

SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram



TECHNICAL SPECIFICATION

220KV & 110kV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: SCM-SPEC/XT/220kV & 110kV CTs (Live / Dead Tank)

Rev.#: 1

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SUPPLY CHAIN MANAGEMENT THIRUVANANTHAPURAM

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APPLICABLE TO KSEBL

Rev#1

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(ii) Amendments and History

Sec. #	Rev. #	Date	History of Change
4(2), 6.4, 6.5.1(8), 7.6, 8	R1/08/2022	IS/IEC Standard corrected
3(7)	R1/08/2022	Rated short circuit current for 1 sec. duration – 50kA for 220kV system and 40kA for 110kV system.
11	R1/08/2022	Inspection – 220kV Current Transformers Stage Inspection added

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1. PURPOSE:

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **220kV & 110kV Current Transformers (Live/ Dead Tank Type) of various ratings and Supporting Structures** in a professional manner

2. SCOPE:

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL. Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of **220kV & 110kV Current Transformers (Live/ Dead Tank Type) of various ratings and Supporting Structures** used in field by KSEBL

3. RESPONSIBILITY:

The Executive Engineer (T), Office of Chief Engineer, Supply Chain Management shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions

4. PROCEDURE FOR REVISION:

Modifications if any, in the technical specification will be incorporated as **Revisions**. Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev. No.0.1, 0.2 etc.**

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A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev. No.1.0, 2.0 etc.**

All the details of regarding the revisions (both minor and major) will be incorporated in **“(ii)-Amendments and history”** above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by **Chief Engineer (SCM)**. Those who notice any discrepancy or have any suggestion regarding revision, may bring the matter to the attention of Chief Engineer (SCM) in writing or through e-mail id:**cescm@kseb.in**

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TECHNICAL SPECIFICATION OF 220KV AND 110KV CURRENT TRANSFORMERS (Live Tank /Dead Tank Type)

1) Scope:-

This section covers the design, manufacture, assembly, testing at the manufacturer's works, supply and delivery of outdoor, **Dead Tank (hair pin type only)/ Live Tank design**, oil impregnated paper, single phase current Transformer with **Primary winding of high purity annealed high conductivity electrolytic Copper /Aluminium** meeting the requirements of IEC 28/ (IS:16227) and the **secondary windings shall be of suitably insulated copper wire of electrolytic grade** as detailed in the enclosed schedule of requirement for relaying and metering service in three phase solidly ground system AC System. The Current transformers shall be so constructed that it can be easily transported to site within the allowable limitation and in horizontal position, if transport limitations so demand. 220kV and 110kV Current transformers shall be with **silicon polymer insulator** and supporting structure.

The bidder shall give assurance for trouble free and maintenance free performance for a period of 36 (Thirty six) months from the date of receipt at store, during which period, the CTs shall be repaired/reconditioned/replaced free of cost immediately in case of any trouble. Therefore, the bidder shall ensure that sealing of Current Transformer is properly achieved.

2) Type and Rating:-

The current transformers shall be of the outdoor Dead Tank (hair pin type only)/ Live tank type, single phase, 50Hz. Oil immersed and self-cooled and suitable for operation in humid atmospheres and in the tropical sun with temperature up to 40°C. Ambient temperature class of -5/40°C shall be adopted. They should be suitable for use in areas subject to heavy lightning, storms and heavy rains.

3) The Current Transformers shall have the following ratings.

System Parameter:-

SI No	Description of parameters	220kV System	110kV System
1)	Maximum system operating voltage	245kV	123kV
2)	Rated frequency	50Hz	50Hz
3)	Number of phase	3	3
4)	Rated insulation levels		
i)	Full wave impulse withstand voltage(1.2/50micro sec)	1050kVp	550kVp

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ii)	Switching impulse withstand voltage(250/2500 micro sec.) dry and wet	NA	NA
iii)	One minute power frequency dry and wet withstand voltage(rms)	460kV	230kV
5)	Maximum radio Interference voltage for frequency between 0.5MHz and 2MHz 156kV rms for 220kV system	2500 Micro Volt	2500 Micro Volt
6)	Minimum creepage distance mm	25mm/kV (6125mm)	25mm/kV (3075mm)
7)	Rated short circuit current for 1 sec. duration	50kA	40kA/1sec.
8)	System Neutral Earthing	Solidly earthed	Solidly earthed
9)	Rated Continuous Thermal Current	120%	120%
10)	Transformation ratio	1600-800/1A (5C)	1200/600/1A (4C)
		1200/800/1A (5C)	800/400/1A(4C)
		600/300/1A(5C)	400/200/100/1A(4C)
		200/1A (5C)	

The minimum knee point voltage, maximum exciting current and secondary resistance shall be guaranteed.

a) Core wise Details of 220kV CTs – 1600-800/1A (5C)

Sl. No.	Core No.	Accuracy class as per IEC 185	Output burden (VA)	Minimum knee point voltage at 1600A tap	CT Secondary Resistance at 75 °C at maximum ratio tap	Maximum Exciting Current (mA) at 1600/1A tap	ISF
1	Core -I	PS	-	900V	<6 ohms	30mA at Vk/2	
2	Core -II	PS		900V	<6 ohms	30mA at Vk/2	
3	Core -III	0.2S	20				<=5
4	Core -IV	PS		900V	<6 ohms	30mA at Vk/2	
5	Core -V	PS		900V	<6 ohms	30mA at Vk/2	

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b) Core wise Details of 220kV CTs– 1200-800/1A (5C)

Sl. No.	Core No.	Current Ratio (A)	Output burden (VA)	Accuracy class as per IEC 185	Minimum knee point voltage at 1200A tap	CT Secondary Resistance at 75 °C at maximum ratio tap	Maximum Exciting Current (mA) at 1200/1A tap	ISF
1	Core -I	1200-800/1	-	PS	900V	<6 ohms	30mA at Vk /2	
2	Core -II	-do-		PS	900V	<6 ohms	30mA at Vk /2	
3	Core -III	-do-	20	0.2S				<=5
4	Core -IV	-do-		PS	900V	<6ohms	30mA at Vk /2	
5	Core -V	-do-		PS	900V	<6 ohms	30mA at Vk /2	

c) Core wise Details of 220kV CTs – 600/300/1A (5C)

Sl. No	Core No.	Current Ratio (A)	Output burden (VA)	Accuracy class as per IEC 185	Minimum knee point voltage at 600A tap	CT Secondary Resistance at 75 °C at maximum ratio tap	Maximum Exciting Current (mA) at 600/1A tap	ISF
1	Core -I	600-300/1		PS	900V	<6 ohms	50mA at Vk/2	
2	Core -II	-do-		PS	900V	<6 ohms	50mA at Vk/2	
3	Core -III	-do-	20	0.2S				<=5
4	Core-IV	-do-		PS	900V	<6ohms	50mA at Vk/2	
5	Core -V	-do-		PS	900V	<6 ohms	50mA at Vk/2	

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d) Core wise Details of 220kV CTs - 200/1A (5C)

Sl. No.	Core No.	Accuracy class as per IEC 185	Output burden (VA)	Minimum knee point voltage at 200A tap	CT Secondary Resistance at 75 °C at 200A tap	Maximum Exciting Current (mA)at 200/1A tap	ALF/ ISF
1	Core -I	PS	-	800V	<6 ohms	30mA at Vk/2	
2	Core -II	5P	30	800V	<6 ohms	30mA at Vk/2	10
3	Core -III	0.2S	20				<=5
4	Core -IV	PS		800V	<6 ohms	30mA at Vk/2	
5	Core -V	PS		800V	<6 ohms	30mA at Vk/2	

e) Core wise details of 110kV CTs 1200-600/1 A – 5C

Sl. No.	Core No.	Current Ratio (A)	Output burden (VA)	Accuracy class as per IEC 185	Minimum knee point voltage at 600A tap	CT Secondary resistance at 75°C at 1200A tap	Maximum Exciting Current (mA)at 1200/1A tap	ISF/ ALF
1)	Core -I	1200-600/1	-	PS	600	<4ohms	30mA at Vk/2	-
2)	Core -II	-do-	20	0.2S	-	-	-	<=5
3)	Core -III	-do-	30	PS	-	-	-	10
4)	Core -III	-do-	-	PS	600	<4ohms	30mA at Vk/2	-
5)	Core -IV	-do-	-	PS	900	<4ohms	30mA at Vk/2	-

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f) Core wise details of 110kV CTs -800-400/1 A (4C)

Sl. No.	Core No.	Current Ratio (A)	Output burden (VA)	Accuracy class as per IEC 185	Minimum knee point voltage at 800A tap	CT Secondary resistance at 75°C at 800A tap	Maximum Exciting Current (mA) at 800/1A tap	ISF/ ALF
1)	Core -I	800-400/1A	-	PS	900	<4ohms	30mA at Vk/2	-
2)	Core -II	-do-	20	0.2S	-	-	-	<=5
3)	Core -III	-do-	30	PS	900	<4 ohms	30mA at Vk/2	10
4)	Core -IV	-do-	-	PS	900	<4ohms	30mA at Vk/2	-

g) Core wise details of 110kV CTs (400-200-100/1-1-1-1 A)

Sl. No.	Core No.	Current Ratio (A)	Output burden (VA)	Accuracy class as per IEC 185	Minimum knee point voltage at 400A tap	CT Secondary resistance at 75°C at 400A tap	Maximum Exciting Current (mA) at 400/1A tap	ISF at 200/1 A tap/ ALF
1)	Core -I	400-200-100/1	-	PS	900	<4ohms	30mA at Vk/2	-
2)	Core -II	-do-	20 at 400/1A tap	0.2S	-	-	-	<5
3)	Core -III	-do-	30	PS	900	<4 ohms	30mA at Vk/2	10
4)	Core -IV	-do-	-	PS	900	<4ohms	30mA at Vk/2	-

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4) Standards:-

Unless otherwise specified elsewhere in this specification the rating as well as performance and testing of the instrument transformers shall conform but not limited to the latest revisions and amendments available at the time of placement of order of all the relevant standards as listed here under.

Sl.No.	Standard No.	Title
1)	IS:2165	Insulation Co-ordination for equipment of 100kV and above.
2)	IS:16227(1&2)	Current Transformers.
3)	IS:2099	Bushings for alternating voltages above 1000Volts.
4)	IS:2071	Method of High Voltage Testing.
5)	IS:335	Insulating oil for transformers Switch gears.
6)	IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control.
7)	IS:2633	Method of testing hot dipped galvanized articles.
8)	IS:4800	Enameled round winding wires.
9)	IS:5561	Terminal connectors.
10)	IS:11065	Drawings.
11)	IEC 44-1	Current Transformers.
12)	IEC-270 (or IS:11322)	Partial Discharge &RIV Measurement
13)	IEC-44(4)	Instrument Transformer measurement of PDs.
14)	IEC-60071	Insulation co-ordination.
15)	IEC-60060	High voltage testing techniques.
16)	IEC-8263	Method for RIV test on high voltage insulators.
17)	IEC 61869	Rated insulation level
18)	CEA Regulations	Accuracy class of instrument transformers
19)	IEC:61109 & amendment,	Polymer insulators./Hollow insulators

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	IEC 60815-3, IEC-61462	
20)	IEC:61869-1 &2-2007	Internal Arc Fault Test
21)	IEC-60529	Protection against ingress of water

Equipment meeting with the requirements of other authoritative standards, which ensure equal or better performance than the standards mentioned above, shall also be considered. When the equipment offered by the supplier conforms to other standards salient points of difference between standards adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule.

5) Climatic Conditions:-

Maximum temperature of air in shade	40°C
Minimum temperature of air in shade	15°C
Maximum relative humidity	100%
Average number of thunderstorm days per annum	50
Average number of rainy days per annum	180
Average annual rainfall	3000 mm
Maximum wind pressure	100Kg/M2
Altitude not exceeding	1000 Metres above MSL

6) General:- The current transformers shall be of single phase, oil immersed and self cooled suitable for the services indicated complete in all respects conforming to the modern practice of design and manufacture.

The current transformers shall be sealed to eliminate breathing and prevent air and moisture from entering the tank. These shall be provided with oil level gauge and shall be provided with a pressure-relieving device/ Explosion vent capable of releasing abnormal internal pressures. The temperature rise should be as specified in IEC 60044-1. *The value of Tan δ shall be less than 0.005 at ambient temperature as per IEC 60044.* Oil level indicator should be of prismatic type and oil sight window at front side of the top tank at suitable location so that level of oil can be viewed clearly from ground. Hermetically sealed drain plug for Oil and oil filling plug with cap should be provided. Lifting lug should also be provided to lift the unit without damage to the instrument.

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- 6.1. **Limit of temperature rise:-** The temperature rise of a CT Winding when carrying a primary current equal to the rated continuous thermal current at a rated frequency and with rated burden, shall not exceed the appropriate values given in the following table. The temperature rise of the windings is limited by the lowest class of insulation either of the windings itself or of the surrounding medium in which it is embedded.

	Class of Insulation	Maximum temperature rise in °C
1)	All classes immersed in Oil	60
2)	All classes immersed in Bituminous compound.	50
3)	Classes not immersed in Oil or bituminous compound Class-A insulation.	60

The temperature rise of the oil at the top of the tank shall not exceed 50°C

- 6.2. **Bushing:-**

- 6.2.1 The insulators to be used for **220kV and 110kV current transformers** shall be made of high quality composite silicon. The composite silicon insulators shall be as reinforced fiberglass tubes coated with composite silicon whereas shall include metal connection elements on the ends.

The composite silicon shall be flame-resistant, full (without any spaces/ cavities), hydrophobic (not retaining water) and resistant against explosion and shatter/break up. The basis polymer to be used in composite silicon (before the addition of reinforcing filling materials) shall be 100% silicon rubber. The filling materials to be added shall be selected as suitable for enabling the insulator to mechanically resist against the vibrations to arise during the operating or short-circuit conditions, atmospheric conditions and earthquake scenario conditions.

The insulators shall resist against the forces to arise due to normal operating conditions or from extreme voltages probable in the system. The insulators shall resist against the forces to arise from short-circuits, earthquakes and vibrations. The insulator shall be designed and produced as resistant against the atmospheric conditions.

The insulation section of the insulators shall be straight and symmetrical whereas shall enable a uniform distribution of mechanical impacts and electrical area distribution. The insulation shall be designed as to minimize the radio interference. The insulation parts of the

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finished current transformers shall not be processed once the manufacturing is complete; whereas they shall be flawless, seamless, uniform and perfect.

The flange, bolt, nuts and other metal sections of the insulators shall be fixed to the insulator as not to break or loose in cases of temperature changes and mechanical pressures. The materials used for fixation shall be of high quality and not entering in reaction with the metal parts.

The minimum superficial leakage route length (creepage) shall be at least **25 mm/ kV** unless stated otherwise.

- 6.2.2. Hollow Composite Silicon Insulator Tube:-** The reinforced fiberglass tube shall be of chemically strengthened fiberglass material (E-Glass or ECR-Glass) against electrical corrosion, acid corrosion and hydrolysis. Such features of the tube shall be certified. The hollow composite silicon insulator tube shall be strong mechanically and electrically whereas without any spaces within. They shall be purified from any impurities and will not include any production faults.

The identification documents of the tube producers and the technical documents for the glass, fiber, epoxy resin etc. materials to be used for the production of the tube shall be presented to the administration.

- 6.2.3. Silicon body and leaves:-** The thickness of the silicon material covering the tube may not be lesser than 3,00 mm at any point whereas it shall be adhered to the tube tightly. The resistance between the silicon material and the tube shall be higher than the tearing strength of the composite silicon.

The profile parameters of the silicon leaves shall be under the “none” (among the zones none/minor/major) zone expressed in the Article 9 “Checking of profile parameters” of IEC 60815-3 standard.

If the production of the silicon body and leaves is performed through mould injection method, 145 kV insulators shall be produced with a single injection and 220 kV insulators shall be produced at most with three injections.

The technical documents including the general features of the materials to be used for silicon body and leaves, and the physical and electrical strength (resistance) thereof, shall be submitted to the KSEBL by the bidder.

The silicon body and leaves shall be resistant against flames, environmental impacts, UV rays, infrared rays, external dirt and humidity and shall employ hydrophobic (not retaining

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water) features; whereas such features shall be preserved all through the operating life. The manufacturers shall take the respective measures to prevent the damage by the birds and the rodents.

The interval between the leaves, together with the slopes and shapes thereof, shall be in line with the latest versions of the respective standards. They shall demonstrate the best electrical performance and shall be designed as not to keep any dirt, dust etc. particles on their surfaces.

All the other casing (enclosure, body) features shall be in accordance with IEC TR62039.

6.2.4. End Parts:- The materials to be used for manufacturing the end parts shall be aluminum, galvanized steel or any other material with suitable hardness and corrosion resistance. No sharp edges or corners shall be manufactured.

6.2.5. Sealing:- The hollow composite silicon insulator tube and metal end parts shall be sealed to each other as to provide a permanent sealing to prevent any humidity, acid etc. materials to infiltrate. The performance of the sealing system shall be in line with the respective standards. The sealing system shall provide maximum protection. The system and features thereof shall be provided with drawings and accompanying explanations.

6.2.6 Post Insulators should have technical particulars as detailed below:

Sl. No	Description	Unit(kV)	Unit(kV)
i	Nominal system voltage kV (rms)	220	110/132
ii	Highest system voltage kV (rms)	245	123/145
iii	Dry Power Frequency one minute withstand voltage (rms) in kV	460	230
iv	Wet Power Frequency one minute withstand voltage (rms) in kV	460	230
v	Power Frequency puncture kv (rms) voltage	1.3 times the actual dry flash over voltage	1.3 times the actual dry flash over voltage
vi	Impulse withstand voltage kV(Peak)	1050	550
vii	Creepage distance in mm(minimum)	6125	3075

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Note:- The Bidder shall submit type test reports of 220 kV and 110 kV Polymeric Insulators as per IEC:61109 from CPRI/ERDA/KERI/ Government NABL Approved Laboratory along with bid.

6.2.7. Tests on Insulator units:-

Design Test:- The design tests shall be performed under the conditions required by respective IEC standard whereas on numbers/amounts of samples specified for each test.

- 1) **Tests on interfaces and connections of end fittings (IEC 61462 Article 7.2)**
 - a) Reference dry power frequency flash over test (IEC 61462 Article 7.2.2)
 - b) Thermal- mechanical per-stressing test (IEC 61462 Article 7.2.3)
 - c) Water immersion per-stressing test (IEC 61462 Article 7.2.4)
 - d) Verification tests (IEC 61462 Article 7.2.5)
 - i) Visual examination (IEC 61462 Article 7.2.5.1)
 - ii) Steep-front impulse voltage test (IEC 61462 Article 7.2.5.2)
 - iii) Dry power frequency voltage test (IEC 61462 Article 7.2.5.3)
- 2) **Skirt and external casing (enclosure) material tests (IEC:61462 Article 7.3)**
 - a) Hardness test (IEC 61462 Article 7.3.1)
 - b) Accelerated weathering test (IEC 61462 Article 7.3.2)
 - c) Tracking and erosion test (IEC 61462 Article 7.3.3) (only 1000 hours of salt fog test shall apply)
 - d) Flammability test (IEC 61462 Article 7.3.4)
 - e) Tracking resistance test of the material (IEC 60587)
- 3) **Tests on the tube material (IEC 61462 Article 7.4)**
 - a) Dye penetration test (IEC 61462 Article 7.4.1)
 - b) Water diffusion test (IEC 61462 Article 7.4.2)
- 4) **Mechanical Test:-** Bending test (IEC 61462 Article 8.5)
- 5) **Sample Tests:-** The following sample tests shall be conducted on samples to be randomly selected from the insulator batches (lots) which have passed the routine tests.
 - a) Verification of dimensions (IEC 61462 Article 9.3)
 - b) Mechanical tests (IEC 61462 Article 9.4)
 - i) Test at maximum mechanical load (IEC 61462 Article 9.4.1.2)
 - ii) Test at 1,5 x maximum mechanical load (IEC 61462 Article 9.4.1.3)
 - c) Galvanizing test (IEC 61462 Article 9.5) /IS:2633/IS:6745

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d) Check of the interface between end fittings and the housing (IEC 61462)

6) **Routine Test:-** The following tests apply to each of the hollow composite silicon insulators during the manufacturing process.

a) Visual examination (IEC 61462 Article 10.2)

b) Routine mechanical test (IEC 61462 Article 10.4)

6.3. **Marking:-** Polarity shall be marked indelibly on block letters marked on each CT and at the lead terminals of the associated terminal block. It should not be peeled off during the life span of the Current Transformers.

6.4. **Name Plate:-** Instrument transformer shall be provided with stainless steel name plates as per IS:16227 incorporating year of manufacture and all relevant information as per IEC:60044-1 engraved or printed. The supplier's Serial No. shall also be punched on the tank for easy identification in case of loss of nameplate. Resistance of the secondary winding corrected at 75°C shall be recorded on name plate. Value of $\tan \delta$ obtained during testing should invariably be recorded on the nameplate. ($\tan \delta$ shall be measured in GST mode)

6.5. **Drawings:-** Drawings incorporating the following particulars shall be submitted by each bidder with the bid for the purpose of preliminary study.

- General arrangement and assembly drawings of equipment.
- Graphs showing the performance of equipment in regard to magnetizing characteristics, ratio and phase angle error curves and composite error curves.
- Arrangement of secondary terminal equipment and including of duplicate terminal connection arrangement.
- All constructional drawings, Name Plate, Structural Drawing.
- Supporting structure drawing

Drawings shall be submitted within 15 days from the acceptance of the order and approval shall be issued within one month from the submitting of the base design.

6.5.1. The Bidder shall submit to the Purchaser, the following drawings for the approval of the Purchaser. The schedule shall be prepared so as to ensure delivery commitments made in the contract.

- 1) Outline dimensional drawing plan, elevation, end-view dimension, shipping dimensions etc. of the CTs.
- 2) Dimensional drawing of CT along with details of clamp and terminal connectors.
- 3) Complete mounting arrangement and structure drawing of CT's indicating cable entry clearly

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- 4) Cross section view of the Instrument Transformers.
 - 5) Winding diagram with polarity marks.
 - 6) Magnetization curves.
 - 7) Diagram plate, electrical connections of component parts of the CTs and terminal arrangement of secondary terminal box.
 - 8) Name and rating plate as per Indian Standard IS:16227.
 - 9) Drawing is necessary for design and fabrication of supporting structure (structures are included in the scope of supply).
- 6.5.2. The Bidder may submit any other drawing found necessary in addition to those stated above.
- 6.5.3. Copies of nicely printed and bound volumes of operation, maintenance and erection manuals in English language, for each type of equipment (for each consignee) shall be submitted by the supplier along with despatch documents. The manual shall contain all the drawings and information required for erection, operation and maintenance of CT. The manual shall also contain a set of all the approved drawings, type test reports etc.
- 7) Construction:-**
- 7.1. Core:-** The core shall be of high grade, non- aging, electrical silicon laminated steel of low hysteresis loss and high permeability to ensure high accuracy at both normal and over currents. The current transformer core to be used for metering and instrumentation shall be of accuracy class specified or appropriate class (CRGO silicon steel or Nickel alloy) suitable for precision metering. The saturation factor of this core shall be low enough not to cause any damage to measuring instruments in the event of maximum short circuit current. Current Transformer cores to be used for protective relaying purposes shall be of accuracy class specified or appropriate class suitable for distance protection, differential protection, over current protection and bus protection. The protection class cores shall be designed for a minimum saturation factor of 10 for the highest setting. The PS class core for distance protection shall be of low remanence flux type.
- 7.2.** Current Transformers shall be provided with type **oil sight** window at suitable location so that the oil level is clearly visible with naked eye to an observer standing at ground level. If metal bellow is used for above purpose, a ground glass window shall also be provided to monitor the position of the metal bellow. For compensation of variation in volume the oil due to temperature variation nitrogen cushion or suitable steel below shall be used. Rubber diaphragms shall not be permitted for this purpose. Current transformer shall be hermetically sealed to climatic breathing and entering air & moisture in the tank, either by providing stainless steel bellow or by nitrogen cushioning. All parts of bellow shall be steel only. In case of current transformer without stainless steel bellow, but sealed by nitrogen cush-

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ion, the pressure relief valve shall be provided so that over pressure caused by internal faults can be instantaneously relieved and bursting of unit is avoided.

7.3. The pressure relief valve shall comply as follow:

- a) It shall be either of stainless steel or brass material.
- b) Spring used shall be of non -magnetic stainless Steel.
- c) It shall conform to relevant IS/IEC standards.
- d) It shall be suitably calibrated for the maximum allowed pressure.
- e) Bidder shall ensure that during any of the acceptance tests PRV shall not operate.
- f) Its satisfactory operation shall be offered during stage inspection.
- g) It will be treated as major bought out item hence; necessary test report from vendor shall be submitted.

7.4. Tank:- The metal tank shall have minimum number of welded joints and shall be made of mild steel/stainless steel /aluminum alloy depending on the requirement. The metal tank including top cover shall be coated with coats of Zinc rich epoxy painting of thickness 50 microns. All ferrous parts shall be hot dip galvanized. The dome shall be made of stainless steel in order to prevent corrosion. Expansion chamber at the top of the insulator should be suitable for expansion of oil and provision of primary terminals. Between expansion chambers of primary terminals leak proof and temperature resistant five play gasket shall be used.

7.5. Gaskets:- The gasket material used shall be Neoprene based rubberized cork type RC 70-C as per IS.4253 Part II-1980/ high quality 'O' rings shall be used for ensuring no oil leakage.

- | | | |
|-------------------------------------------------|---|-------------------|
| 1) Specific gravity | - | 0.7 to 0.8 |
| 2) Hardness, IRHD | - | 70 ±5 |
| 3) Compressibility at 28 kg/cm ² , % | - | 30 ±5 (for 6.4t) |
| | - | 33 ±5 (for 9.6t) |
| 4) Compressibility at 60 kg/cm ² , % | - | 40 ±5 (or 6.4t) |
| | - | 45 ±5 (or 9.6t) |
| 5) Recovery at 28kg/cm ² , % min | - | 80 |
| 6) Recovery at 60kg/cm ² , % min | - | 70 |
| 7) Tensile Strength, Kgcm ² , min. | - | 18 |
| 8) Compression Set, % Max. | - | 80 (110 to 120°C) |
| 9) Flexibility | - | Shall pass |
| 10) Chemical test on water extract - | | |
| a) PH | - | 5 to 8. |
| b) Chloride Content as chloride ion | - | 0.2% max. |
| c) Sulphate Content as sulphate ion | - | 0.2% max. |

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The gaskets provided on all openings of CTs should be clamped properly with stoppers of optimum torque to avoid permanent setting, no over tightening should be carried out causing loss of spring effect. Porcelain bottom gaskets shall be placed on suitable grooves and also no oil leakage.

- 7.6 **Winding:-** Primary winding shall be of high purity **annealed high conductivity electrolytic Copper /E.C Grade Aluminium conductor of equivalent standard** meeting the requirements of IEC:61869/ IS:16227. Conductors used for the primary winding shall be rigid or housed in rigid metallic shell. Unavoidable joints in the primary winding shall be braced type. The details of such welded joints shall be indicated in the drawings submitted with the offer. For primary winding current density shall not exceed **1.65 A/sq. mm** for copper solid conductor / $1A/mm^2$ for Aluminium Conductor meeting the quality and extent shall be as per relevant ISS or other equivalent standard.

The secondary windings shall be of suitably insulated **copper wire of electrolytic grade**. The type of insulation used shall be described in the offer. The secondary taps shall be adequately reinforced to withstand handling without damage. The ratios specified in tender specification and the change in ratio shall be by secondary taps (winding). The rating of the secondary winding shall be one ampere as specified in the schedule. Secondary terminals shall be brought out in a compartment on one side of Current Transformer for easy access. The secondary terminals shall be provided with short circuiting arrangements. The secondary taps shall be adequately reinforced to withstand normal handling without damage. All fixing nuts, bolts, washers in electrical current path shall be made of stainless steel.

For CTs/ NCTs the primary terminals shall be made out of rods not less than 30mm dia. copper or equivalent as per IS\IEC. Primary termination shall be round to suit the terminal connectors.

The design density for short circuit current as well as conductivity of the metal used for primary winding shall meet the requirement of IS:16227. The Bidder shall in his offer furnish detailed calculations for selection of winding cross-sections.

Primary and secondary windings shall have continuous thermal rating, as specified, for all ratios.

- 7.7 **Insulation:-** The current transformers shall withstand satisfactorily the dielectric test voltages corresponding to basic insulation level of 1050kVp/460kV rms (220kV CT) and 550kVp/ 230kVrms (110kV CT), RIV and PD voltages as per IEC:270, 61869-1. The IR value should be more than 50GΩ at 5kV DC.

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7.8 Insulation oil:- The first fill of oil complies with the requirement of latest edition of IS:335/ IEC:60296. Current Transformer shall be vacuum filled with oil and thereafter hermetically sealed to eliminate breathing and to prevent air and moisture to enter the tank. For compensation for variation of oil volume due to temperature, stainless steel bellows shall be provided.

The oil shall conform to the requirements of Indian Standard 335, subject to the requirements of the contractor's specification being fulfilled; The contractor shall provide the details of oil used.

Sl. No.	Characteristics	Requirements	Method of Test
1	Appearance	The oil shall be clear & transparent & free from suspended matter or sediment.	A representative sample of oil Shall be examined in a 100mm thick layer, at ambient temperature of equivalent authoritative standard.
2	Density at 27°C Max.	0-89g / cm ³	IS:1448 (P-16) 1967 or Equivalent Authoritative standard.
3	Kinematics viscosity at 27°C Max.	27 CST	IS 1448 (P-25),1960 or Equivalent Authoritative standard.
4	Interracial tension at 27°C Min.	0.04 N / m	IS : 6104 – 1971 or equivalent Authoritative standard.
5	Flash point pensky marten (closed) Min.	140 °C	IS 1448 (P-21) 1970 or Equivalent Authoritative standard.
6	Four point max.	- 10 °C	IS 1448 (P-10) 1970 or Equivalent Authoritative standard.
7	Neutralization value	0.03Mg/KOH/g	IS:335-1972,Appendix -A or

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	(Total acidity) max.		Equivalent Authoritative standard.
8	Corrosive sulphur (in terms of classification of copper strip)	Non – corrosive	IS:335-1972,Appendix B or equivalent Authoritative standard.
9	Electric strength (break-down voltage) Min. a)New untreated oil. b)After treatment	30KV (rms). If the above value is not attained, the oil shall be treated. 50 KV (rms.)	IS : 6792 – 1972 or equivalent Authoritative standard.
10	Dielectric dissipation factor (tan δ) at 90°C Max.	0.002	IS : 6262 – 1971 or equivalent Authoritative standard.
11	Specific resistance (resistivity)		
	a)At 90 °C Min b) At 27 °C Min.	35 x 1212 ohm / cm 1500 x 10012 Ohm	IS 6103 – 1971 or equivalent Authoritative standard
12	Oxidation stability a) Neutralization value after oxidation max. b) Total Sludge after oxidation Max.	40 mg / KOH / g 0.10percent by weight.	IS:335–1972, Appendix-C or equivalent Authoritative standard.
13	Aging characteristic after accelerated aging a) Specific resistance (Resistivity). i)27°C Min. ii) At 90°C Min. b) Dielectric dissipation factor (tan δ) at 900C Max. c) Total slug acidity %	2.5 x 10 ¹² ohm/cm. 0.2 x 10 ¹² ohm/cm. 0.2	IS : 6103 – 1971

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	by weight. d) Total slug value% by weight.	0.05 max. mg. KOH/ G 0.05	IS : 6262 – 1971 IS:1448 – 1967
14	Water content max.	50 ppm.	IS:2362 – 1963 or equivalent Authoritative standard.

If the oil used is of IEC:60296, the values to be specified.

7.9. **Terminal connectors:-** Bimetallic Terminal Connector suitable for ACSR Double “MOOSE” for 220kV CT and ACSR Double Kundah for 110kV CT with a spacing of 250mm shall be supplied. Metal tank of CT shall be provided with two separate earthing terminal for bolted connections. The terminal connectors shall meet the following requirements:

- 1) Terminal connectors shall be manufactured and tested as per IS:5561 or equivalent IEC.
- 2) All castings shall be free from blowholes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.
- 3) No part of a clamp shall be less than 10mm thick.
- 4) All ferrous parts shall be hot dip galvanized conforming to IS:2633 or equivalent IEC.
- 5) For bimetallic connectors, copper alloy liner of minimum 2mm thickness shall be cast integral with aluminium body (2mm thick bimetallic sleeves integral part of terminal connector).
- 6) Flexible connectors shall be made from tinned copper/ aluminium sheets.
- 7) All current carrying parts shall be designed and manufactured to have minimum contact resistance.
- 8) Connectors shall be designed to be corona free in accordance with the requirements stipulated in IS:5561 or equivalent. Bolt and nut are also included in the scope of supply.

7.10. **Secondary Terminal Box:-** CT secondary terminals shall be brought out in weatherproof terminal box. The terminal box shall be provided with removable cover and 5 No's of cable gland. Cable gland shall be suitable for 1100 V grade PVC insulated Steel wire armored PVC sheathed two core stranded 4 mm² copper conductor. Dimension and opening of box shall be adequate for easy access and working space with normal tool. Provision should be made for short-circuiting

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and grounding CT terminal, inside the box. Connect well make 32 A CST terminal connector shall be used for terminating leads from CT secondary board and outgoing cable.

- 7.11. **Test Tap:-** Test Tap shall be provided for all CT's to measure dielectric dissipation factor ($\tan \delta$) at field in UST as well as in GST modes and shall be shown in GA Drawing. Provision shall be made of a screw on cap for solid and secured earthing of the test tap connection, when not in use. A suitable caution plate shall be provided duly fixed on the cover of the secondary terminal box indicating the purpose of the test tap and necessity of its solid earthing as per prescribed method before energizing the equipment. The value of $\tan \delta$ shall be less than 0.005 on GST mode measurement at corrected temperature of 20 deg.C as per IEC:60044. The value shall be recorded on the nameplate. The test tap shall have minimum 2 kV insulation level. **$\tan \delta$ should be <0.3% at GST Mode.**

The KSEBL accepted Power equipment protocol is as follows.

Sl. No.	Test	Tests to be done by PET Team & Periodicity	Tests to be done by Station Maintenance Team & Periodicity	Limit value	Remarks
1)	Tan delta	Commission Test + 1 Year		Commission Test <0.5% @ 10kV Routine Test <2 @ 10kV for 110kV CT<0.5% @10kV. Routine Test <1.5% @ 10kV for ≥ 220 kV	Commission Test <0.5% at Ambient temperature (IEC:6044-1) Routine Test <2% / 1.5% with gradual and consistent change, then insulation is good and satisfactory for service until next test period. Routine Test <2%/ 1.5% and trending >0.3 of previous year value, then investigate and repeat the test after 6 months.
2)	IR	Commission Test + 2 Year	1 Year	Commission Test >50 G @ 5kV Routine Test >10G @ 5kV	

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3)	Thermo vision scanning		1/2 Year	Temperature up to 15 deg C above ambient – Normal; Temperature 15-50 deg C above ambient – Alert & Temperature 50 deg C above Ambient – To be immediately attended	To be done by Station Engineer. (IEEE/C.37.010. 1979)
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7.12. **Type of Mounting:-** The Current transformers shall be suitable for mounting on hot dip galvanized steel supporting structures. The necessary flanges, bolts etc., for the base of the CT shall be supplied and these shall be hot dip galvanized.

The supporting structure (galvanized) for the current transformers is included in the scope of this specification. The details of supporting structures should also be furnished along with dimensional drawing. The height of the 220kV and 110kV Supporting structure shall be such that clearance between ground and live part shall not be less than **5.5 m and 4.85m** respectively.

Adequate factor of safety shall be provided in the design of structure. The structure shall be of Lattice Type. Bottom PCD of CT shall be as per relevant IS so that transformer can be replaced on damage. Structure shall be made of 4Nos. Of 65x65x6mm mainframe and 32 Nos. of 50x50x6mm cross pieces. Preferably bottom plate size shall be 600x600x8mm with minimum structure weight 180 kg /Tubular structure with adequate mechanical strength covering ASTM standard are also acceptable.

The structures shall be suitable to fix on foundation bolts having size (dia. Shall be 24mm.) with a spacing of 400mm x 400mm, both ways (for 110kV and 220kV). The height of the structure shall be such as to meet the ground clearances for the respective voltage class. That is, Height of structure + height of the supporting insulator of the CT up to live portion shall be 5600mm & 4600mm. (minimum) for 220kV & 110kV CTs respectively.

7.13. **Structure Standards:-**

1)	Specification for zinc	IS:209-1966
2)	Code of practice for use of structural steel in general Building Construction	IS:800-1962
3)	Hexagon head bolts, screws and nuts of product grade 'C'	IS:1363-1984(Part 3)
4)	Technical supply conditions for threaded fasteners (First Revision)	IS:1367-1967

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5)	Plain washers	IS:2016-1967
6)	Steel for general structural purposes specification	IS:2062-1992
7)	Recommended practice for hot-dip galvanizing of iron and steel	IS:2629-1966
8)	Methods of testing weight thickness and uniformity of coating on hot-dip galvanized articles.	IS:2633-1972
9)	Single Coil Rectangular Section spring washers for bolts, nuts, screws	IS:2063-1972
10)	Specification for hot-dip zinc containing on structural steel and other allied products	IS:4759-1968
11)	Specification for hot-dip galvanized coating on fasteners	IS:5358-1969`
12)	Heavy washers for steel structures	IS:6610-1972
13)	Hexagonal bolts for steel structures	IS:6639-1972
14)	Methods for determination of weight of zinc coating of zinc coated iron and steel articles	IS:6745-1972
15)	Transmission Tower bolts	IS:12427-1988

8) Tests:-

The offered product shall be type tested as per IS:16227 and IEC:60044-1/IEC:61869-1,2 at Government of India Lab or lab accredited by "National Accreditation Board for testing and Calibration Lab" and shall comply with all relevant standards. The Bidder must submit copies of Type test reports with the bid as per latest edition of IS:16227 (Part 1&2), IEC:60044-1, IEC:61869-1,2 Each current transformer shall be subjected to routine tests as specified in Indian Standard :16277, IEC.60044-1/IEC:61869-1,2. All routine tests shall be made prior to dispatch in the presence of the representative of the purchaser if so desired by the purchaser and the test results in quadruplicate shall be supplied to the purchaser for approval. Also 24 hours pressure test to check for leakage shall be done in the presence of Board's representative if so desired by the Board. Test report of CT shall be submitted before offering for FAT. All routine tests shall be carried out on 10% of the quantity as per standard acceptance procedure.

9) Type tests:-

- Short time current test
- Temperature rise test
- Lightning impulse test on primary terminals
- Power Frequency Withstand Voltage Wet test

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- e) Determination of errors of measuring and protection core
- f) Verification of Degree of protection by enclosures.
- g) Electromagnetic compatability test.
- h) Multiple Chopped Impulse on Primary terminals – Applicable to 220kV and above.
- i) Internal arc fault protection requirements.
- j) Measurement of capacitance & dissipation factor measurement in UST & GST modes
- k) Protection against ingress of water.
- l) Internal arc fault test:- Those CT tested with polymer insulator with internal arc fault current rms value <40 KA Protection stage 1 and class II with No external effect other than the operation of suitable pressure relief device as per relevant IEC-61869-1 is acceptable. The system fault level on 110 kV level is **40kA/1s**. The test shall be carried out strictly in accordance with IEC 61869-1 /relevant IS and applicable tolerance acceptable. As per the clause 7.4.6 of IEC 61869,if already a CT of similar design of next higher voltage level is tested for internal arc, the same shall be accepted for lower voltage only if the manufacturer provides the necessary technical parameters demonstrating the design similarity. The following critical design parameters shall be provided by the manufacturer to demonstrate the ability of the non -qualified rating CT to withstand an internal faults without additional tests.
 - i) Similarity of bellow/pressure relief device-material and thickness comparison.
 - ii) Similarity of fault clearing grounding electrode- Material and cross section comparison.

The supplier shall submit the above design comparison to the purchaser for review and acceptance.

The test reports of the type tests and the following additional type tests shall be submitted:- (Obtained from CPRI/ ERDA/KERI/internationally approved lab):-

- i) Corona & Radio interference voltage test
- ii) Seismic withstand test
- iii) Thermal stability test, i. e. application of rated voltage and rated extended thermal current simultaneously by synthetic test circuit.
- iv) Tan delta measurement.

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v) The current transformer shall be subjected to Chopped impulse test by to assess the CT performance in service to withstand the high frequency over voltage generated due to closing & opening operation of isolators.

vi) Internal arc fault test

Type test on Insulator:-

a) Reference dry power frequency flash over test

b) Thermal-mechanical per-stressing test

c) Water immersion per-stressing test

d) Verification tests

i) Visual examination

ii) Steep-front impulse voltage test

iii) Dry power frequency voltage test

e) Hardness test

f) Accelerated weathering test

g) Tracking and erosion test

h) Flammability test

i) Tracking resistance test of the material

j) Dye penetration test

k) Water diffusion test.

l) Bending test

Acceptance/Routine tests:- (Utility representative witnessing required- unless it is waived)

Verification of terminal marking

Power frequency withstand test on primary winding

Partial discharge test on primary winding

Power frequency withstand test on secondary winding

Power frequency withstand test between sections

Inter turn voltage test

Enclosure tightness test at ambient temperature.

Pressure test for enclosure.

Tan delta measurement in GST and UST modes

Lightning Impulse Test & Temperature rise Test on one CT of highest ratio from 220kV and 110kV shall be carried out in NABL accredited Lab in the presence of KSEBL representative.

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Determination of errors of measuring and protection core

Vkn, Io and Rct measurement of class X core

All tests shall be carried out with meters/equipment having valid calibration certificates obtained from NABL accredited labs. CT/PT used shall have 0.2S/0.2 Accuracy Class.

Copy of the calibration certificates to be produced along with acceptance test reports.

All the above tests are to be carried out in the presence of the KSEBL Inspector as described in Cl.12 of the special instruction and according to the QA/ QC Plan.

10) QUALITY ASSURANCE PLAN:-

The Bidder shall invariably furnish following information along with his offer. Information shall be separately given for individual type of equipment offered.

- i) Statement giving list of important raw materials, names of sub-suppliers for the raw material, list of standards according to which the raw material in presence of Bidder's representative, copies of test certificates.
- ii) Information and copies of test certificates as in (i) above in respect of bought out items.
- iii) List of manufacturing facilities available.
- iv) Level of automation achieved and list of areas where manual processing exists.
- v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- vi) Special features provided in the equipment to make it maintenance free.
- vii) List of testing equipment available with the Bidder for final testing of equipment specified and test plant imitation, if any, vis-a-vis type, special, acceptance and routine tests specified in the relevant standards. These limitations shall be very clearly brought out in schedule of deviations from specified test equipmen's.
- viii) The following testing equipments shall be available for testing at bidders works.
 - 1) Partial Discharge test set up (preferably Robinson)
 - 2) Tan delta and capacitance test set up (Dobble)
 - 3) Minimum Sensitivity of high voltage laboratory-2.5pC for PD measurement

SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram



TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: SCM-SPEC/XT/220kV & 110kV CTs
(Live /Dead Tank)

Rev.#: 1

Effective Date 29/09/2022

11) Inspection:-

All routine tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the manufacturer and purchaser at the time of purchase.

Inspection may be carried out by the purchaser at any stage of manufacture. The supplier shall grant free access to the purchaser's representative at a reasonable time when the work is in progress. Inspection and acceptance of any material under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing materials in accordance with the specification and shall not prevent subsequent rejection, if the material is found to be defective.

The supplier shall keep the purchaser informed in advance about the manufacturing programme so that arrangement can be made for inspection. The purchaser reserves the right to insist for advance intimation. The supplier shall give 20 days to enable the purchaser to depute his representative for witnessing the acceptance and routine tests.

The purchaser has the right to have the tests carried out at the supplier's cost by an independent agency wherever there is a dispute regarding the quality of supply.

220kV Current Transformers Stage Inspection

Client shall be intimated minimum 20days in advance for stage inspection for Measurement of ratio error prior to tanking and measurement of clearance between active part and tanking before closing.

- 12) All the type test report of 220kV & 110kV CT (Dead/Live Tank Type) shall be submitted as per Clause-8 of the Technical Specification before acceptance of the material.
- 13) Submission of Type test for qualification Criteria:-Generally those submitting 100% type test report of CT & Insulator are only considered as valued bidder. In case if the type test report obtained by the supplier is outdated and having valid type test of 80%, such supplier shall be considered for Pre-qualification. If they submitted an undertaking to the extent that, before type test to be conducted without delivery schedule with supplier's account.

Chief Engineer (SCM & CSC)

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: SCM-SPEC/XT/220kV & 110kV CTs
(Live /Dead Tank)

Rev.#: 1

Effective Date 29/09/2022

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 220KV CURRENT TRANSFORMERS -220kV CT 1600-800/1A(5C)

Sl. No.	Particulars	KSEBL's Requirement	Guaranteed Values
1)	Type	Outdoor, Oil Cooled, Live/ Dead (Hair Pin type) Tank Type Current Transformer	
2)	Manufacturers Design type		
3)	Rated voltage	220 kV	
4)	Rated primary current	1600-800A	
5)	Rated secondary current	1A	
6)	Number of cores	5	

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: SCM-SPEC/XT/220kV & 110kV CTs
(Live /Dead Tank)

Rev.#: 1

Effective Date 29/09/2022

7)	Core details	Rated out put	Accurac y class	Rated Output	Accuracy Class
				Guaranteed	Guaranteed
	Core I	-	PS		
	Core II	-	PS		
	Core III	20 VA	0.2S		
	Core IV	-	PS		
	Core V	-	PS		
		ALF	ISF	ALF	ISF
				Guaranteed	Guaranteed
	Core I				
	Core II				
	Core III				
	Core IV				
	Core V				

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: **SCM-SPEC/XT/220kV & 110kV CTs (Live /Dead Tank)**

Rev.#: 1

Effective Date **29/09/2022**

		Knee Point Voltage	'Sec. winding resistance at 75 deg.C at max. ratio tap	Knee Point Voltage @1600A	Sec. winding resistance at 75 deg.C at max. ratio tap
				Guaranteed	Guaranteed
	Core - I	900 V @ 1600 A	<4 Ohms @ 800 A		
	Core -II	900 V @ 1600 A	<4 Ohms @ 800 A		
	Core -III	-	-		
	Core - IV	900 V @ 1600 A	<4 Ohms @ 800 A		
	Core -V	900 V @ 1600 A	<4 Ohms @ 800 A		
		Required		Guaranteed	
8)	Rated short circuit current for 1 sec	50kA			
9)	Rated current dynamic (peak value)				
10)	Rated continuous thermal current.	120%			

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: SCM-SPEC/XT/220kV & 110kV CTs
(Live /Dead Tank)

Rev.#: 1

Effective Date 29/09/2022

11)	One minute power frequency dry withstand test voltage	460kV	
12)	One minute power frequency wet withstand test voltage	460kV	
13)	Full wave lightning impulse withstand voltage 1.2/50 microseconds	1050kVp	
14)	One minute power frequency withstand test voltage on secondary	3kV	
15)	Type tests		Attach test reports
a)	Short time current test		
b)	Temperature rise test		
c)	Lightning impulse test on primary terminals		
d)	Power Frequency Withstand Voltage Wet test		
e)	Determination of errors of measuring and protection core		

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220kV & 110kV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: SCM-SPEC/XT/220kV & 110kV CTs
(Live /Dead Tank)

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f)	Verification of Degree of protection by enclosures.		
g)	Electromagnetic compatibility test.		
h)	Multiple Chopped impulse on Primary terminals – Applicable to 220kV and above		
i)	Internal arc fault protection requirements.		
j)	Measurement of capacitance & dissipation factor measurement in UST & GST modes.		
k)	Protection against ingress of water.		
l) m)	Internal arc fault test		
16)	Current density in the primary winding at		
a)	Normal rating	1.65 Amps/mm ² for copper conductor 1A/ mm ² for Aluminium Conductor	

SUPPLY CHAIN MANAGEMENT

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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(Live /Dead Tank)

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b)	Short time rating for 1 sec.	50 kA	
c)	Short time rating for 3 sec.	23.09 kA	
d)	Dynamic rating	100 kAP	
17)	Flux density at knee point voltage	<1.5	
18)	Variation in ratio and phase angle error due to variation in		
a)	Voltage by 1%	NA	
b)	Frequency by 1 Hz.	NA	
19)	Whether pressure relief device is provided	Yes	
20)	Weight of Oil		

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: SCM-SPEC/XT/220kV & 110kV CTs
(Live /Dead Tank)

Rev.#: 1

Effective Date 29/09/2022

21)	Total weight		
22)	Magnetization curve of CT cores		
23)	Overall dimensions		
24)a)	Minimum knee point voltage	Core – 1&2: 900 V @ 1600 A Core – 4&5: 900 V @ 1600 A	
b)	Maximum exciting current at knee point voltage	Core – 1&2: <30 mA @ 1600 A Core – 4&5: <30 mA @ 1600 A	
c)	Resistance of the secondary winding corrected to 75°C	Core – 1&2: <4 Ohms @ 1600A Core – 4&5: <4 Ohms @ 1600A	
d)	Resistance of the secondary winding corrected to 35°C	Core – 1&2: <3.48 Ohms @ 1600A Core – 4&5: <3.48 Ohms @ 1600A	

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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(Live /Dead Tank)

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25)	Total /protected creepage in mm	25 mm/kV i.e, 6125 mm/ 3062.5 mm	
26)	Any other details require as per IS.16227		
27)	Method of ratio change	By Secondary Tap	
28)	Grade of Oil	EHV Grade IS 335	
29)	Material of Primary winding	Electrolytic Copper/ E.C Grade Aluminium conductor of equivalent standard	
30)	Material of Secondary Winding	Electrolytic Copper	
31)	Type of Insulator Bushing		

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TECHNICAL SPECIFICATION

**220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS
AND SUPPORTING STRUCTURES**

Doc. #: **SCM-SPEC/XT/220kV & 110kV CTs
(Live /Dead Tank)**

Rev.#: 1

Effective Date **29/09/2022**

32)	Make of Insulator		
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Name and Address of Bidder

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: SCM-SPEC/XT/220kV & 110kV CTs
(Live /Dead Tank)

Rev.#: 1

Effective Date 29/09/2022

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 220KV CURRENT TRANSFORMERS -220kV CT 1200-800/1A(5C)

Sl. No.	Particulars	KSEBL's Requirement	Guaranteed Values
1)	Type	Outdoor, Oil Cooled, Live/ Dead Tank Type Current Transformer	
2)	Manufacturers Design type		
3)	Rated voltage	220 kV	
4)	Rated primary current	1200/800A	
5)	Rated secondary current	1A	
6)	Number of cores	5	

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: **SCM-SPEC/XT/220kV & 110kV CTs (Live /Dead Tank)**

Rev.#: 1

Effective Date **29/09/2022**

7)	Core details	Rated out put	Accurac y class	Rated Output	Accuracy Class
				Guaranteed	Guaranteed
	Core I	-	PS		
	Core II	-	PS		
	Core III	20 VA	0.2S		
	Core IV	-	PS		
	Core V	-	PS		
		ALF	ISF	ALF	ISF
				Guaranteed	Guaranteed
	Core I				
	Core II				
	Core III				
	Core IV				
	Core V				

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: **SCM-SPEC/XT/220kV & 110kV CTs (Live /Dead Tank)**

Rev.#: 1

Effective Date **29/09/2022**

		Knee Point Voltage	Sec. winding resistance at 75 deg.C at max. ratio tap	Knee Point Voltage @1200A	Sec. winding resistance at 75 deg.C at max. ratio tap
				Guaranteed	Guaranteed
	Core - I	900 V @ 1200 A	<4 Ohms @ 1200A		
	Core -II	900 V @ 1200 A	<4 Ohms @ 1200A		
	Core -III	-	-		
	Core - IV	900 V @ 1200 A	<4 Ohms @ 1200A		
	Core -V	900 V @ 1200 A	<4 Ohms @ 1200A		
		Required		Guaranteed	
8)	Rated short circuit current for 1 sec	50 KA			
9)	Rated current dynamic (peak value)	100 KA			
10)	Rated continuous thermal current.	120 %			

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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(Live /Dead Tank)

Rev.#: 1

Effective Date 29/09/2022

11)	One minute power frequency dry withstand test voltage	460 kV	
12)	One minute power frequency wet withstand test voltage	460 kV	
13)	Full wave lightning impulse withstand voltage 1.2/50 microseconds	1050 kVp	
14)	One minute power frequency withstand test voltage on secondary	3kV	
15)	Type tests		Attach test reports
a)	Short time current test		
b)	Temperature rise test		
c)	Lightning impulse test on primary terminals		
d)	Power Frequency Withstand Voltage Wet test		
e)	Determination of errors of measuring and protection core		

SUPPLY CHAIN MANAGEMENT

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220kV & 110kV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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f)	Verification of Degree of protection by enclosures.		
g)	Electromagnetic compatibility test.		
h)	Multiple Chopped impulse on Primary terminals – Applicable to 220kV and above		
i)	Internal arc fault protection requirements.		
j)	Measurement of capacitance & dissipation factor measurement in UST & GST modes.		
k)	Protection against ingress of water.		
l) n)	Internal arc fault test		
16)	Current density in the primary winding at		
a)	Normal rating	1.65 Amps/mm ² for copper conductor 1A/ mm ² for Aluminium Conductor	

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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b)	Short time rating for 1 sec.	50 kA	
c)	Short time rating for 3 sec.	23.09 kA	
d)	Dynamic rating	100 kAP	
17)	Flux density at knee point voltage	<1.5	
18)	Variation in ratio and phase angle error due to variation in		
a)	Voltage by 1%	NA	
b)	Frequency by 1 Hz.	NA	
19)	Whether pressure relief device is provided	Yes	
20)	Weight of Oil		

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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21)	Total weight		
22)	Magnetization curve of CT cores		
23)	Overall dimensions		
24)a)	Minimum knee point voltage	Core – 1&2: 900 V @ 1200 A Core – 4&5: 900 V @ 1200 A	
b)	Maximum exciting current at knee point voltage	Core – 1&2: <30 mA @ 1200 A Core – 4&5: <30 mA @ 1200 A	
c)	Resistance of the secondary winding corrected to 75°C	Core – 1&2: <4 Ohms @ 1200A Core – 4&5: <4 Ohms @ 1200A	
d)	Resistance of the secondary winding corrected to 35°C	Core – 1&2: <3.48 Ohms @ 1200A Core – 4&5: <3.48 Ohms @ 1200A	

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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25)	Total /protected creepage in mm	25 mm/kV i.e, 6125 mm/ 3062.5 mm	
26)	Any other details require as per IS.16227		
27)	Method of ratio change	By Secondary Tap	
28)	Grade of Oil	EHV Grade IS 335	
29)	Material of Primary winding	Electrolytic Copper/ E.C Grade Aluminium conductor of equivalent standard	
30)	Material of Secondary Winding	Electrolytic Copper	
31)	Type of Insulator Bushing		

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**220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS
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32)	Make of Insulator		
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Name and Address of Bidder

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 220KV CURRENT TRANSFORMERS – 220kV CT 600/300/1A(5C)

Sl. No.	Particulars	KSEBL's Requirement	Guaranteed Values
1)	Type	Outdoor, Oil Cooled, Live/ Dead (Hair pin type) Tank Type Current Transformer	
2)	Manufacturers Design type		
3)	Rated voltage	220 kV	
4)	Rated primary current	600/300A	
5)	Rated secondary current	1A	
6)	Number of cores	5	

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7)	Core details	Rated out put	Accurac y class	Rated Output	Accuracy Class
				Guaranteed	Guaranteed
	Core I	-	PS		
	Core II	-	PS		
	Core III	20 VA	0.2S		
	Core IV	-	PS		
	Core V	-	PS		
		ALF	ISF	ALF	ISF
				Guaranteed	Guaranteed
	Core I				
	Core II				
	Core III				
	Core IV				
	Core V				

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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		Knee Point Voltage	Sec. winding resistance at 75 deg.C at max. ratio tap	Knee Point Voltage @600A	Sec. winding resistance at 75 deg.C at max. ratio tap
				Guaranteed	Guaranteed
	Core - I	800 V @ 600 A	<2 Ohms @ 600A		
	Core -II	800 V @ 600 A	<2 Ohms @ 600A		
	Core -III	-	-		
	Core - IV	800 V @ 600 A	<2 Ohms @ 600A		
	Core -V	800 V @ 600 A	<2 Ohms @ 600A		
		Required		Guaranteed	
8)	Rated short circuit current for 1 sec	50 KA			
9)	Rated current dynamic (peak value)	100 KA			
10)	Rated continuous thermal current.	120 %			

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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(Live /Dead Tank)

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11)	One minute power frequency dry withstand test voltage	460 kV rms	
12)	One minute power frequency wet withstand test voltage	460 kV rms	
13)	Full wave lightning impulse withstand voltage 1.2/50 microseconds	1050 kVp	
14)	One minute power frequency withstand test voltage on secondary	3kV	
15)	Type tests		Attach test reports
a)	Short time current test		
b)	Temperature rise test		
c)	Lightning impulse test on primary terminals		
d)	Power Frequency Withstand Voltage Wet test		
e)	Determination of errors of measuring and protection core		

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f)	Verification of Degree of protection by enclosures.		
g)	Electromagnetic compatibility test.		
h)	Multiple Chopped impulse on Primary terminals – Applicable to 220kV and above		
i)	Internal arc fault protection requirements.		
j)	Measurement of capacitance & dissipation factor measurement in UST & GST modes.		
k)	Protection against ingress of water.		
l)	Internal arc fault test		
o)			
16)	Current density in the primary winding at		
a)	Normal rating	1.65 Amps/mm ² for copper conductor 1A/mm ² for	

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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		Aluminium Conductor	
b)	Short time rating for 1 sec.	50 kA	
c)	Short time rating for 3 sec.	23.09 kA	
d)	Dynamic rating	100 kAP	
17)	Flux density at knee point voltage	<1.5	
18)	Variation in ratio and phase angle error due to variation in		
a)	Voltage by 1%	NA	
b)	Frequency by 1 Hz.	NA	
19)	Whether pressure relief device is provided	Yes	

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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20)	Weight of Oil		
21)	Total weight		
22)	Magnetization curve of CT cores		
23)	Overall dimensions		
24)a)	Minimum knee point voltage	Core – 1&2: 800 V @ 600 A Core–4&5: 800 V @ 600A	
b)	Maximum exciting current at knee point voltage	Core – 1&2: <50 mA @ 600 A Core – 4&5: <50 mA @ 600 A	
c)	Resistance of the secondary winding corrected to 75°C	Core – 1&2: <2 Ohms @ 600A Core – 4&5: <2 Ohms @ 600A	

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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d)	Resistance of the secondary winding corrected to 35°C	Core – 1&2: <1.74 Ohms @ 600A Core – 4&5: <1.74 Ohms @ 600A	
25)	Total /protected creepage in mm	25 mm/kV i.e, 6125 mm/ 3062.5 mm	
26)	Any other details require as per IS.16227		
27)	Method of ratio change	By Secondary Tap	
28)	Grade of Oil	EHV Grade IS 335	
29)	Material of Primary winding	Electrolytic Copper/ E.C Grade Aluminium conductor of equivalent standard	
30)	Material of Secondary Winding	Electrolytic Copper	

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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31)	Type of Insulator Bushing		
32)	Make of Insulator		

Name and Address of Bidder

SUPPLY CHAIN MANAGEMENT

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: SCM-SPEC/XT/220kV & 110kV CTs
(Live /Dead Tank)

Rev.#: 1

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SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 220KV CURRENT TRANSFORMERS – 220kV CT 200/1A(5C)

Sl. No.	Particulars	KSEBL's Requirement	Guaranteed Values
1)	Type	Outdoor, Oil Cooled, Live/ Dead (Hair Pin type) Tank Type Current Transformer	
2)	Manufacturers Design type		
3)	Rated voltage	220 kV	
4)	Rated primary current	200A	
5)	Rated secondary current	1A	
6)	Number of cores	5	

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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7)	Core details	Rated out put	Accurac y class	Rated Output	Accuracy Class
				Guaranteed	Guaranteed
	Core I	-	PS		
	Core II	-	PS		
	Core III	20 VA	0.2S		
	Core IV	-	PS		
	Core V	-	PS		
		ALF	ISF	ALF	ISF
				Guaranteed	Guaranteed
	Core I				
	Core II				
	Core III				
	Core IV				
	Core V				

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		Knee Point Voltage	Secondary Limiting Voltage	Knee Point Voltage	Secondary Limiting Voltage
				Guaranteed	Guaranteed
	Core - I	400 V @ 200 A	<2 Ohms @ 200 A		
	Core -II	400 V @ 200 A	<2Ohms @ 200 A		
	Core -III	-	-		
	Core - IV	400 V @ 200 A	<2Ohms @ 200 A		
	Core -V	400 V @ 200 A	<2Ohms @ 200 A		
		Required		Guaranteed	
8)	Rated short circuit current for 1 sec	50 KA			
9)	Rated current dynamic (peak value)	100 KA			
10)	Rated continuous thermal current.	120 %			
11)	One minute power frequency dry withstand test voltage	460 kV rms			
12)	One minute power frequency wet withstand test voltage	460 kV rms			

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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13)	Full wave lightning impulse withstand voltage 1.2/50 microseconds	1050 kVp	
14)	One minute power frequency withstand test voltage on secondary	3kV	
15)	Type tests		Attach test reports
a)	Short time current test		
b)	Temperature rise test		
c)	Lightning impulse test on primary terminals		
d)	Power Frequency Withstand Voltage Wet test		
e)	Determination of errors of measuring and protection core		
f)	Verification of Degree of protection by enclosures.		
g)	Electromagnetic compatibility test.		

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TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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h)	Multiple Chopped impulse on Primary terminals – Applicable to 220kV and above		
i)	Internal arc fault protection requirements.		
j)	Measurement of capacitance & dissipation factor measurement in UST & GST modes.		
k)	Protection against ingress of water.		
l)	Internal arc fault test		
p)			
16)	Current density in the primary winding at		
a)	Normal rating	1.65 Amps/mm ² for copper conductor 1A/mm ² for Aluminium Conductor	
b)	Short time rating for 1 sec.	50 kA	

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c)	Short time rating for 3 sec.	23.09 kA	
d)	Dynamic rating	100 kAP	
17)	Flux density at knee point voltage	<1.5	
18)	Variation in ratio and phase angle error due to variation in		
a)	Voltage by 1%	NA	
b)	Frequency by 1 Hz.	NA	
19)	Whether pressure relief device is provided	Yes	
20)	Weight of Oil		
21)	Total weight		

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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22)	Magnetization curve of CT cores		
23)	Overall dimensions		
24)a)	Minimum knee point voltage	Core – 1&2: 400 V @ 200 A Core – 4&5: 400 V @ 200 A	
b)	Maximum exciting current at knee point voltage	Core – 1&2: <50 mA @ 200 A Core – 4&5: <50 mA @ 200 A	
c)	Resistance of the secondary winding corrected to 75°C	Core – 1&2: <2 Ohms @ 200 A Core – 4&5: <2 Ohms @ 200 A	
d)	Resistance of the secondary winding corrected to 35°C	Core – 1&2:<1.74 Ohms @ 200 A Core – 4&5:<1.74 Ohms @ 200 A	
25)	Total /protected creepage in mm	25 mm/kV i.e, 6125 mm/ 3062.5 mm	
26)	Any other details require as per IS.16227		
27)	Method of ratio change	By Secondary Tap	

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220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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28)	Grade of Oil	EHV Grade IS 335	
29)	Material of Primary winding	Electrolytic Copper/ E.C Grade Aluminium conductor of equivalent standard	
30)	Material of Secondary Winding	Electrolytic Copper	
31)	Type of Insulator Bushing		
32)	Make of Insulator		

Name and Address of Bidder

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SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 110KV CURRENT TRANSFORMERS -110KV CT 1200/600/1A(5C)

Sl. No.	Particulars	KSEBL's Requirement		Guaranteed Values	
1)	Type	Outdoor Oil Cooled type Live/ Dead (Hair Pin type) Type current Transformer with polymer insulator			
2)	Manufacturers Design type				
3)	Rated voltage	110 kV			
4)	Rated primary current	1200-600A			
5)	Rated secondary current	1A			
6)	Number of cores	5			
7)	Core details	Rated output	Accuracy class	Rated Output	Accuracy Class
				Guaranteed	Guaranteed
	Core I	-	PS		
	Core II	-	0.2S		
	Core III	20 VA	PS		

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	Core IV	30 VA	PS		
	Core V	-	PS		
		ALF	ISF	ALF	ISF
				Guaranteed	Guaranteed
	Core I				
	Core II		<=5		
	Core III	10			
	Core IV				
	Core V				
		Knee Point Voltage	Secondary Limiting Voltage	Knee Point Voltage @600A	Secondary Limiting Voltage -@1200A
				Guaranteed	Guaranteed
	Core - I	600 V @ 600 A	<4 Ohms @ 1200 A		
	Core -II				
	Core -III				
	Core - IV	600 V @ 600 A	<4 Ohms @ 1200 A		

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	Core –V	900 V @ 600 A	<4 Ohms @ 1200 A		
		Required		Guaranteed	
8)	Rated short circuit current for 1 sec	40kA			
9)	Rated current dynamic (peak value)	78.75kA			
10)	Rated continuous thermal current.	120 %			
11)	One minute power frequency dry withstand test voltage	230 kV rms			
12)	One minute power frequency wet withstand test voltage	230 kV rms			
13)	Full wave lightning impulse withstand voltage 1.2/50 microseconds	550 kVp			
14)	One minute power frequency withstand test voltage on secondary	3kV			
15)	Type tests			Attach test reports	
a)	Short time current test				
b)	Temperature rise test				

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c)	Lightning impulse test on primary terminals		
d)	Power Frequency Withstand Voltage Wet test		
e)	Determination of errors of measuring and protection core		
f)	Verification of Degree of protection by enclosures.		
g)	Electromagnetic compatibility test.		
h)	Internal arc fault protection requirements.		
i)	Measurement of capacitance & dissipation factor measurement in UST & GST modes.		
j)	Protection against ingress of water.		
k)	Internal arc fault test		
16)	Current density in the primary winding at		

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a)	Normal rating	1.65 Amps/mm ² (Maximum)for copper conductor 1A/ mm ² for Aluminium Conductor	
b)	Short time rating for 1 sec.	40kA (Maximum)	
c)	Short time rating for 3 sec.		
d)	Dynamic rating	78.75kA (Maximum)	
17)	Flux density at knee point voltage	1.40 Tesla	
18)	Variation in ratio and phase angle error due to variation in		
a)	Voltage by 1%	NA	
b)	Frequency by 1 Hz.	NA	

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19)	Whether pressure relief device is provided	Yes SS Bellows	
20)	Weight of Oil		
21)	Total weight		
22)	Magnetization curve of CT cores		
23)	Overall dimensions		
24)a)	Minimum knee point voltage	Core – 1: 600 V @ 600 A Core – 4: 600 V @ 600 A Core – 5: 900 V @ 600 A	
b)	Maximum exciting current at knee point voltage	Core – 1: 30 mA at vk/2 @ 1200 A Core – 4: 30 mA at vk/2 @ 1200 A Core – 5: 30 mA at vk/2 @ 1200 A	
c)	Resistance of the secondary winding corrected to 75°C	Core – 1: <4 Ohms @ 1200 A Core – 4: <4 Ohms @ 1200 A	

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		Core – 5: <4 Ohms @ 1200 A	
d)	Resistance of the secondary winding corrected to 35°C	Core – 1: <3.48 Ohms @ 1200 A Core – 4: <3.48 Ohms @ 1200 A Core – 5: <3.48 Ohms @ 1200 A	
25)	Total /protected creepage in mm	25 mm/kV i.e, 3075 mm/1537.50 mm	
26)	Any other details require as per IS.16227		
27)	Method of ratio change	By Secondary Tap	
28)	Grade of Oil	As per IS 335	
29)	Material of Primary winding	Hard drawn Electrolytic Copper/ E.C Grade Aluminium conductor of equivalent standard	
30)	Material of Secondary Winding	Electrolytic Copper	

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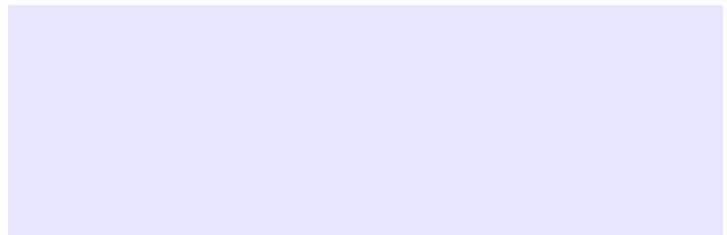
220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

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31)	Type of Insulator Bushing		
32)	Make of Insulator		



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SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 110KV CURRENT TRANSFORMERS – 110kV CT 800/400/1A(4C)

Sl. No.	Particulars	KSEB's Requirement		Guaranteed Values	
1)	Type	Outdoor Oil Cooled type Live / Dead (Hair pin type) Type current Transformer with polymer insulator			
2)	Manufacturers Design type				
3)	Rated voltage	110 kV			
4)	Rated primary current	800-400A			
5)	Rated secondary current	1A			
6)	Number of cores	4			
7)	Core details	Rated out put	Accuracy class	Rated Output	Accuracy Class
				Guaranteed	Guaranteed
	Core I	-	PS		
	Core II	-	0.2S		
	Core III	20 VA	PS		
	Core IV	30 VA	PS		
	Core V				

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		ALF	ISF	ALF	ISF
				Guaranteed	Guaranteed
	Core I				
	Core II		<=5		
	Core III	10			
	Core IV				
	Core V				
		Knee Point Voltage	Secondary Limiting Voltage	Knee Point Voltage @400A	Secondary Limiting Voltage -@800A
				Guaranteed	Guaranteed
	Core - I	900 V @ 400 A	<4 Ohms @ 800 A		
	Core -II				
	Core -III				
	Core - IV	900 V @ 400 A	<4 Ohms @ 800 A		
	Core -V				
		Required		Guaranteed	
8)	Rated short circuit current for 1 sec	40 KA			
9)	Rated current dynamic (peak value)	100 KA			
10)	Rated continuous thermal current.	120 %			
11)	One minute power frequency dry withstand test voltage	230 kV rms			
12)	One minute power frequency wet withstand test voltage	230 kV rms			

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13)	Full wave lightning impulse withstand voltage 1.2/50 microseconds	550 kVp	
14)	One minute power frequency withstand test voltage on secondary	3kV	
15)	Type tests		Attach test reports
a)	Short time current test		
b)	Temperature rise test		
c)	Lightning impulse test on primary terminals		
d)	Power Frequency Withstand Voltage Wet test		
e)	Determination of errors of measuring and protection core		
f)	Verification of Degree of protection by enclosures.		
g)	Electromagnetic compatibility test.		
h)	Internal arc fault protection requirements.		
i)	Measurement of capacitance & dissipation factor measurement in UST & GST modes.		
j)	Protection against ingress of water.		

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k	Internal arc fault test		
16)	Current density in the primary winding at		
a)	Normal rating	1.65 Amps/mm ² (Maximum) for copper conductor 1A/ mm ² for Aluminium Conductor	
b)	Short time rating for 1 sec.	40kA (Maximum)	
c)	Short time rating for 3 sec.		
d)	Dynamic rating	78.75kA (Maximum)	
17)	Flux density at knee point voltage	1.40 Tesla	
18)	Variation in ratio and phase angle error due to variation in		
a)	Voltage by 1%	NA	
b)	Frequency by 1 Hz.	NA	
19)	Whether pressure relief device is provided	Yes SS Bellows	
20)	Weight of Oil		
21)	Total weight		
22)	Magnetization curve of CT cores		
23)	Overall dimensions		

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24)a)	Minimum knee point voltage	Core – 1: 900 V @ 400 A Core – 4: 900 V @ 400 A	
b)	Maximum exciting current at knee point voltage	Core – 1: 30 mA at vk/2 @ 400 A Core – 4: 30 mA at vk/2 @ 400 A	
c)	Resistance of the secondary winding corrected to 75°C	Core – 1: <4 Ohms @ 800 A Core – 4: <4 Ohms @ 800 A	
d)	Resistance of the secondary winding corrected to 35°C	Core – 1: <3.48 Ohms @ 800 A Core – 4: <3.48 Ohms @ 800 A	
25)	Total /protected creepage in mm	25 mm/kV i.e, 3075 mm/ 1537.50 mm	
26)	Any other details require as per IS.16227		
27)	Method of ratio change	By Secondary Tap	
28)	Grade of Oil	As per IS 335	

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29)	Material of Primary winding	Hard drawn Electrolytic Copper/ E.C Grade Aluminium conductor of equivalent standard	
30)	Material of Secondary Winding	Electrolytic Copper	
31)	Type of Insulator Bushing		
32)	Make of Insulator		

Name and Address of Bidder

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SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR 110KV CURRENT TRANSFORMERS – 110kV CT 400/200/100/1A(4C)

Sl. No.	Particulars	KSEB's Requirement		Guaranteed Values	
		Rated out put	Accuracy class	Rated Output	Accuracy Class
1)	Type	Outdoor Oil Cooled type Live/ Dead (Hair Pin type) Type current Transformer with polymer insulator			
2)	Manufacturers Design type				
3)	Rated voltage	110 kV			
4)	Rated primary current	400-200-100A			
5)	Rated secondary current	1A			
6)	Number of cores	4			
7)	Core details			Rated Output	Accuracy Class
				Guaranteed	Guaranteed
	Core I	-	PS		
	Core II	-	0.2S		
	Core III	20 VA	PS		
	Core IV	30 VA	PS		
	Core V				
		ALF	ISF	ALF	ISF
				Guaranteed	Guaranteed
	Core I				
	Core II		<=5		
	Core III	10			
	Core IV				
	Core V				

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		Knee Point Voltage	Secondary Limiting Voltage	Knee Point Voltage @400A	Secondary Limiting Voltage -@400A
				Guaranteed	Guaranteed
	Core - I	900 V @ 400 A	<4 Ohms @ 400 A		
	Core -II				
	Core -III				
	Core - IV	900 V @ 400 A	<4 Ohms @ 400 A		
	Core -V				
		Required		Guaranteed	
8)	Rated short circuit current for 1 sec	40kA			
9)	Rated current dynamic (peak value)	78.75kA			
10)	Rated continuous thermal current.	120 %			
11)	One minute power frequency dry withstand test voltage	230 kV rms			
12)	One minute power frequency wet withstand test voltage	230 kV rms			
13)	Full wave lightning impulse withstand voltage 1.2/50 microseconds	550 kVp			
14)	One minute power frequency withstand test voltage on secondary	3kV			
15)	Type tests			Attach test reports	
a)	Short time current				

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	test		
b)	Temperature rise test		
c)	Lightning impulse test on primary terminals		
d)	Power Frequency Withstand Voltage Wet test		
e)	Determination of errors of measuring and protection core		
f)	Verification of Degree of protection by enclosures.		
g)	Electromagnetic compatibility test.		
h)	Internal arc fault protection requirements.		
i)	Measurement of capacitance & dissipation factor measurement in UST & GST modes.		
j)	Protection against ingress of water.		
k)	Internal arc fault test		
16)	Current density in		

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	the primary winding at		
a)	Normal rating	1.65 Amps/mm ² (Maximum)for copper conductor 1A/ mm ² for Aluminium Conductor	
b)	Short time rating for 1 sec.	40kA (Maximum)	
c)	Short time rating for 3 sec.		
d)	Dynamic rating	78.75kA (Maximum)	
17)	Flux density at knee point voltage	1.40 Tesla	
18)	Variation in ratio and phase angle error due to variation in		
a)	Voltage by 1%	NA	
b)	Frequency by 1 Hz.	NA	
19)	Whether pressure relief device is provided	Yes SS Bellows	
20)	Weight of Oil		
21)	Total weight		
22)	Magnetization curve of CT cores		
23)	Overall dimensions		
24)a)	Minimum knee point voltage	Core – 1: 900 V @ 400 A Core – 4: 900 V @ 400 A	
b)	Maximum exciting current at knee	Core – 1: 30 mA at vk/2 @ 400 A Core – 4: 30 mA at vk/2 @ 400 A	

SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram



TECHNICAL SPECIFICATION

220KV & 110KV CURRENT TRANSFORMERS (LIVE/ DEAD TANK TYPE) OF VARIOUS RATINGS AND SUPPORTING STRUCTURES

Doc. #: **SCM-SPEC/XT/220kV & 110kV CTs**
(Live /Dead Tank)

Rev.#: 1

Effective Date **29/09/2022**

	point voltage		
c)	Resistance of the secondary winding corrected to 75°C	Core – 1: <4 Ohms @ 400 A Core – 4: <4 Ohms @ 400 A	
d)	Resistance of the secondary winding corrected to 35°C	Core – 1: <3.48 Ohms @ 400 A Core – 4: <3.48 Ohms @ 400 A	
25)	Total /protected creepage in mm	25 mm/kV i.e, 3075 mm/ 1537.50 mm	
26)	Any other details require as per IS.16227		
27)	Method of ratio change	By Secondary Tap	
28)	Grade of Oil	As per IS 335	
29)	Material of Primary winding	Hard drawn Electrolytic Copper/ E.C Grade Aluminium conductor of equivalent standard	
30)	Material of Secondary Winding	Electrolytic Copper	
31)	Type of Insulator Bushing		
32)	Make of Insulator		

Name and Address of Bidder

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SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS FOR SUPPORTING STRUCTURES OF 220kV & 110KV CURRENT TRANSFORMERS

Sl.No.	Particulars	Guaranteed Values	
		220kV / 110kV	
1)	Mounting details		
2)	Over all dimensions		
3)	Weight of Supporting Structure		
4)	Thickness of Galvanizing of Supporting Structure		
5)	Additional information, if any.		
6)	Size of the foundation bolt (dia., length) in mm.		
7)	Sizing between foundation bolts in mm (both ways)	400mm x 400mm (for 110kV & 220kV)	
8	Height of the structure in mm	Height of structure+ height of insulator stack up to live parts of the CT shall be minimum: a) 4600mm for 110kV b) 5600mm for 220kV	

Name and Address of Bidder