupling device directly will not result in any additional attenuation.

4.8 The coupling device including the drainage coil, surge arrester and earthing switch shall conform to type tests and shall be subject to routine tests as per IEC-60481/IS:8998.

Routine tests shall include but not be limited to the following :

- i) Composite loss and return loss tests on coupling device.
- ii) Turns ratio test and insulation tests on the balancing transformer.
- iii) Milli volt drop test, power frequency voltage test and mechanical operation test on earthing switch.
- iv) Power frequency spark over test for lightning arrester as per relevant IS/IEC.

4.9 Reports for the following type tests on coupling device shall be submitted as mention below:

- 1.)Return loss test.
- 2.)Composite loss test.
- 3.)Distortion and inter modulation test .
- 4.)Impulse voltage test.
- 5)Tests on Arrestors

Bidder shall furnish, along with his bid copies of all type and routine test conducted earlier on similar coupling device in accordance with relevant standards.