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CEB SPECIFICATION

COMBINED METERING TRANSFORMERS (OUTDOOR TYPE) FOR 11kV AND 33kV SYSTEMS



CEYLON ELECTRICITY BOARD

SRI LANKA

oved Specifica 9/11/21 st Co

Telephone: +94 11 232 8051

Fax: +94 11 232 5387

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SPECIFICATION FOR COMBINED METERING TRANSFORMERS (OUTDOOR TYPE) FOR 11kV AND 33kV SYSTEMS

1.0 SCOPE

This specification covers the design, manufacture and testing of following categories of Outdoor Combined Metering Transformers for 11kV and 33kV Distribution System of the CEB.

- a) 11kV/33kV Combined Metering Transformers with CT ratio of 50-100/5
- b) 11kV/33kV Combined Metering Transformers with CT ratio of 100-200/5
- c) 11kV/33kV Combined Metering Transformers with CT ratio of 200-400/5
- d) 11kV/33kV Combined Metering Transformers with CT ratio of 400-800/5

2.0 SYSTEM PARAMETERS

(a)	Nominal voltage (U)	11 kV	33 kV	
(b)	System highest voltage (U _m)	12 kV	36 kV	
(c)	System frequency	50 Hz		
(d)	Method of earthing	Effectively earthed	Non-Effectively earthed	
(e)	System fault level	12.5 kA	16 kA	

3.0 SERVICE CONDITIONS

(i).	Annual average ambient temperature	30 °C
(ii).	Maximum ambient temperature	40 °C
(iii).	Maximum relative humidity	90%
(iv).	Solar Radiation	4.5 kWh/m²/day
(v).	Environmental conditions	Humid tropical climate with heavily polluted atmosphere
(vi).	Operational altitude	From M.S.L. to 1900 m above M.S.L.
(vii).	Isokeraunic (Thunder days) level	100 days



4.0 APPLICABLE STANDARDS

The equipment and components supplied shall be in accordance with the latest editions of the standards specified below and amendments thereof.

(a)	IEC 61869-1:2007	Instrument transformers - Part 1: General requirements	
(b)	IEC 61869-2 [.] 2012	Instrument transformers - Part 2: Additional requirements for	
		current transformers	
	IEC 61869-3.2011	Instrument transformers - Part 3: Additional requirements for	
		inductive voltage transformers	
(d)	IEC 61869-4:2013	Instrument transformers - Part 4: Additional requirements for	
(u)		combined transformers	
		Selection and dimensioning of high-voltage insulators intended	
	IEC 60815-1 2 3.2008	for use in polluted conditions - Part 1: Definitions, information and	
(e)	120 000 10-1,2,3.2000	general principle- Part 2: Ceramic and glass insulators for a.c.	
		systems- Part 3: Polymer insulators for a.c. systems	
(f)	BS 4190:2014	ISO metric black hexagon bolts, screws and nuts.	
	BS EN ISO 1461-2009	Hot dip galvanized coatings on fabricated iron and steel articles.	
(9)	BO EN 100 1401.2003	Specifications and test methods	

Material conforming to other International Standards which are not less stringent than the Standards stipulated above may be offered. When such alternative Standards are used, reference to such Standards shall be quoted and English language copies of such Standards shall be provided with the offer.

However, in the event of discrepancy, details given in this CEB specification supersede above standards.

5.0 BASIC FEATURES

5.1 Design

- 5.1.1 The outdoor combined transformer shall be designed for system highest voltage (Rated Voltage) stipulated in clause 2.0 above and are intended for metering of three phase three wire unbalanced loads using three wattmeter principle.
- 5.1.2 It shall be suitable for mounting on steel cross arms or concrete plinth. Holes shall be provided to anchor the unit on to the channel iron cross arm.



- 5.1.3 The Current Transformer shall have dual ratios as indicated in the schedule of prices, with provision for easy change of ratios externally on the secondary side. The withstand ability of the primary, the saturation of the magnetic core and the secondary characteristic shall not be less than that requested in the technical particulars (Clause Nos. 5.3.1 and 5.3.2)
- 5.1.4 Earth lugs shall be provided for the tank on the lid.
- 5.1.5 Surge Arrester Mountings shall be provided with suitable Steel Mounting Frames on both sides.
- 5.1.6 All insulation material used in the unit (external as well as internal) shall be of non hygroscopic. In case of dry type, cast resin Transformers shall have the core and coil assemblies cast in Epoxy Resin, which shall be suitable to withstand high thermal and dynamic stresses due to system and climatic fluctuations.
- 5.1.7 The Transformer oil shall be highly refined, PCB free, pure mineral oil, uninhabited, of a naphthenic base and meeting the requirements of BS 148:1972 or IEC 60296.
- 5.1.8 Suitably rated low voltage fuses shall be provided at secondary terminal of voltage transformers. These fuses shall be easily replaceable by opening secondary terminal box.

5.2 Manufacture

5.2.1 Tank

Tanks shall be stainless steel or galvanized powder coated/painted steel tanks.

All steel tanks shall be designed and treated for corrositivity environment C5 category as per ISO/EN 12944-2. The surface shall be thorough cleaned and shall be treated with hot zinc dip/spray of minimum 50 micron thickness. Then it shall be painted with a etch primer minimum thickness of 50 micron and minimum thickness of 100 micron undercoating. Then it shall be painted with a gloss or semi-gloss paint of minimum 50 micron thickness. The ultimate dry film thickness (DFT) shall not be less than 300 microns. (ISO/EN 12944-2).

5.2.2 Mounting Arrangement

Mounting of the tank shall be of the bottom on channel cross iron using M16 Bolts

5.2.3 Terminals

The primary terminals and connections shall also be suitable to carry the rated current specified in the schedule of prices. The secondary terminals shall be enclosed in a weatherproof IP54 rated (in accordance with IEC 60529) terminal box with gland plates at the

base of the Combined Transformers.

The lid of the secondary terminal box of the Current and Voltage Transformers (metering unit) shall be provided with sealing facilities by using a sealing wire to prevent access to the unauthorized persons.

5.2.4 Handling / Lifting

Two (2) lifting tackles shall be provided for convenient and safe handling of the transformers.

5.2.5 Flags

Bushing palms made of brass shall be available and be suitable for the bolting of conductor compression lugs. They shall be in accordance with the drawing No DS&S/2015/006 (Annex-C).

5.2.6 Oil Level Indicator

A suitable oil level indicator easily visible from the ground level shall be provided.

5.2.7 Winding

The primary and the secondary windings shall be made of high conductivity E.C. grade Copper.

5.2.8 Bushings

Bushing insulators shall be made of Glazed Porcelain or Silicone Rubber. The minimum creepage distances for insulators and bushings shall comply with the IEC 60815 standard (Site Pollution Severity category is "d" in accordance with IEC 60815).

5.2.9 Pressure Relief Mechanism

A pressure relief valve shall be provided for the unit. The design of the pressure relief valve is such that no water ingress takes place on its pressure release operations.

5.2.10 Gaskets (If applicable)

Gasket shall be suitable for oil tight joints and;

- The Combined Transformers shall be of the hermetically sealed type and provided with a satisfactory lid sealing gasket.
- b. The gasket shall be of good quality to maintain the sealing effect through its life span and shall prevent seeping of oil due to ageing and extreme operating temperature.

- c. There would be no deleterious effects on either gaskets or oil when the gaskets are continuously in contact with hot oil. No gaskets shall be used in which the material of the gasket is mounted on a textile backing.
- d. Exterior gaskets shall be of rubberized cork material, weatherproof and shall not be affected by a solar radiation level as specified in clause 3.0.

5.2.11 Bolts and nuts

All steel bolts and nuts shall conform to BS 4190 the standard specified and the nuts and heads of all bolts to be hexagonal type.

5.3 Technical requirements

5.3.1 Technical Particulars for Current Transformers

		11 kV	33 kV
a)	Transformation ratios	As per Schedule of Prices	
b)	Rated output	15 VA	15 VA
C)	Number of CTs	3	3
d)	Accuracy Class	CI. 0.2S	Cl. 0.2S
e)	Rated continuous thermal current	120%	120%
f)	Instrument Security Factor	5	5
g)	Rated primary current	50-100/5, 100-200/5,	, 200-400/5, 400-800/5
h)	Rated secondary current	5 A	5 A
i)	Rated Short-time Thermal Current and Duration	Not less than 12.5 kA for 1 sec	Not less than 16 kA for 1 sec
j)	Rated dynamic Peak current	Not less than 31.25 kA	Not less than 40 kA
k)	Markings	in accordance	with IEC 61869-2
I)	Insulation Level		· .
	(i)Impulse withstand voltage	75kV	170kV
	(ii) Power frequency	28kV	70kV
	withstand voltage (1min.)	Stapproved s	
		8 (M-191	u[21)

		11 kV 33 kV		
a)	Transformation ratios	11kV / 110V	33kV / 110V	
b)	Rated output	25 VA	25 VA	
C)	Number of VTs	3	3	
d)	Accuracy Class	Cl. 0.2	Cl. 0.2	
e)	Rated Voltage Factor	1.2	1.2	
f)	Rated time	Continuous		
g)	Markings	in accordance with IEC 61869-3		
h)	Insulation Level			
	(i)Impulse withstand voltage	75kV	170kV	
	(ii)Power frequency withstand voltage (1min.)	28kV	70kV .	

5.3.2 Technical Particulars for Voltage Transformers

6.0 REQUIREMENTS FOR SELECTION

6.1 Quality Assurance

The manufacturer shall possess ISO 9001:2015 or latest Quality Assurance Certification for the design, manufacture of Combined Metering Transformers (Combined Unit). The certificate shall be valid throughout the delivery period of this bid. In the event the Combined Metering Transformers are manufactured in a plant under the license of the manufacturer, the manufacturing plant shall possess ISO 9001:2015 or latest Quality Assurance Certificate for manufacturing and testing of Combined Metering Transformers. The Bidder shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacturer, along with the offer

6.2 Manufacturing Experience

The manufacturer shall have minimum of 10 years' experience in manufacturing Combined Metering Transformers. The manufacturer shall have supplied Combined Metering Transformers similar to the offered, to minimum of 5 Electricity Authorities/Utilities out of which at least 3 are from outside the country of manufacture during last 5 years.

The manufacturer shall furnish a list of Authorities/Utilities to whom Combined Metering Transformers were supplied during the past 5 years, indicating their names, addresses and contact details clearly. The purchaser reserves the right to communicate with Electricity supply authorities/utilities to whom meters have been supplied with regard to the performance of the meters.

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If the manufacturer has supplied similar items to CEB for the last 5 years with proven sales records; without any adverse performance records, such manufacturers will be exempted from above requirements.

6.3 Type Tests

Type Test Certificates conforming to the above referred standards or any other international standard which is not less stringent, issued by:

Either

- (a) an accredited independent testing laboratory acceptable to the CEB or
- (b) an accredited or independent testing laboratory acceptable to the CEB where the type tests have been witnessed by CEB or a reputed independent body acceptable to CEB

shall be furnished with the offer. Type Test Certificates shall clearly indicate the relevant standard, items concerned, showing the manufacturers identity, type No. /catalogue No. and basic technical parameters. In case if the submitted type tests are according to any other international standard which is not less stringent than the specified, then the copy of the used standard in English shall be submitted with offer.

Proof of accreditation and accredited scope by a national/ international authority shall be forwarded with the offer. Test certificates shall be complete including all the pages as issued by the testing authority. Type test certificates shall be in English language. Parts of test certificates shall not be acceptable.

Type Test Certificates on CT, VT and Combined Unit shall be furnished with the offer.

- (a) On Current Transformers In accordance with IEC 61869 -2.
- (b) On Voltage Transformers in accordance with IEC 61869-3.
- (c) On Combined Unit in accordance with IEC 61869-4.
- (c) Short-circuit withstand capability test (Combine Unit only).
- (d) Accelerated weathering test in accordance with IEC 62217 (Only on Silicone Rubber insulators)

7.0 INFORMATION TO BE FURNISHED WITH THE OFFER

The following shall be furnished with the offer.

- a) Technical details in English clearly identifying the offered items, but not limited to
 - i. The Comprehensive catalogues,
 - ii. The dimensional drawings,
 - iii. Schematic diagrams,

- iv. Calculations, graphs and tables
- v. Literature describing the operational features
- b) ISO 9001:2015 or latest Quality Assurance Certificate in accordance with clause 6.1.
- c) Manufacturer shall furnish a list of supplies with supplied item, purchaser (specifying address contact persons and contact details, country), year & quantity to prove his manufacturing experience and outside the country sales in accordance with Clause 6.2.
- d) Type Test Certificates in accordance with the clause 6.3.
- e) Duly filled and signed relevant annexes.
- f) Other relevant Technical Details, protection operating curves and Calculations.

Not furnishing above documents and details may result in offer being rejected.

8.0 PERFORMANCE GUARANTEES AND WARRANTY

8.1 Warranty

Manufacturer shall provide 1 year warranty to CEB for the items and accessories from the date of delivery to CEB stores. Manufacturer should forward the duly signed Warranty Certificate together with the letter of acceptance of the award.

9.0 SAMPLES

Not applicable.

10.0 PACKING AND LABELING/MARKING

10.1 Packing

The equipment shall be suitably packed in such a way that long distance transport is possible without any harm or damage.

10.2 Identification and Labelling/Marking

10.2.1 Terminal Markings

The Primary and Secondary winding terminals shall be marked clearly and indelibly on their surface or in their immediate vicinity conforming to IEC60869.



10.2.2 Rating Plate markings

Ratings and data of the Combined Transformers shall be provided in the name plate, which shall be weather and corrosion proof. The name plate shall be securely attached to the side of the (lower part) Current / Voltage Transformers so that it could be easily read from the ground level when it is installed at a height of 2.5 m from the ground level.

It shall consist of the following information.

- (a) Number and year of the standard adopted.
- (b) Manufacturer's identification.
- (c) Serial number and type designation.
- (d) Rated primary and secondary currents.
- (e) Rated primary and secondary Voltage.
- (f) Rated frequency.
- (g) Rated output and the corresponding accuracy class of current transformer.
- (h) Rated output and the corresponding accuracy class of voltage transformer.
- (i) Rated highest equipment voltage and the insulation level.
- (j) Rated short-time current (Ith.) in kA and the rated time expressed.
- (k) Rated dynamic current (I_{dyn}).
- (I) Class of insulation.
- (m) The words "CEB".

11.0 INSPECTION AND TESTING

11.1 Routine Test

Routine tests conforming to IEC 61869- 2, 3, 4 shall be performed on all units and test report shall be furnished for the observation of the engineer appointed by the purchaser at the time of inspection.

- (a) On Current Transformers In accordance with IEC 61869 -2.
- (b) On Voltage Transformers in accordance with IEC 61869-3.
- (c) On Combined Unit in accordance with IEC 61869-4.

11.2 Inspection

The Successful bidder shall make necessary arrangements for inspection by an Engineer appointed by the CEB and also to carry out in his presence necessary Acceptance tests on equipment and material. CEB may waive off the inspection with the condition of witness the acceptance tests by an independent testing authority acceptable to CEB. In such a situation a notice of waive off will be issued in advance to the supplier.

11.3 Acceptance Test

The following Tests as per IEC 61869-4 shall be witnessed by the representative of the purchaser.

- (a) Power-frequency voltage withstand tests on primary terminals.
- (b) Partial discharge measurement.
- (c) Power-frequency voltage withstand tests between sections.
- (d) Power-frequency voltage withstand tests on secondary terminals.
- (e) Tests for accuracy.
- (f) Verification of markings.
- (g) Enclosure tightness test at ambient temperature.
- (h) Pressure test for the enclosure.
- (i) Determination of the secondary winding resistance.
- (j) Determination of the secondary loop time constant.
- (k) Rated knee point e.m.f. and maximum exciting current .
- (I) Inter-turn overvoltage test.
- (m) Determination of the instrument security factor (FS) of measuring current transformers.

12.0 ANNEXES

Annex – B:

- Annex A1: Schedule of Guaranteed Technical Particulars - Current Transformer
- Schedule of Guaranteed Technical Particulars Voltage Transformer Annex – A2:
- - Schedule of Guaranteed Technical Particulars CT/PT Unit housing/tank
- Annex C: Drawing No: DS&S/2015/006
- Annex D Non-Compliance Schedule

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Annex A1 - SCHEDULE OF TECHNICAL REQUIREMENTS AND GUARANTEED TECHNICAL PARTICULARS (Current Transformer)

(CEB Requirements shall be filled by the procurement entity and information of the offer shall be filled by the manufacturer)

1	Manufacturer		
2	Country of origin		
3	Make and model		
4	Rated voltage	kV	
5	Rated frequency	Hz	
6	Rated primary current	А	
7	Rated secondary current	А	
8	Rated output	VA	
9	Rated insulation level		
	i) Dry Impulse withstand voltage (1.2kV/50μs) peak		
	Positive Wave		
	Negative Wave	+kV	
		-kV	
	ii) Power frequency withstand voltage	kV	
10	Rated short time thermal current and Duration	kA,Sec	
11	Secondary winding resistance at 75°C	Ohm	
12	Rated dynamic peak current	kA	
13	Creepage distance of the insulator	mm	
14	Protected creepage distance	mm	
15	Accuracy class		
16	Rated accuracy limit factor		
17	Knee point e.m.f.	V	
18	Special features (if any)		
19	Connection drawings		
20	Insulation material used for mounting		
21	Whether a copy ISO 9001:2015 certificate provided?	Yes/No	

Signature of the Manufacturer and seal

Date

I/We certify that the above data are true and correct

Signature of the Bidder and seal

Annex A2 - SCHEDULE OF TECHNICAL REQUIREMENTS AND GUARANTEED TECHNICAL PARTICULARS (Voltage Transformer)

(CEB Requirements shall be filled by the procurement entity and information of the offer shall be filled by the

1	Manufacturer		
2	Country of origin		
3	Make and model		
4	Rated voltage	kV	
5	Rated frequency	Hz	
6	Rated primary Voltage	V	
7	Rated secondary Voltage	V	
8	Rated output	VA	
9	Rated insulation level		
	i) Dry Impulse withstand voltage (1.2kV/50µs) peak		
	Positive Wave		
	Negative Wave	+kV	
		-kV	
	ii) Power frequency withstand voltage	kV	
10	Secondary winding resistance at 75°C	Ohm	
11	Creepage distance of the insulator	mm	
12	Protected creepage distance of the insulator	mm	
13	Accuracy class		
14	Voltage factor and rated time	Sec	
15	Service conditions :		
	Such as indoor or outdoor temperature conditions, altitude, humidity,		
	suitability for exposure to steam, vapour, fumes, explosive gases,		
10	excessive dust, sait air etc. should be stated.		
10			
17	For non-composite capacitor voltage transformers.		
	(i) In a tapped bushing, the nominal Capacitance & P.f. values of C1 and C2 and the tolerance limit		
	(ii) The maximum permissible working	k\/	
	voltage on C1	ΝV	
18	Insulation material used for mounting.		1
19	Whether a copy ISO 9001:2015 certificate provided?	Yes/No	

manufacturer)

Signature of the Manufacturer and seal

I/We certify that the above data are true and correct

Signature of the Bidder and seal

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Annex B - SCHEDULE OF TECHNICAL REQUIREMENTS AND GUARANTEED TECHNICAL PARTICULARS (CT/PT Unit housing/tank)

(CEB Requirements shall be filled by the procurement entity and information of the offer shall be filled by the

	· · · · · · · · · · · · · · · · · · ·		
1.	Manufacturer		
2.	Country of origin		
3.	Make and model		
4.	Rated voltage	kV	
5.	Whether combined metering transformer comply with three-watt meter principle?		
	Rated insulation level		
	i) Dry Impulse withstand voltage (1.2kV/50µs) peak		
6.	Positive Wave	+kV	
	Negative Wave	-kV	
	ii) Power frequency withstand voltage	kV	
7.	Whether 3 nos of CTs provided?	Yes/No	
8.	Whether 3 nos of VT provided?	Yes/No	
9.	Whether earth lugs provided? Yes/No		
10.	Whether surge arrester mounting arrangement provided as per clause 5.1.5?		
11.	Whether suitably rated low voltage fuses provided?	Yes/No	
12.	Creepage distance of the insulator mm		
13.	Material of the bushing flag (as per clause 5.2.5)		
14.	CT/PT Unit housing/tank material		
	CT/PT Unit housing/tank external surface		
	(i). Method of exterior surface painting		
15	(ii). Galvanize thickness	μm	
15.	(iii). Thickness of paint layers		
	a) Primer thickness	μm	
	b) Under Coating thickness	μm	
16.	Type/Material of Gasket.		
17.	Whether a copy ISO 9001:2015 certificate provided?	Yes/No	
18.	Whether information supplied as per clause 7.0 ?	Yes/No	

manufacturer)

Signature of the Manufacturer and seal

Date

I/We certify that the above data are true and correct

Signature of the Bidder and seal





Annex D - NON-COMPLIANCE SCHEDULE

On this schedule the bidder shall provide a list of non-compliances with this specification, documenting the effects that such non-compliance is likely to have on the equipment life and operating characteristics. Each non-compliance shall be referred to the relevant specification clause.

Clause No.	Non-Compliance

Signature of the Manufacturer

Date

I/We certify that the above data are true and correct

Signature of the Bidder and seal

