Saudi Electricity Company	الشركة السعودية للكهرباء

SEC Distribution Materials Specification	50-SDMS-02 Rev 0
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50-SDMS-02

Rev 0

SPECIFICATION

FOR

PRIMARY SUBSTATION CURRENT TRANSFORMERS 11KV THROUGH 69KV

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1.0 SCOPE

This SEC Distribution Material Specification (SDMS) specifies the minimum technical requirements for design, engineering, manufacture, inspection, testing and performance of outdoor/indoor single phase free-standing, bushing type and ring type Current Transformers 11kV through 69kV, intended to be used in the Primary Distribution Substations of Saudi Electricity Company, Saudi Arabia.

2.0 CROSS REFERENCES

This Material Standard Specification shall always be read in conjunction with latest SEC General Specification No. 01-SDMS-01, titled "General Requirements for All Equipment/Materials", which shall be considered as an integral part of this SDMS.

This SDMS shall also be read in conjunction with SEC Purchase Order or Contract Schedules for project, as applicable.

3.0 APPLICABLE CODES AND STANDARDS

The latest revision/amendments of the following Codes and Standards shall be applicable for the equipment/material covered in this SDMS. In case of conflict, the vendor/manufacturer may propose equipment/material conforming to one group of Industry Codes and Standards quoted hereunder without jeopardizing the requirements of this SDMS.

3.1	IEC 61869-1	Instrument Transformers, Part 1: General Requirements
3.2	IEC 61869-2	Instrument Transformers, Part 2: Additional Requirements for Current Transformers
3.3	IEC 62155	Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1000 V
3.4	IEC 60529	Degree of Protection Provided By Enclosures (IP-Code)
3.5	IEC 60836	Specifications for unused siliconeinsulation liquids for electricomechanical purposes
3.6	IEEE C37.110	Guide for the Application of Current Transformers used for

Protective Relaying Purposes

3.7	IEEE C57.13	IEEE Standard Requirements for Instrument Transformers
3.8	IEEE C57.19.00	IEEE Standard General Requirements and Test Procedure for Outdoor Power Apparatus Bushings
3.9	IEEE C57.111	IEEE Guide for Acceptance of Silicone Insulating Fluid and its Maintenance in Transformers
3.10	ASTM 4652	Standard Specification for Silicone Fluid Used for Electrical Insulation
3.11	54-TMSS-01	Mineral Insulating Oil for Electrical Apparatus
3.12	SEC-02-01(REV-0)	Insulating Oil forTransformers and Switchgear

4.0 DESIGN AND CONSTRUCTION REQUIREMENTS

4.1 Design

4.1.1 Ratings

a. The primary current, secondary current and voltage ratings shall be as specified in the data schedule.

b. Short time current ratings of protective and metering current transformers shall be equal to or higher than that of associated switchgear and equipment as applicable and shall meet the requirement per data schedule.

c. Unless otherwise specified all current transformers CT/CTs core for protection shall have ratings and performance requirements of relaying including transient performance characteristics at specified tap. Calculation for the same shall be furnished.

d. Continuous thermal current for all CTs at highest tap shall be as per data schedule without exceeding temperature limits.

e. CTs shall be designed to operate continuously for the respective application/installations.

4.1.2 Class of CTs

a. Unless otherwise specified in the data schedule the metering class shall be 0.2 IEC at specified tap.

b. Metering core shall have Instrument Security Factor (ISF) less than or equal to 5 for single ratio current transformers and for multi-ratio CTs (at highest tap) used in a single breaker scheme. For multi-ratio CTs used in multi-CB scheme or ring main scheme, ISF shall be less than or equal to 6.

c. When CTs are manufactured per IEC all protection CTs shall be class P, PX, and TPX per IEC 61869-2 or as specified in the data schedule.

d. CTs manufactured per class P of IEC 61869-2 shall meet the requirement of knee-point voltage (V_k), magnetizing current at specified voltage (I_{mag}), CT secondary resistance (R_{CT}) and any other special requirement per data schedule and/or the requirements of respective applications as specified in CT sizing requirements of PTS. When CTs are manufactured per class TPX of IEC 61869-2, the knee-point voltage requirement shall be replaced by excitation limiting secondary voltage (U_{al}).

4.2 Construction

4.2.1 General

a. CTs shall be of ring type (with continuous ring or split core), bushing type or free-standing type as specified in the data schedule.

b. All CTs shall be of low leakage construction.

c. Cores of protection CTs shall be of high grade grain-oriented, silicone steel with non-gapped construction.

d. Cores of metering CTs shall be of nickel alloy type to provide low losses, high accuracy and low saturation levels.

e. Insulation for CTs of different voltage class and indoor/outdoor installations shall be per Table-1. Unless otherwise specified in the data schedule, 13.8kV CTs shall be indoor cast resin type only as per Table-1.

f. CTs with mineral oil/silicone liquid as insulation per Table-1 shall be hermetically sealed and provided with a secondary terminal compartment and a grounding terminal. The sealing system shall prevent drying and leakage of oil. The upper part of CT shall consist of procelain housing only with primary terminal, bellows/vessel expansion tank and oil/liquid level indicator.

g. CTs with cast resin insulation with nominal voltage of 34.5kV and below, as per Table-1 shall be provided with secondary terminal compartment, grounding terminal and primary terminal.

h. Each free-standing type CT shall be provided with a suitable lifting arrangement to lift the entire unit.

Table-1

Nominal Voltage, KV	Installation (Indoor/Outdoor)	Type of CT Insulation
11, 13.8, 33, 34.5	Indoor (Bushing or Ring Type)	Cast Resin
33, 34.5, 69	Outdoor	Mineral Oil
69	Indoor	Cast Resin or Silicone Liquid

4.2.2 Insulating Oil/Silicone Liquid

a. The insulating oils shall be PCB free.

b. The mineral insulating oil shall conform to 54-SDMS-01.

c. Silicone liquid shall be per ASTM D-4652 or IEC 60836.

4.2.3 Insulator Housing

a. Outdoor insulator housings shall be electrical grade, wet processed procelain of brown color conforming to IEC 60233.

b. Indoor insulator housings shall be of procelain or resin cast.

c. Outdoor porcelain housing shall withstand a washing pressure of 3500 kPa without permitting water ingress into the internal of CTs or secondary terminal box.

d. Minimum creepage distance for insulator housings shall be per 01-SDMS-01.

e. Housings of bushing current transformer shall meet all the requirements as given in their respective equipment SDMS.

4.2.4 Terminals

a. The primary terminals shall be aluminum or tin plated copper round or flat bar terminals for bar primary and shall be copper only for wound type primary.

b. The secondary terminals shall be of non-captive pan head screw type and shall accept copper cable of adequate size as determined by current transformer sizing calculation with minimum of 4 mm^2. Facility shall be provided for shorting, isolation and grounding of secondary terminals inside the terminal box. Removable cable gland plate shall be provided on the terminal box.

c. The degree of protection of enclosure for secondary terminal box shall be per 01-SDMS-01.

d. Primary and secondary terminals and polarity shall be marked per applicable standards.

4.3 Primary Winding for Free-Standing Type CTs

4.3.1 Material

The primary can be of bar type or multiple core winding type. When bar primary is provided it can be copper or aluminum per data schedule. However when wound primary is provided the winding shall be of copper only.

4.3.2 Insulation

Minimum primary winding insulation requirements for CTs shall be per 01-SDMS-01.

4.4 Secondary Windings

4.4.1 Winding

Each core of CTs shall be supplied with copper secondary core winding/s with negligible leakage reactance in the whole windings and also between tapings. The protection core shall be designed without turn correction for class TPX CTs. For other class of CTs and/or measuring CTs, turn correction is acceptable.

4.4.2 Burden and Other Characteristics

Unless otherwise specified in the data schedule the burden rating and other characteristics shall be specified by the CONTRACTOR with supporting calculations for approval.

4.4.3 Multi-Ratio

For multi-ratio CTs ratio tap shall be provided on the secondary windings per IEC and it shall be per CT sizing criteria specified in the PTS.

4.4.4 Other Requirements

The secondary winding shall meet all other requirements per PTS or data schedule.

4.5 Grounding

Each free-standing CT shall be provided with one ground pad and a clamp type terminal located at the base to accommodate grounding conductor sizes from 70mm^2 to 240mm^2.

4.6 Nameplate

4.6.1 The CT shall bear a nameplate which shall be written in English and contain the information listed in IEC 61869-2 for all taps from the highest tap up to the specified tap and the following additional information:

a. The words "_____kV Current Transformer"

b. SEC Purchase Order No. and Contract No./Job Order No.

c. 50-SDMS-02, Rev.0

4.6.2 The nameplate material shall be stainless steel and shall be fastened to the equipment by stainless steel screws or rivets.

5.0 TESTS

All tests result shall be provided for review and approval.

5.1 Type (Design) Tests

5.1.1 All type tests described in IEC 61869-2 shall be performed on the representative unit or on the first unit of every new design or rating to be supplied.

5.1.2 Temperature rise tests carried out per IEC 61869-2 shall meet the requirement of clause 4.1.1.d above.

5.1.3 Low leakage flux tests shall be performed per IEC 61869-2 at all taps for class TPX CTs. For class P or PX CTs, when specified in the data schedule the same shall be carried out at specified tap. This test shall be performed when the value factor of construction Fc $\leq$ 1.1

5.1.4 Chopped lightning impulse test per IEC 61869-2 shall be carried out for all CTs.

5.1.5 Type tests of hollow insulators for CTs manufactured per IEC shall be carried out as per IEC 62155.

5.1.6 In lieu of the actual type tests, certified test reports of type tests performed on an identical unit may be submitted for review and approval during the bidding stage.

5.2 Routine (Production) Tests

5.2.1 All routine tests prescribed in the relevant IEC standards shall be performed on all CTs.

5.2.2 Partial discharge measurement shall be performed on all CTs.

5.2.3 The following additional tests shall be performed in accordance with IEC 61869-2 or equivalent standards at each tap for all CTs.

a. Turns Ratio Error

b. CT Secondary Resistance (R_{CT})

c. Excitation Characteristics

d. Determination of secondary limiting emf for classes P and PX CTs manufactured per IEC 61869-2

e. Determination of excitation limiting secondary voltage (U_{al}) for class TPX CTs manufactured per IEC 61869-2.

6.0 DATA SCHEDULE

PRIMARY S/S CURRENT TRANSFORMERS (CT), 11KV THROUGH 69KV

SEC Enquiry No. _____ Date: _____

SEC Purchase Order No. or Contract No. _____ Date: _____

SEC PTS No./Project Title with J.O. No. _____

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
	Nominal System Voltage (kV)			
	System Short Circuit Current (kA_{sym}) at rated voltage			
	Type of System Grounding			
	Installation (Indoor/Outdoor)			

'A' – SEC SPECIFIED DATA/PARAMETER
'B' – BIDDER/SUPPLIER/VENDOR/CONTRACTOR PROPOSED DATA/PARAMETERS
'C' – REMARKS SUPPORTING THE PROPOSED DEVIATION IN COLUMN 'B'
(*) – DATA/PARAMETER TO BE PROVIDED/PROPOSED BY THE BIDDER/SUPPLIER/ VENDOR/CONTRACTOR IN COLUMN 'B'

6.0 DATA SCHEDULE

PRIMARY S/S CURRENT TRANSFORMERS (CT), 11KV THROUGH 69KV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
3.0	APPLICABLE CODES AND STANDARDS	*		
4.0	DESIGN AND CONSTRUCTION REQUIREMENTS			
4.1	Ratings			
	Rated Primary Current (A)			
	Rated Secondary Current (A)	1 or 5		
4.1.1	Continuous Thermal Current Rating Factor	1.2		
	Multi-Ratio CTs	1.2		
	Single Ratio CTs	1.2		
	Rated Short Time Thermal Current-I_{th} (kA_{rms}) (21, 25, 31.5, 40kA_{rms})			
	Short Time Thermal Current Duration (second)	1		
	Rated Dynamic Current (kA_{peak})	2.6 x I_{th}		
	Fault Current Duration (second)			
	Rated Primary Short Circuit Current-IPSC (kA)	*		
	Temperature Rise (°C)	*		
	Number of Metering Cores			
	Number of Protection Cores			
4.2	Construction			
	Type of CT (Ring Continuous/Split Core Type, Bushing Type, Cast Resin Type, Free-Standing Oil Filled/Fluid Filled Type)			

6.0 DATA SCHEDULE

PRIMARY S/S CURRENT TRANSFORMERS (CT), 11KV THROUGH 69KV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.2	Construction (*Continued*)			
	Free-Standing CT Core Location (Top or Bottom)	*		
	Type of Insulation (Mineral Oil Filled/Fluid/Cast Resin)			
	Manufacturer's Type Designation	*		
4.2.2	Insulating Oil/Fluid [Refer to data schedule of 54-SDMS-01 for Insulating Oil, Vendor to Fill-In Column 'B' of the same]	*		
4.2.3	High Voltage Insulator Housing			
	Name of Manufacturer	*		
	Type (Porcelain/Cast Resin)	*		
	Make Designation	*		
	Creepage Distance (mm)			
	Color	Brown		
	Cantilevel Strength (kN)	*		
4.2.4	Terminals			
	Primary Terminal Connector:			
	Conductor Material (Al or Cu)			
	Size (mm^2)			
	Number of Conductors/phase			
	Degree of Protection of Enclosure for Secondary Terminal Box			

6.0 DATA SCHEDULE

PRIMARY S/S CURRENT TRANSFORMERS (CT), 11KV THROUGH 69KV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.3	Primary Winding for Free-Standing Type CTs			
	Bar Primary	Al or Cu		
	Wound Primary Material	*		
	Winding Insulation and Class	*		
	Rated Maximum Voltage (kV)	*		
	BIL (kV_{peak})	*		
	Power Frequency Withstand Voltage (kV_{rms}) Indoor CTs	*		
	Power Frequency Withstand Voltage (kV_{rms}) Outdoor CTs			
	1 Minute Dry (kV_{rms})	*		
	10 Seconds Wet (kV_{rms})	*		
4.4	Secondary Winding			
	Number of Cores	1/2/3/4		
	Purpose (Relaying/Metering)			
	Winding No. 1: Purpose	Relaying or Metering		
	Type of Protection (Backup/Differential/Distance etc…)	/ / /		
	Current Ratio at Specified Tap			
	Accuracy Class			
	Burden (VA) / Resistive Burden-R_b (Ω)	*/*/*/*		

6.0 DATA SCHEDULE

PRIMARY S/S CURRENT TRANSFORMERS (CT), 11KV THROUGH 69KV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
4.4	Secondary Winding (*Continued*)			
	Secondary Winding Resistance-R_{CT} at 20°C (Ω)	*/*/*/*		
	Specified Tap			
	For class PTX CTs per IEC 61869-2			
	Rated Symmetrical Short Circuit Current Factor - KSSC			
	Dimensioning Parameter-K	*		
	Excitation Limiting Secondary Voltage-U_{al} (Volts)	*		
	Accuracy Limiting Secondary Exciting Current-I_{al} (mA)	*		
	Secondary Excitation Current-I_{mag} At Half Excitation Limiting Secondary	*		
	Secondary Winding Resistance-R_{CT} (Ω)	*		
5.1.3	Special Tests			
	Special Tests Required Class P CTs			
	Chopped Lightning Impulse			
	Measurement of Capacitance and Dielectric Dissipation factor			

6.0 DATA SCHEDULE

PRIMARY S/S CURRENT TRANSFORMERS (CT), 11KV THROUGH 69KV

REFERENCE SECTION NO.	DESCRIPTION	'A'	'B'	'C'
5.1.3	Special Tests (*Continued*)			
	Multiple Chopped Impulse Test on Primary Winding	_____	_____	_____
	Mechanical Tests	_____	_____	_____
	Measurement of Transmitted Over-Voltages	_____	_____	_____
	Special Tests Required Class TPX CTs	_____	_____	_____
	Verification of Low Leakage Flux	_____	_____	_____

6.0 DATA SCHEDULE

PRIMARY S/S CURRENT TRANSFORMERS (CT), 11KV THROUGH 69KV

A. ADDITIONAL TECHNICAL INFORMATION OR FEATURES TO BE FURNISHED BY SEC:

B. ADDITIONAL SUPPLEMENTARY DATA OR FEATURES PROPOSED BY BIDDER/VENDOR/SUPPLIER/CONTRACTOR:

C. OTHER PARTICULARS TO BE FILLED UP BY BIDDER/VENDOR/SUPPLIER/ CONTRACTOR:

	Actual Manufacturer of Equipment/Material	Vendor/Supplier/ Contractor
Name of the Company Location and address	_____	_____
Name and Signature of authorized Representative and date	_____	_____
Official Seal/Stamp of the Company & Date	_____	_____