SECTION – 2.14

CURRENT TRANSFORMER

1.0.0 INTRODUCTION

This section covers the requirements of the 132kV Current Transformer.

2.0.0 SCOPE OF WORK

2.1. The scope of work shall be include but not limited to the design, engineering, manufacture, testing inspection at manufacturer's works, packing supply, transportation, transit insurance, delivery to site of 132kV Current Transformer. The design and engineering shall make use of most recent international standards and best design practices.

2.2. The existing CTs (other than tariff metering CT's – MCT's) shall be replaced by the new CTs at respective existing locations. The existing support structures & accessories may be utilized subject to validation of its suitability. For Line Tariff metering MCT's (3-Phase) at GIPCL end shall be installed after removal of existing wave trap which is installed only in "R" phase.

2.3. The Bidder shall be solely responsible for carrying out all required assessments related to installation and or removal of 132 kV equipment's including installation of new MCTs at the remote end (GETCO/STU) substation.

2.4. Bidder shall be responsible for proper operation of complete unit assembly as indicated by the factory as indicated by the factory performance test. field acceptance tests and as required by the provisions of the code.

2.5. Dedicated CT shall be provided for metering purpose.

2.6. Current transformer GTP, various test certificate and details specification including but not limited to number of tapings, number of cores, burden, ISF, ALF , accuracy class, Rct, knee point voltage, excitation current etc mentioned in this section and in SLD is indicative and shall be finalised during details engineering subject to approval of STU/GECO/ Concern competent statutory authorities and project requirement without any cost to the owner.

2.7. All required approvals from STU/GETCO or any other concerned statutory authority and liasioning are in the scope of the Bidder.

2.8. Tariff metering CT testing shall be carried out at a third-party NABL-accredited laboratory (other than the OEM), in accordance with the testing requirements of GETCO/SLDC/DISCOM or other applicable authorities. The NABL laboratory shall be subject to approval by GETCO/SLDC/DISCOM. Testing shall be witnessed by representatives of GETCO/SLDC/DISCOM, and specifications shall comply with the requirements of the competent authority.

2.9. Post-testing, instrument transformers are typically sealed by the authorities and kept under their custody until commissioning. All necessary liaisoning in this regard shall be in the scope of the bidderCommissioning testing and sealing activities at site by GETCO/SLDC/DISCOM or other applicable authorities shall be arranged by the bidder.

2.10. Equipment shall be procured from GETCO approved vendors only.

3.0.0 CODES AND STANDARDS.

3.1. The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the relevant IS / IEC standards including amendments, if any, except where modified and / or supplemented by this specification. Some of the applicable standards are listed below.

IS 2705(PART 1 TO 4)	Current Transformer
IS 11322	Partial Discharge Test
IEC 6189-1	Instrument transformers-Part 1: General requirements
IEC 6189-2	Instrument transformers - Part 2: Additional requirements for current transformers
IEC 6189-103	Instrument transformers - The use of instrument transformers for power quality measurement
IEC 60044-1 & IEC 60044-2	International standard for instrument transformers
IEC 60060	High Voltage Test techniques. Part-1 General definitions and test requirements
IEC 60270	High-voltage test techniques – Partial discharge measurements
IEC 62155	Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V
IEC 60507	Artificial pollution tests on high-voltage ceramic and glass insulators to be used on A.C. systems
IEC 60376	Specification of technical grade sulphur hexafluoride(SF6) for use in electrical equipment
IEC 60529	Degrees of protection provided by enclosures (IP code)
IEC-815	Porcelain housing for instrument transformer

4.0.0 Schedule of Current Transformer

- The basic details of CT's to be installed at GIPCL 132 kV switchyard is tabulated hereunder.

Substation	132 kV Bay		Core	Purpose	Class	Qty (Single Phase)	Installation Location
GIPCL	Line-3	MCT	Core-1	Tariff Metering (ABT Meters)	0.2s	3	New
		CT	Core-1	Busbar Protection Main-1, Check-1 and LBB-1	PS	3	Existing
			Core-2	Busbar Protection Main-2, Check-2 and LBB-2	PS		
			Core-3	General Purpose Metering (PQM, PMU)	0.2s		
			Core-4	Line Protection (87L, 21, 67, 79 etc.)	PS		
			Core-5	Spare	PS		
	Line-4	MCT	Core-1	Tariff Metering (ABT Meters)	0.2s	3	New
		CT	Core-1	Busbar Protection Main-1, Check-1 and LBB-1	PS	3	Existing
			Core-2	Busbar Protection Main-2, Check-2 and LBB-2	PS		
			Core-3	General Purpose Metering (PQM, PMU)	0.2s		
			Core-4	Line Protection (87L, 21, 67, 79 etc.)	PS		
			Core-5	Spare	PS		
	70 MVA Transformer	CT	Core-1	Transformer Protection (87T, 67 etc.)	PS	3	Existing
			Core-2	Transformer Protection (64R)	PS		
			Core-3	General Purpose Metering (MFM)	0.2s		
			Core-4	Busbar Protection Main-1, Check-1 and LBB-1	PS		
			Core-5	Busbar Protection Main-2, Check-2 and LBB-2	PS		
	Bus Coupler	CT	Core-1	Busbar Protection Main-1, Check-1 and LBB-1	PS	3	Existing
			Core-2	Busbar Protection Main-2, Check-2 and LBB-2	PS		
			Core-3	General Purpose Metering (MFM)	0.2s		
			Core-4	Protection (50,51, 50N, 51 N etc.)	5P20		
	Total Number of Current Transformers					**18**	

Note: Minimum Number of Tapping for each core of all CT's shall be 3 (Three)

- The conceptual details of CTs to be installed at the GETCO 132 kV GETCO / STU / Grid Substation (GSS) are furnished in the table below. The bidder shall provide optional costs for each type of Line CTs in the price schedule.

Substation	132 kV Bay		Core	Purpose	Class	Qty (Single Phase)	Installation Location
GETCO / STU / GSS	Line-3	MCT	Core-1	Tariff Metering (ABT Meters)	0.2s	3	New
		CT	Core-1	Busbar Protection Main-1, Check-1 and LBB-1	PS	3	Existing
			Core-2	Busbar Protection Main-2, Check-2 and LBB-2	PS		
			Core-3	General Purpose Metering (MFM, PQM, PMU)	0.2s		
			Core-4	Line Protection (87L, 21, 67 etc.)	PS		
			Core-5	Spare	PS		
	Line-4	MCT	Core-1	Tariff Metering (ABT Meters)	0.2s	3	New
		CT	Core-1	Busbar Protection Main-1, Check-1 and LBB-1	PS	3	Existing
			Core-2	Busbar Protection Main-2, Check-2 and LBB-2	PS		
			Core-3	General Purpose Metering (MFM, PQM, PMU)	0.2s		
			Core-4	Line Protection (87L, 21, 67 etc.)	PS		
			Core-5	Spare	PS		
	Total Number of Current Transformers					**12**	

Note: Minimum Number of Tapping for each core of all CT's shall be 3 (Three)

5.0.0 SPECIFIC DESIGN REQUIREMENTS

5.1. Instrument transformers shall be hermetically sealed single-phase units, oil immersed, self-cooled suitable for outdoor installations as per IEC 60044-1.

5.2. It shall be either dead tank or live tank type. The secondary terminals shall be brought out at the bottom to a weather-proof (IP55) terminal box. All ratios shall be provided at secondary taps.

5.3. The current density of conductor shall not exceed the following values:

a. For Copper – 1.65 A/sq. mm @ rated continuous thermal current.

b. For Aluminum – 1.00 A/sq. mm @ rated continuous thermal current.

5.4. Current Transformers shall have single primary – either ring type or hair pin type Each Current Transformers shall be furnished with a number of independent cores with ratios and other ratings as required.

5.5. Different ratios of each core shall be achieved by secondary taps only and primary reconnection is not acceptable.

5.6. The secondary winding shall be rated for 1A continuously. (However secondary current rating 1A or 5A is subject to approval of STU/GETCO)

5.7. The current transformer shall be suitable for horizontal transportation. Current Transformers shall be suitable for high-speed auto reclosing.

5.8. CTs for protection shall be provided with PS class. For metering, 0.2s accuracy class CTs shall be used.

5.9. Core lamination shall be of cold rolled grain-oriented silicon steel or other equivalent alloys. μ metal or nano-crystalline core can also be used for metering cores.

5.10. The Current Transformers shall conform to the type tests and routine tests as per IEC 61869-1 & 2. Bidder shall perform all tests mentioned in IEC 61869-1 & 2 without any cost implication.

5.11. Bidder to provide detailed Datasheet of Current Transformer mentioning all technical parameters as per relevant IEC/IS standard.

Constructional Feature

5.12. The current transformer shall be single pole unit, designed for upright mounting on steel structure and furnished complete with fixing hardware.

5.13. Insulator shall be of wet process porcelain, brown glazed and free from imperfections. All metal parts and hard wares shall be hot dip galvanized.

5.14. The creepage distance shall correspond to the value required. Grading ring, if required, shall be furnished to maintain voltage gradient within permissible limit.

5.15. Current transformer shall be provided with oil level gauge, drain plug and pressure relief device. An inert gas cushion/ stainless steel bellow shall be provided on top for expansion of the oil.

5.16. Insulating oil to be used shall be EHV grade conforming to IS 335 / IEC-60296

5.17. Polarity marks shall indelibly be marked on each current transformer and at the lead terminals at the associated terminal block.

5.18. Current transformer shall be so constructed as to ensure that the oil does not flow out or leak out even when the current transformer is used continuously at the maximum allowable temperature.

5.19. Secondary terminal box mounted along with the instrument shall conform to all requirements given elsewhere in the document. The wiring diagram for the interconnection of three phase current transformer shall be pasted inside the box. Terminal blocks in the junction box shall have facility for star/delta formation, short circuiting and grounding of secondary terminals. The box shall have enough terminals to wire all control circuits plus 20% spare terminals.

5.20. Common marshalling box shall be supplied to terminate all three single phase instruments wiring together. The box shall have enough terminals to wire all control circuits plus 20% spare terminals.

5.21. The insulator shall be one piece without any metallic flange joint.

5.22. Core lamination shall be of cold rolled grain-oriented silicon steel or other equivalent alloys. The cores shall produce undistorted secondary current under transient conditions at all ratios with specified parameters.

5.23. The CT shall be provided with oil filling plug, drain plug, and oil sight glass which should be clearly visible to maintenance personnel standing on ground.

5.24. The secondary terminals of CT shall be terminated to suitable number of stud type non-disconnecting and disconnecting terminal blocks as required inside the terminal box of degree of protection IP 55 at the bottom of CT.

5.25. Different ratios shall be achieved by secondary taps only; primary reconnection shall not be accepted.

5.26. The Instrument Security Factor (actual) at all ratios shall be less than five (5) for metering core.

5.27. Current transformers shall be suitable for high-speed auto reclosing.

5.28. Tariff metering / Revenue metering CT terminal block (TB's) and CT terminal box shall be tamperproof sealing facilities as per GETCO/STU/DISCOM prevailing practices.

Bushing (For Oil Filled CT)

5.29. Oil filled condenser type porcelain bushing/insulator conforming to latest edition of IS:2009/IS:5621 shall be used for 132kV CT class.

5.30. Oil expansion chamber and bushing clamp shall be of high strength. They shall have smooth surface to prevent discharge taking place between the metal parts and porcelain as a result of ionization. Ferrous parts only shall be hot dip galvanized.

5.31. The insulation of bushings shall be coordinated with that of the current transformer such that the flashover, if any will occur only external to the CT.

5.32. Each of the bushings porcelain shall have creepage distance suitable for different voltage class as specified in specific technical parameters

5.33. Cantilever strength of bushing/insulator shall be as per IS:2099 for 132kV Voltage class

Terminals

5.34. The primary terminals shall be made of heavily tinned electrolytic grade copper when the primary winding is of copper. Palm type Aluminium primary terminals shall be provided when primary winding is of Aluminium.

5.35. The current density of the terminal pad shall not be greater than that of primary winding current density. Polarity shall be marked on each terminal.

5.36. Suitably insulated copper wire of electrolytic grade shall be used for secondary windings. For multi ratio design, suitable tapping shall be provided on the secondary winding.

5.37. Secondary terminals shall be brought out to a terminal box and suitable for connection to 1100V, FRLS, PVC insulated multi strand 6 sq.mm copper conductors per way.

5.38. All primary and secondary terminals shall be clearly and indelibly identified as per relevant standard.

5.39. The terminal box shall be of 3 mm thick sheet steel, IP-55, weatherproof and dust-tight, complete with gasketed front access cover and removable gland plate at bottom for cable entry.

Junction Box for CT

5.40. CT junction box shall be outdoor type having IP-55 class of protection with suitable canopy of gasketed weatherproof construction fabricated from sheet steel minimum 2mm thick.

5.41. The box shall have front access door with lock and key and removable gland plate at the bottom for cable entry.

5.42. The junction box shall have stud type (non-disconnecting) terminals. Arrangement shall be provided for shorting of the secondary terminals while the CT is in energized condition for testing and other purposes. Sufficient space shall be provided so that all terminals are accessible. Number of spare terminals shall be 20% in each terminal station.

5.43. All incoming and outgoing connections in the junction box shall be properly marked with ferrules.

5.44. The box shall be epoxy painted to shade 631 of IS 5

5.45. Marshalling boxes shall not be used for tariff metering CTs (MCTs). All cables from each single-phase CT shall be directly routed and terminated at the metering panel/cubicle, without any intermediate joints, to ensure measurement integrity and compliance with metering requirements.

Grounding

5.46. Each current transformers shall be provided with two ground pads for connection to station ground mat.

5.47. The ground pad shall comprise buffed metal surface with two holes, M10 G.I. bolts and spring washers to receive Cu flat of appropriate size.

6.0.0 TESTS

Minimum requirement of testing is mentioned hereunder. However, bidder to comply all requirement of STU/GETCO.

Type Tests

- Lightning Impulse Voltage Test.
- Multiple chopped lightning impulse test. (IEC-60044-1 Clause-9.1)
- High Voltage power frequency wet withstand voltage Test.
- Short time current test.
- Temperature rise test.
- Determination of errors or other characteristics according to the requirements of the appropriate designation and accuracy class as per individual parts of IS: 2705.

- Instrument Security Factor Test.
- IP-55 Test on Secondary Terminal Box. (In addition to the above tests, following type

Routine Tests

- Appearance and Dimensional Check.
- Verification of Terminal Marking and polarity.
- Verification of all individual parts / components of the Current Transformer toensure to have complied the above specification.
- Measurement of Insulation Resistance.
- Power Frequency Dry Withstanding Test on Primary and Secondary windingincluded.
- Primary intersections.
- Over – Voltage Inter-turn test.
- Partial discharge Test
- Knee point voltage and Excitation current measurement for 'PS' class cores.
- Secondary winding resistance measurement.
- Determination of errors.
- ISF Test.
- Leakage Test.
- Magnetization Characteristics of the Current Transformers.
- Turn ratio error on 'PS' class cores.
- Measurement of capacitance.
- Measurement of tan delta at 0.3, 0.7, 1.0 and 1.1 $U_M/\sqrt{3}$

Test Witness

- Tests shall be performed in presence of employer representative if so desired. The Bidder shall give at least seven (07) days' advance notice of the date when the tests are to be carried out.

Test Certificates

- Certified reports of all the tests carried out at the works shall be furnished in four (4) copies for approval of the employer.
- The equipment shall be dispatched from works only after receipt of employer written approval of the test reports.
- Type test certificate on any equipment, if so desired by the employer, shall be furnished. Otherwise, the equipment shall have to be type tested, free of charge, to prove the design.

Maintenance responsibility during Guaranteed Availability Period

- During the Guaranteed Availability Period, Supplier shall take continual actions to ensure guaranteed availability and shall make available all the necessary resources such as specialist personnel, spare parts, tools, test devices etc. for replacement or repair of all defective parts and shall have prime responsibility for keeping the system operational

All type test report as per the applicable standards shall be submitted.

7.0.0 GUARANTEED PARTICULARS

Electrical and mechanical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, M/s Employer shall have the right to reject the material. Guaranteed Technical particulars are to be submitted by the successful bidder during detailed engineering along with submitted drawings / documents.

8.0.0 WARRANTY

All the equipment included in the scope shall satisfy the warranty of 12 months from the date of Commissioning, or 18 months from delivery at site whichever later.

9.0.0 QUALITY CONTROL

Bidder shall submit the MQAP, FAT and FQP for all the replaced electrical equipment.

10.0.0 DOCUMENTS REQUIRED TO BE SUBMITTED BY BIDDER AT TIME OF PROPOSAL:

a. Quality assurance plan.
b. Material test certificates.
c. Technical data sheets for all equipment covered.
d. Installation drawings and manuals for all equipment/ systems.
e. Current UL/ FM certificates

11.0.0 DOCUMENTS REQUIERD TO BE SUBMITTED AFTER AWARD OF CONTRACT:

a. Detailed design / drawing submission schedule including erection, testing & commissioning schedules.
b. Operation and maintenance manual for all equipment.
c. Technical data sheets for all equipment covered.
d. Detailed write-up, Layout drawings and equipment drawings etc.
e. Detailed write-up for shop tests and site performance tests.
f. Test certificates for type/ routine and standard acceptance tests.
g. As-built drawings for all equipment/ systems supplied under this contract and all buildings/ structures/ works
executed under this contract incorporating all changes/ modifications up to the time of commissioning / handling over to the Owner.
h. Materials test certificates and performance test certificates for all equipment tested at works.
i. Drawings/ data required to be submitted to statutory authorities.
j. Any other document/ details as required as per approved QAP.

12.0.0 TECHNICAL PARTICULARS

Sl. No	Description	Particulars
A	**General**	
1.	Type of Current transformer	Outdoor type
2.	Rated frequency	50 Hz
3.	Type of insulation	Class A
4.	System neutral earthing	Effectively earthed
5.	Temperature rise	As per IEC 60044
6.	Number of terminals in marshalling box	As per requirement
B	**132kV Metering Current transformer (Oil filled type)**	**Quantity**- 3 numbers
1.	Rated short time thermal current	31.5 kA for 1 sec
2.	Rated dynamic current	78.8 kA (Peak)
3.	Rated system voltage (Um)	132 kV (rms)
4.	Highest system Voltage	145 kV (rms)
5.	Creepage Distance	31mm/KV
6.	1.2/50 micro-sec. impulse	650 kVp
7.	One minute power frequency withstandvoltage	275 kV rms
8.	Rated extended primary current	120% of rated primary currentas per SLD
9.	Type of insulation	Oil immersed class A
10.	Type	Outdoor, oil filled, hermetically sealed
11.	Accuracy class for tariff metering	0.2S