

**SPECIFICATION FOR CURRENT TRANSFORMERS
RATED UP TO 36KV**

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SPECIFICATION

FOR

CURRENT TRANSFORMERS RATED UP TO 36KV

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Revision History

#	Date	Revision No.	Major Revision Description
1	February, 2021	3	Secondary wires terminals (S1, S2) identification.

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1 SCOPE

This specification defines the minimum technical requirements for design, engineering, manufacturing, testing, inspection and performance of current transformers rated up to 36kV for indoor and outdoor installation in an enclosure and intended to be used for metering and protection in the distribution system of Saudi Electricity Company (SEC) in Saudi Arabia.

2 CROSS REFERENCES

This specification shall always be read in conjunction with SEC General Specification No. 01-SDMS-01 (latest revision) titled "General Requirements for all Equipment/Materials," which shall be considered as an integral part of this specification. It shall also be read in conjunction with SEC purchase order and/or contract schedules, and scope of work/technical specifications for projects, as applicable.

3 APPLICABLE CODES AND STANDARDS:

The latest revision of the following codes and standards shall be applicable for the equipment/materials covered in this specification. In case of any deviation, the vendor/manufacturer may propose equipment/materials conforming to alternate codes or standards. However, the provisions of SEC standards shall supersede the provisions of these alternate standards in case of any difference.

IEC	International Electro-technical Commission
IEC 61869-1	Instrument Transformers - Part 1: General Requirements
IEC 61869-2	Instrument Transformers - Part 2: Additional Requirements for Current Transformers
IEC TR 61869-100	Instrument Transformers - Part 100: Guide for Application of Current Transformers in Power System Protection
IEEE C37.110	Guide for the Application of Current Transformers Used for Protective Relaying Purposes

Table 1: Applicable Codes and standards (IEC)

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4 SERVICE CONDITIONS:

The CTs shall be suitable for operation under the service conditions specified in the latest revision of SEC specification 01-SDMS-01.

All fittings and attachments of the CTs shall be capable of withstanding the effects of direct solar radiation at their installed locations. The temperature of surfaces exposed to direct solar radiation shall be regarded as 75°C plus the effect of any internal heating.

5 SYSTEM CONDITIONS:

5.1 GENERAL

- 5.1.1 The CTs shall meet or exceed the requirements of this specification in all respects and it shall be manufactured and tested in conformance with relevant international standards.
- 5.1.2 Manufacturer's drawings shall show the outline of the CTs together with all pertinent dimensions. Any variations in these dimensions due to manufacturing tolerances shall be indicated.
- 5.1.3 The CTs shall be manufactured and tested in conformance with the applicable clauses of IEC 61869-1 and IEC 61869-2.
- 5.1.4 The CTs shall be made from high-quality materials. The encapsulating material shall be self-extinguishing and heat-resistant with excellent mechanical strength.
- 5.1.5 Low-voltage CTs shall be single-ratio.
- 5.1.6 Medium-voltage CTs shall either be single-ratio or multi-ratio.
- 5.1.7 CTs shall be provided with stainless steel mounting accessories for cables and busbars. Mounting arrangement on wall/floor shall be excluded.
- 5.1.8 CTs with 2-Core secondary winding shall have shorting provisions available prior to opening of the measuring circuit.

5.2 RATED PRIMARY TERMINAL INSULATION LEVELS

The rated primary terminal insulation level of the CTs shall be based on highest voltage for the equipment, and shall be determined by the rated power-frequency withstand voltages and rated lightning impulse withstand voltage wherein the minimum values are shown in Table 2 below.

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Highest Voltage for Equipment, U_m (rms) kV	Rated Power-Frequency Withstand Voltage, (rms) kV	Rated Lightning Impulse Withstand Voltage, (peak) kV
0.72	3	6
17.5	38	95
36	70	170

Table 2: Rated primary terminal insulation levels of CTs

5.3 INSULATION REQUIREMENT FOR SECONDARY TERMINALS

The rated power-frequency withstand voltage (insulation level) at the secondary terminals shall be 3kV (rms).

5.4 RATED FREQUENCY

The CTs shall be designed to operate at rated frequency of 60Hz.

5.5 BURDEN

The minimum burden at 0.8PF lagging shall be 10VA for LV CTs, and 15VA for MV protection and metering CTs.

The actual value of burden shall be decided based on calculations carried out by the manufacturer/supplier of the various loads/burdens that shall be connected on the CTs.

5.6 ACCURACY CLASS

The accuracy class of metering CTs shall be 0.5 for the rated burden at rated current and extended current.

The accuracy class of protection CTs shall be 5P10 and 10P10.

5.7 EXTENDED CURRENT RATINGS

The minimum requirement for the extended rating at 55°C shall be 120% of the primary current, and it shall be clearly marked on the nameplate of the CTs.

5.8 INSTRUMENT SECURITY FACTOR

Instrument security factor (FS) shall be less than five (5).

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5.9 RATED SHORT-TIME THERMAL CURRENT

The rated short-time thermal current (I_{th}) shall be equal or higher than the associated equipment as applicable, with a minimum duration of 1 second.

5.10 RATED DYNAMIC CURRENT

The rated dynamic current (I_{dyn}) shall not be less than $2.5 \times I_{th}$.

6 LOW-VOLTAGE CURRENT TRANSFORMERS:

6.1 DESIGN AND CONSTRUCTION

The LV CTs shall be window-type suitable for horizontal and vertical mounting on cables and /or busbars.

Rated Primary and Secondary Current of LV CTs

- The rated secondary current is 5A.
- The rated primary currents are:
150A, 200A, 250A, 300A, 400A, 500A, 600A, 800A, 1000A, 1500A, 3000A, and 4000A
- LV CTs with primary current rated up to 600A shall be suitable for rigidly fixing on the surface of fiberglass meter boxes with secondary wires brought-out directly with ends crimped with ferrules/end-sleeves.
- The secondary wires shall be high-temperature insulated copper 2.5mm² designed for a maximum permissible continuous temperature of 90°C, with minimum length of 60cm.
- The secondary wires terminals shall be marked with colors where (S1) shall be (RED) and (S2) shall be (BLUE).
- The connection of the secondary wire and the winding shall be rigidly and permanently fixed, and the orifice to where the secondary wire passes through shall be provided with wire grommets or better to provide mechanical protection on the wire. Other methods to provide mechanical protection on the wire may be proposed for SEC evaluation and approval.

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- LV CTs with primary current rated above 600A shall be suitable for fixing on busbars.
- The window sizes of LV CTs suitable for the sizes of cables and/or busbars are shown in Table 3.

CT Ratio	Body RAL Colour	Minimum Window Size, mm		Maximum Dimensions, mm		
		Busbar	Cable	Height	Width	Depth
150/5	9001	1 x 10 x 20	1 x Ø40	110	80	55
200/5	3001	1 x 10 x 20	1 x Ø40	110	80	55
250/5	2010	1 x 10 x 25	1 x Ø40	110	80	55
300/5	1003	1 x 10 x 30	1 x Ø40	110	80	55
400/5	6032	1 x 10 x 40	1 x Ø40	110	80	55
500/5	5005	1 x 10 x 50	1 x Ø45	110	80	55
600/5	5012	1 x 10 x 60	1 x Ø45	110	80	55
800/5	4008	1 x 10 x 100	N/A	180	115	55
1000/5	6038	1 x 10 x 100	N/A	180	115	55
1500/5	8002	2 x 10 x 100	N/A	180	115	55
3000/5	9004	3 x 10 x 100	N/A	200	120	55
4000/5	7004	3 x 15 x 100	N/A	200	120	55

Table 3: Allowable dimensions of Solid-Core LV CTs

6.1.1. Split-Core CTs

Split-core CTs shall be encapsulated with integrated mounting brackets and accessories suitable for fixing on busbar sizes per Table 4, and for cable fixing, window size shall be 85 x 85mm for 1500/5 CT, and 135 x 135mm for both 3000/5 and 4000/5 CTs.

CT Ratio	Body RAL Colour	Minimum Window Size, mm		Maximum Dimensions, mm		
		Busbar	Cable	Height	Width	Depth
1500/5	8002	2 x 10 x 100	85 x 85	160	170	45
3000/5	9004	3 x 10 x 100	135 x 135	210	250	55
4000/5	7004	3 x 15 x 100	135 x 135	210	250	55

Table 4: Allowable dimensions of Split-Core LV CTs

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7 MEDIUM-VOLTAGE CURRENT TRANSFORMERS:

7.1 DESIGN AND CONSTRUCTION

7.1.1. The MV CTs shall be block type, cast-resin insulated.

7.1.2. Number of Secondary Windings:

- 2-Core Secondary Windings, i.e. 1-core for metering and 1-core for protection, each core has its own magnetic core.
- 1-Core Secondary Winding, used for metering only of pole-mounted metering units as specified in the technical data schedule

7.1.3. All MV CTs shall be of dual-ratio type that is selectable on the primary side as shown in Table 5.

VOLTAGE LEVEL	RATIOS
17.5kV	600 - 300 / 5 – 5
	400 - 200 / 5 – 5
	300 - 150 / 5 – 5
	150 - 75 / 5 – 5
36kV	600 - 300 / 5 – 5
	400 - 200 / 5 – 5
	200 - 100 / 5 – 5
	80 - 60 / 5 – 5
	60 - 30 / 5 – 5
	20 - 10 / 5 – 5

Table 5: Allowable dimensions of MV CTs

8 MARKING

The terminals shall be marked clearly and indelibly either on surfaces of the encapsulating body or in their immediate vicinity as P1/P2 and S1/S2 for primary and secondary terminals, respectively in accordance with international standards.

Each CT shall have a clear nameplate showing the following information in accordance with the applicable clauses of IEC 61869-1 and IEC 6189-2:

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- a. Manufacturer and Model/Type
- b. Serial Number
- c. Conformance Standard, i.e. IEC 61869-1 / IEC 61869-2
- d. Rated Primary and Secondary Current, e.g. 150/5A
- e. Rated Frequency
- f. Rated Short-Time Thermal Current, I_{th}
- g. Rated Dynamic Current, $I_{dyn} \geq (2.5 \times I_{th})$
- h. For 2-Core Secondary Windings: use of each core and their corresponding terminals
- i. Accuracy
- j. Burden
- k. Extended Current Rating
- l. Highest System Voltage
- m. Rated Insulation Level
- n. Origin
- o. SEC Issued PO Number and Tender Number
- p. Vendor Name
- q. Reference SEC Specification
- r. SEC Monogram

In addition, the transformer ratio shall be boldly marked on the body in figures at least 20mm height.

9 TESTING AND INSPECTION

The CTs shall be tested in conformance with the applicable requirements of the latest version of IEC 61869-1 and IEC 61869-2.

9.1 Routine Tests

Routine tests in conformance with the applicable clauses of IEC 61869-1 and IEC 61869-2 shall be performed on all CTs. Electronic copies of the test reports shall be submitted to SEC in USB Flash Drive for each batch to be delivered prior to issuance of the releases.

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9.2 Type tests

Type test shall be performed in complete conformance with the applicable clauses of IEC 61869-1 and IEC 61869-2. It shall be performed at SEC approved laboratories.

SEC reserves the right to attend and witness the tests.

SEC reserves the right to request the supplier/manufacturer to repeat the type test every five (5) years, or as needed should the supplied CTs have frequent faults and failures.

9.3 Sample inspection

Samples together with actual CAD drawings and routine test reports shall be submitted for inspection/evaluation prior to issuance of approval for mass production. The following attributes shall be checked:

- a. Dimensional verification
- b. Markings
- c. Finishing
- d. Compliance with this specification
- e. Packaging

9.4 Sample testing

SEC reserves the right to optionally carryout testing either through its in-house laboratory or in 3rd-party laboratories to verify the performance of the supplied CTs. This shall be performed by randomly selecting 10% samples of any batch delivered to each SEC warehouses. The batch shall be assumed rejected should more than three (3) CTs are found faulty/non-compliant.

In case of acceptance, SEC can optionally test the whole batch and the supplier/manufacturer shall replace non-compliant CTs.

In case of rejection, the supplier/manufacturer shall either immediately replace the whole batch or to let SEC perform the test on the whole quantity as mentioned above, and the supplier/manufacturer shall bear the cost of the tests, and replace non-compliant CTs.

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10 PACKING AND SHIPPING

Packing and shipping requirement shall generally be as per latest revision of SEC General Requirements for Equipment/Materials, 01-SDMS-01 or as per purchase order requirements.

Each CT with all its accessories shall be packed in a box as a complete unit/assembly and shall be delivered ready for use.

Packing shall protect the CTs against damage during shipment and site handling.

Each CT shall be packed to protect it from dust, dirt, and water.

Suppliers should coordinate with SEC Warehousing Department for additional packing, handling, and or shipping instructions, as applicable.

Each box shall be printed with the same information mentioned in the nameplate per Clause 8 of this specification.

11 GUARANTEE

The supplier/manufacturer shall guarantee the products against all defects arising out of faulty design or manufacturing defects or defective materials for a period of five (5) years from the date of delivery.

The supplier shall guarantee the uniformity of the products delivered with the approved samples.

12 SUBMITTALS

The following submittals shall be provided as hard copies and in electronic formats stored in USB flash Drive. Unless otherwise specified, e-copies of the files should be PDF format.

12.1 Submittals required with tender/inquiry

- 12.1.1 Summary in table form with the following information: list of items offered, manufacturer, origin, catalogue number, and quantity
- 12.1.2 Clause-by-clause compliance with the latest revision of SEC specification 50-SDMS-01.
- 12.1.3 Manufacturer's Catalogue

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- 12.1.4 Certificate stating that the raw material has been sampled, tested and inspected in accordance with relevant standard specifications.
- 12.1.5 Product type test reports and certificates carried out from SEC approved laboratories.
- 12.1.6 Filled-up technical data schedule on each of the items offered, e-copy in Excel (*.xlsx) format.
- 12.1.7 Manufacturer CAD drawings, e-copy in AutoCAD 2010 (*.dwg) format, for each of the items offered showing the following information:
 - a. Dimensions and cross-sectional views of each CT and its associated accessories
 - b. Layout and dimensions of terminals
 - c. Cable/busbar mounting details
 - d. Dimensions of windows aperture
 - e. Weight of the CT
- 12.1.8 USB Flash Drive containing e-copy of all the documents mentioned above

12.2 Submittals required following award of contract

- 12.2.1 Samples in compliance with Clause 9.3 of this specification
- 12.2.2 Manufacturing and routine test schedules
- 12.2.3 Quality assurance tests
- 12.2.4 Factory test reports
- 12.2.5 Special tests, if applicable
- 12.2.6 USB Flash Drive containing e-copies of all the documents mentioned above

13 TECHNICAL DATA SCHEDULE:

- 13.1 The vendor shall complete and return one copy of the attached data Schedule with quotation. In addition to data Schedule, clause-by-clause compliance to this specification shall be confirmed/ submitted.
- 13.2 Detail dimensional drawing of each item shall be submitted.
- 13.3 Type test certificates.

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TECHNICAL DATA SCHEDULE
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(Sheet 1 of 3)

SEC Inquiry No. _____ Item No. _____

S.No.	DESCRIPTION	SEC SPECIFIED VALUES	VENDOR PROPOSED VALUES
1	General		
1.1	Reference Manufacturing Standard	IEC 61869-1 / IEC 61869-2	
1.2	Rated Primary Terminal Insulation Level - Impulse Withstand Voltage (Peak), kV - Power Frequency Withstand Voltage, kV	* *	
1.3	Insulation Level of Secondary Terminals	3kV(rms)	
1.4	Rated Frequency, Hz	60	
1.5	Burden at 0.8PF Lagging, VA - LV CTs - MV CTs	10 15	
1.6	Accuracy Class - Metering - Protection	0.5 5P10 / 10P10	
1.7	Extended Current Rating at 55°C (Minimum)	120% of Primary Current	
1.8	Instrument Security Factor (FS)	<5	
1.9	Rated Short-Time Thermal Current, Ith	*	
1.10	Rated Dynamic Current, Idyn > (2.5 x Ith)	*	
1.11	Current Ratio	*	
1.12	Encapsulating Body RAL Color	*	
1.13	CT Type (Window / Block / Split-Core)		
1.14	Window Size		
2	Terminals		
2.1	Marking of Primary Terminals	P1 / P2	
2.2	Marking of Secondary Terminals	S1 / S2	

Table 6: Technical Data Schedule 1.

* To be specified in tender documents.

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SEC Inquiry No. _____

Item No. _____

S.No.	DESCRIPTION	SEC SPECIFIED VALUES	VENDOR PROPOSED VALUES
2.2	Marking of Secondary Terminals	S1 / S2	
2.3	Shorting Provision of 2-Core Secondary Windings Available	Yes	
2.4	Size of the Secondary Wires	2.5mm ²	
2.5	Mounting Accessories Available	Yes	
2.6	CT Dimensions, mm (H x W x D)		
2.7	Creepage Distance of MV CTs		
3	Testing		
3.1	Product is Type Tested	Yes	
3.2	SEC Approved Laboratory	**	
3.3	Date Tested	**	
3.4	Manufacturer	**	
3.5	Model/Type	**	
3.6	Country of Origin	**	
3.7	Submittals Required with Tender/Inquiry Included or Not?	**	

Table 7: Technical Data Schedule 2.

* To be specified in tender documents.

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SEC Inquiry No. _____

Item No. _____

- Additional Technical Information or Features Specified by SEC
- Additional Supplementary Data or Features Proposed by Bidder/Vendor/Supplier.
- Other Particulars to be filled-up by the Bidder/Vendor/Supplier.
- List of Deviations and Clauses to which exception is taken by the Bidder/Vendor/Supplier. (Use separate sheet, if necessary).

Description	Manufacturer of Material/Equipment	Vendor/Supplier
Name of Company		
Location and Office Address		
Name and Signature of Authorized Representative with Date		
Official Seal / Stamp		

Table 8: Technical Data Schedule 3.