006: 2015

CEB
SPECIFICATION

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

CEYLON ELECTRICITY BOARD
SRI LANKA

Telephone: +94 11 232 8051

Fax: +94 11 232 5387

CONTENTS

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

1.0 SCOPE

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

2.0 SYSTEM PARAMETERS

(a)	Nominal voltage	11 kV	33 kV
(b)	System highest voltage	12 kV	36 kV
(c)	System frequency	50 Hz	50 Hz
(d)	Method of earthing	Effectively earthed	Non Effectively earthed
(e)	System faults level	12.5kA rms	13.1 kA rms

3.0 SERVICE CONDITIONS

(a)	Annual average ambient temperature	30 ℃
(b)	Maximum ambient temperature	40 ℃
(c)	Maximum relative humidity	90%
(d)	Environmental conditions	Humid tropical climate with heavily polluted atmosphere (Type B in accordance with IEC 60815)
(e)	Operational altitude	From M.S.L. to 1900 m above M.S.L.
(f)	Isokeraunic (Thunder days) level	100 days
(g)	Maximum Solar Radiation	4.5 kWh/m^2/day

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
(c)	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 combined transformers
(e)	IEC 60815-1,2,3:2008	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 1: Definitions, information and 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.
(g)	BS EN ISO 1461:2009	Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods

The requirements stated in this specification supersede the requirements in the 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 two/three wattmeter principle.

5.1.2 It shall be of free standing type suitable for mounting on steel cross arms. Holes shall be provided to anchor the unit on to the channel iron cross arm.

5.1.3 Windings of individual current transformers and voltage transformers shall be housed in an insulating medium of high impact resistance cast epoxy resin and then immersed in a mineral transformer oil filled steel tank or complete dry type is also acceptable.

5.2 Manufacture

5.2.1 General

Metering equipment shall be hermetically sealed type or complete dry type.

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. 6.1 and 6.2)

Altogether three (3) earth lugs shall be provided for the tank and surge arrestors. Two (2) on either sides of the transformer and one on the lid. Suitable surge arrestor mounting arrangement shall also be provided on both sides of the tank.

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.

All insulation material used in the unit (external as well as internal) shall be of non – hygroscopic.

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.

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.

5.2.2 Tank

The exterior metal surface of the unit shall be treated with hot zinc spray of minimum 50 micron thickness. Then it shall be painted with primer of 50 micron minimum thickness and a 100 micron minimum thickness undercoating. Then it shall be painted with a gloss or semi gloss paint of minimum 50 micron thickness. The ultimate dry film thickness shall not be less than 300 microns.

Alternatively, galvanized exterior metal surface as per BS EN ISO 1461 painted with a gloss or semi gloss paint of minimum thickness 50 microns is also acceptable.

5.2.3 Mounting Arrangement

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

5.2.4 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.

5.2.5 Handling / Lifting

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

5.2.6 Flags

Terminal flags shall be in accordance with the drawing No DS&S/2015/006 (Annex-C)

5.2.7 Oil Level Indicator

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

5.2.8 Winding

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

5.2.9 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).

5.2.10 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.

5.2.11 Gaskets (If applicable)

Gasket shall be suitable for oil tight joints and;

a. 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.

5.2.12 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.

6.0 TECHNICAL REQUIREMENTS

6.1 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)	Accuracy Class*	Cl. 0.5/ Cl. 0.2	Cl. 0.5/ Cl. 0.2
d)	Accuracy Limit factors	1.25	1.25
e)	Rated primary current	50-100/5, 100-200/5, 200-400/5	
f)	Rated secondary current	5 A	5 A
g)	Rated Short-time Thermal Current and Duration	Not less than 12.5 kA for 1 sec	Not less than 13.1 kA for 1 sec
h)	Rated dynamic Peak current	Not less than 31.25 kA	Not less than 32.75 kA
i)	Markings	in accordance with IEC 61869-2	
j)	Insulation Level		
	(i)Impulse withstand voltage	75kV	170kV
	(ii) Power frequency withstand voltage (1min.)	28kV	70kV

***As specified in the price schedule**

6.2 Technical Particulars for Voltage Transformer

		11 kV	33 kV
a)	Transformation ratios	11kV / 110V	33kV / 110V
b)	Rated output	25 VA	25 VA
c)	Accuracy Class**	Cl. 0.5/ Cl. 0.2	Cl. 0.5/ Cl. 0.2
d)	Rated Voltage Factor	1.2	1.2
e)	Rated time	Continuous	
f)	Markings	in accordance with IEC 61869-3	
g)	Insulation Level		
	(i)Impulse withstand voltage	75kV	170kV
	(ii)Power frequency withstand voltage (1min.)	28kV	70kV

****As specified in the price schedule**

7.0 ADDITIONAL REQUIREMENTS

7.1 Manufacturing Experience

Manufacturer shall have a minimum of five years experience for manufacturing of Combined Metering Transformers (Combined Unit). The manufacturer shall submit proof documents such as supply records, the name of the purchasers, quantity sold, and the year of sale to prove that they have supplied the Metering Current and Voltage Transformers to minimum of three Electricity Utilities internationally during last five years.

7.2 Marking

7.2.1 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.

7.2.2 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 ($I_{th.}$) in kA and the rated time expressed.
(k) Rated dynamic current (I_{dyn}).
(l) Class of insulation.
(m) The words "CEB".

7.2.3 Packing

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

7.2.4 Technical Literature and Drawings

Technical Literature in English language on the installation and operation shall be supplied with each set of equipment and they shall be descriptive and self explanatory, complete with necessary diagrams and drawings.

8.0 QUALITY ASSURANCE

The manufacturer shall posses ISO 9001:2008 Quality Assurance Certification for the plant where the manufacture of Metering Current and Voltage Transformers and, Combined Units are done. The Bidder shall furnish a copy of the ISO 9001:2008 Quality Assurance Certificates certified as true copies of the original by the manufacturer, along with the offer.

9.0 INSPECTION AND TESTING

9.1 Type Test

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)

Test certificates referred to shall be from an **accredited independent testing laboratory acceptable to the purchaser**. Proof of accreditation by a national/ international authority shall be forwarded with the offer. Test reports shall be complete including all the pages as issued by the testing authority. Parts of test reports shall not be acceptable.

9.2 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.

(d) On Current Transformers In accordance with IEC 61869 -2.
(e) On Voltage Transformers in accordance with IEC 61869-3.
(f) On Combined Unit in accordance with IEC 61869-4.

9.3 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.

9.4 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 .
(l) Inter-turn overvoltage test.
(m) Determination of the instrument security factor (FS) of measuring current transformers.

10.0 INFORMATION TO BE SUPPLIED WITH THE OFFER

The following shall be furnished with the offer.

(a) Catalogues describing the equipment and indicating the model number.
(b) Literature describing the operational features of the equipment.
(c) Constructional features, materials used for components and relevant technical literature.
(d) Complete dimensional drawings.
(e) Magnetization and core loss curves.
(f) Performance certificate with regard to manufacture, supply and utilization of the metering transformers of similar type and design quoted.
(g) Manufacturing experience as per Clause 7.1
(h) Rating plate details.
(i) ISO 9001:2008 in accordance with clause 8.
(j) Completed Schedule of Guaranteed Technical Particulars (Annex A1, A2 & B).
(k) Type Test Certificates in accordance with clause 9.1.

Failure to furnish the above information in accordance with clause 9.0 will result in the offer being rejected.

11.0 ANNEX

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

Annex – A1

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS

CURRENT TRANSFORMER

(Following Information shall be furnished with the offer)

1	Manufacturer		
2	Country of origin		
3	Make and model		
4	Rated voltage	kV	
5	Rated frequency	Hz	
6	Rated primary current	A	
7	Rated secondary current	A	
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 9001:2008 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

.....
Date

Annex - A2

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS

VOLTAGE TRANSFORMER

(Following Information shall be furnished with the offer)

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, excessive dust, salt air etc. should be stated.		
16	Special features (if any)		
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 voltage on C1	kV	
18	Insulation material used for mounting.		
19	Whether a copy ISO 9001:2008 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

.....
Date

Annex – B

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS
COMBINED TRANSFORMER CT/PT UNIT HOUSING/TANK
(Following Information shall be furnished with the offer)

1	Manufacturer		
2	Country of origin		
3	Make and model		
4	Rated voltage	kV	
5	Rated insulation level i) Dry Impulse withstand voltage (1.2kV/50µs) peak Positive Wave Negative Wave	 +kV -kV	
	ii) Power frequency withstand voltage	kV	
6	Whether three (3) earth lugs provided (for tank and surge arrestors)?	Yes/No	
7	Whether suitably rated low voltage fuses provided?	Yes/No	
8	Creepage distance of the insulator	mm	
9	CT/PT Unit housing/tank material		
10	CT/PT Unit housing/tank external surface		
	i) Method of exterior surface painting		
	ii) Galvanize thickness	µm	
	(ii) Thickness of paint layers		
	(a)Primer thickness	µm	
	(b)Under Coating thickness	µm	
11	Type/Material of Gasket.		
12	Whether a copy ISO 9001:2008 certificate provided?	Yes/No	

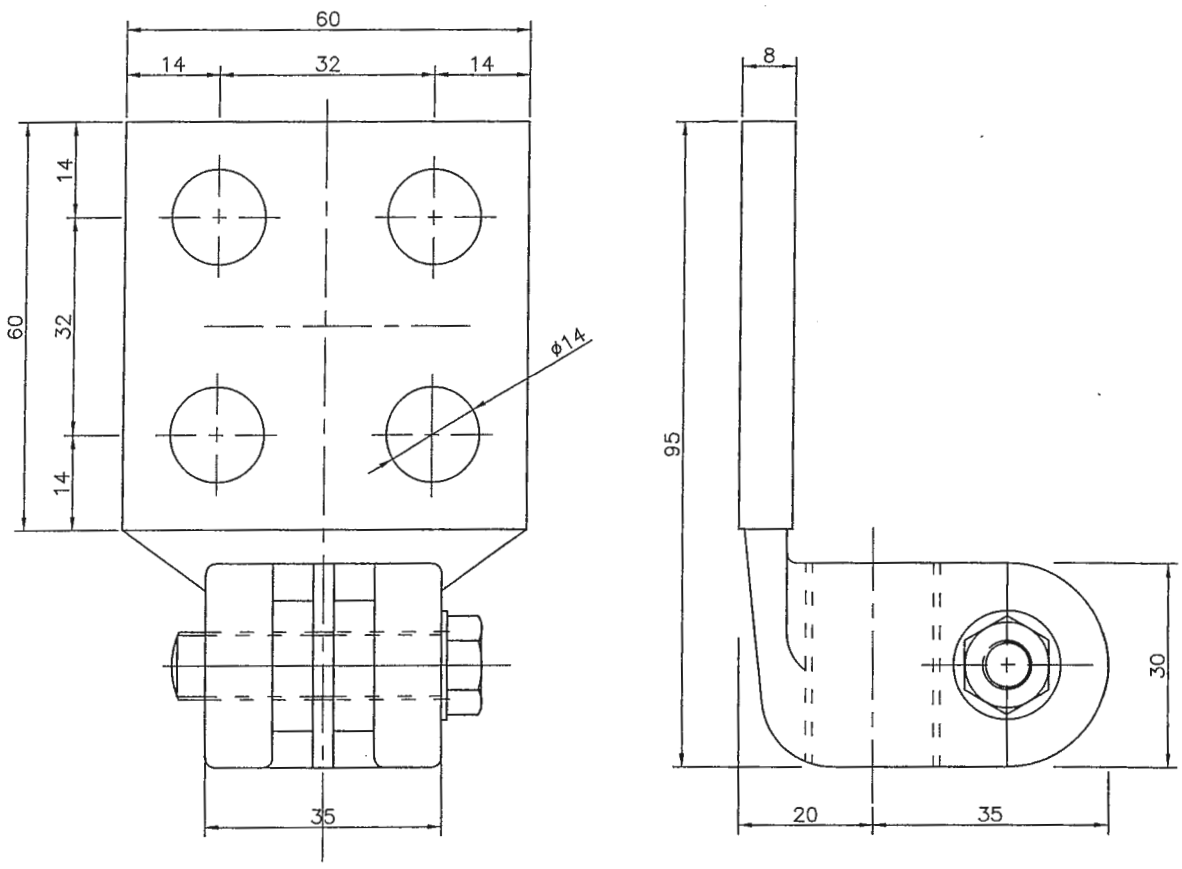
.....
Signature of the Manufacturer and seal

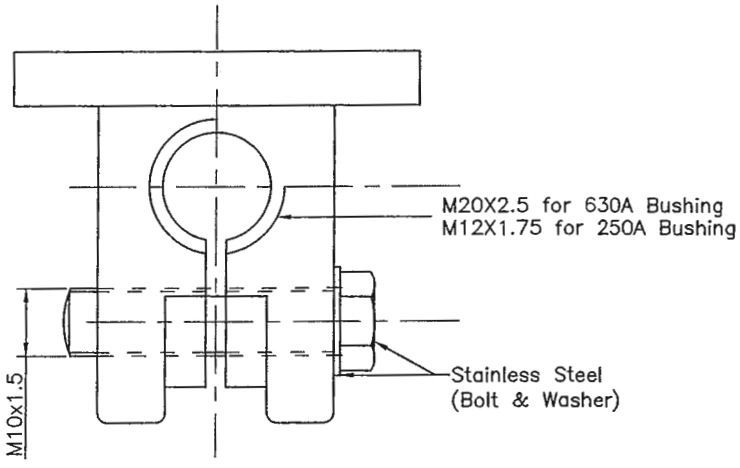
.....
Date

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

.....
Signature of the Bidder and seal

.....
Date





CEB Approved Specification
2016,04,22
Chairperson Dist. Coordination Committee

ALL DIMENSIONS ARE IN mm.

CEYLON ELECTRICITY BOARD	DISTRIBUTION STANDARDS & SPECIFICATION	SCALE : NOT TO SCALE
	DETAILS OF FLAG	DRAWN : LALANI
		DATE : April, 2015
	DESIGNED BY / APPROVED BY	DRG. NO : DS&S/2015/006
DISTRIBUTION COORDINATION BRANCH	EE (DC)1 / CHAIRMAN, SPECIFICATION COMMITTEE	CAD NO :

Annex – D

Non-Compliance Schedule

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

Clause	Non-Compliance

.....
Signature of the Manufacturer and seal

.....
Date

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

.....
Signature of the Bidder and seal

.....
Date