098: 2023

CEB
SPECIFICATION

MEDIUM VOLTAGE DISTRIBUTION TRANSFORMERS

CEB Approved Specification
11/09/23
Chairman Dist. Coordination Committee

CEYLON ELECTRICITY BOARD
SRI LANKA

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CONTENTS

SPECIFICATION FOR MEDIUM VOLTAGE DISTRIBUTION TRANSFORMERS

1.0 SCOPE

This Specification covers the general requirements of the design, manufacture, testing, supply and delivery of following types of medium voltage distribution transformers.

1. 11kV/415V distribution transformer of capacity 100kVA /160kVA /250kVA /400kVA /630kVA /800kVA/1000kVA with off load tap changer.

2. 33kV/415V distribution transformer of capacity 100kVA /160kVA /250kVA /400kVA /630kVA /800kVA/1000kVA with off load tap changer.

The required transformer capacity shall be indicated in the price schedule.

2.0 SYSTEM PARAMETERS

(a)	Nominal voltage	400V	11kV	33kV
(b)	System highest voltage	440V	12kV	36kV
(c)	System frequency	50Hz	50 Hz	50 Hz
(d)	Number of phases	03	03	03
(e)	Method of earthing	Solid earthed	Resistively/ Non-effectively earthed	Solidly via earthing transformer/ Non-effectively earthed
(f)	System fault current	25kA	12.5 kA	14.2 kA

3.0 SERVICE CONDITIONS

(a)	Annual average ambient temperature	30 °C
(b)	Maximum ambient temperature	40 °C
(c)	Maximum relative humidity	90%
(d)	Environmental conditions	Humid tropical climate with heavily polluted atmosphere
(e)	Operational altitude	0 – 1000m MASL (as per IEC 60076-1).
(f)	Isokeraunic (Thunder days) level	100 days
(g)	Atmospheric corrosivity category	C4

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)	IEC60076-1:2011	Power transformers - Part 1: General
(b)	IEC 60076-2:2011	Power transformers- Part 2:Temperature rise for liquid-immersed transformers
(c)	IEC 60076-3:2018	Power transformers - Part 3: Insulation levels, dielectric tests and external clearances in air
(d)	IEC 60076-4:2002	Power transformers - Part 4: Guide to the lightning impulse and switching impulse testing - Power transformers and

		reactors
(e)	IEC 60076-5:2006	Power transformers - Part 5: Ability to withstand short circuit
(f)	IEC 60076-7:2018	Power transformers - Part 7: Loading guide for mineral-oil-immersed power transformers
(g)	IEC 60076-8:1997	Power transformers - Part 8: Application guide
(h)	IEC 60076-10:2016	Power transformers - Part 10: Determination of sound levels
(i)	IEC TS 60076-20:2017	Power transformers - Part 20: Energy Efficiency
(j)	IEC 60137:2017	Insulated bushings for alternating voltages above 1 000 V
(k)	IEC 60156: 2018	Insulating liquids - Determination of the breakdown voltage at power frequency - Test method
(l)	IEC 60296:2020	Fluids for electrotechnical applications – Mineral insulating oils for electrical equipment
(m)	IEC 60616:1978	Terminal and tapping markings for power transformers
(n)	IEC 60815-1:2008	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles
(o)	BS 2562:1979	Specification for cable boxes for transformers and reactors
(p)	BS EN 10025:2004	Hot rolled products of structural steels
(q)	BS EN ISO 14713-1:2017	Zinc coatings — Guidelines and recommendations for the protection against corrosion of iron and steel in structures — Part 1: General principles of design and corrosion resistance
(r)	BS EN ISO 14713-2:2019	Zinc coatings — Guidelines and recommendations for the protection against corrosion of iron and steel in structures — Part 2: Hot dip galvanizing
(s)	ISO 12944-5:2019	Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 5: Protective paint systems

5.0 TECHNICAL REQUIREMENTS

5.1 Medium Voltage Characteristics

(a)	Nominal voltage	11 kV	33 kV
(b)	System highest voltage	12 kV	36 kV
(c)	Lightning impulse withstand voltage (peak)	95kV	200kV
(d)	One minute power frequency withstand voltage	28kV	70kV
(e)	OFF load tapping (High Voltage Side)	+2.5% to -7.5% (in steps of 2.5%)	
(f)	Insulator creepage distance (min.)	300mm	900mm

5.2 Low Voltage Characteristics

(a)	Nominal voltage	230/400 V
(b)	System highest voltage	254/440 V
(c)	One minute test voltage	3 kV
(d)	Impulse (1.2/50μ) wave withstand voltage	6 kV

5.3 Other Performance Characteristics

	Performance Characteristic	
(a)	Vector group	Dyn11
(b)	System frequency	50Hz
(c)	Cooling type	ONAN
(d)	Insulation temperature class (IEC 60076).	A
(e)	Average winding temperature rise (by resistance measurement) at steady state continuous MCR at normal ambient temperature (30°C) under normal service condition.	55 K
(f)	Top oil temperature rise at normal ambient temperature (30°C) under normal service condition.	50 K
(g)	Minimum Short circuit impedance voltage at 75°C as per IEC 60076-5/IEC 60076-1	4% (below 630kVA) 5% (from 630kVA – 1MVA)
(h)	Corrected average A-weighted sound pressure level measured	<55 dB for transformers below 250kVA <57 dB for transformers below 630kVA <58 dB for transformers below 1MVA
(i)	Short time withstand current duration (Under three phase faults)	2 seconds.
(j)	No load loss and load loss (corrected at 75°C) shall be indicated by the bidder in the schedule of particulars. Such indicated values (which will be guaranteed by the bidder) will be considered for the evaluation. Maximum values of losses and nominal weight of each transformer are stipulated in table 1.	

Table 1.0

Transformer (kVA)	No Load loss (W)	Full load loss (W)	Weight (kg)
100 kVA, 11kV / 415V	270	2150	650
160 kVA, 11kV / 415V	360	2650	850
250 kVA, 11kV / 415V	550	3700	1100
400 kVA, 11kV / 415V	387	3250	1550
630 kVA, 11kV / 415V	540	4600	2100
800 kVA, 11kV / 415V	585	6000	2750
1000 kVA, 11kV / 415V	693	7600	3200
100 kVA, 33kV / 415V	340	1900	850
160 kVA, 33kV / 415V	460	2450	1050
250 kVA, 33kV / 415V	610	3150	1400
400 kVA, 33kV / 415V	445	4000	1850
630 kVA, 33kV / 415V	621	5060	2500
800 kVA, 33kV / 415V	673	6600	2850
1000 kVA, 33kV / 415V	797	8360	3350

5.4 Evaluation of Losses

The Bidder shall state in the Guaranteed Technical Particulars, values for component losses of the total loss which shall be as low as is consistent with transport restrictions, reliability and economic use of materials.

Bids will be assessed on the basis of the least 'Present Worth' of capital cost plus guaranteed losses, being the sum of the installed bid Price of the transformers plus:

Sri Lanka Rupees per kW of guaranteed loss	
No load loss	Load loss
2,156,377	1,154,493

The acceptance of transformers yielding component losses higher than the guaranteed values shall be governed by either of the following: -

(A) Component losses in excess of guaranteed values but within the tolerance permitted under IEC 60076 Part 1. Transformers shall be accepted subject to full compliance with all technical particulars including temperature rises at CMR and subject to the Bidder accepting deduction from the Contract Price of charges for each kW on part thereof of component losses in excess of the guaranteed values, at the above evaluation rates.

(B) Component losses in excess of guaranteed values and exceeding the tolerance permitted under IEC 60076 Part 1.

The acceptance of transformers shall be entirely at the discretion of the CEB and subject to the Bidder accepting the deduction from the Contract Price of charges for component losses in excess of the guaranteed values, at the above loss evaluation rates, for each kW on part thereof.

In the event of transformers, which are, either equal to or below the guaranteed losses values, the Bidder will not be entitled to any premium in respect of reduction in losses below the guaranteed values.

6.0 BASIC FEATURES

The transformers shall be 3 phase oil immersed hermetically sealed type and suitable for outdoor application. They shall be fully rated at ambient temperature of 30^0C and the typical operating characteristics specified in clause 5.0 technical requirements shall apply to all transformers.

They shall comply with the requirements of IEC 60076 as regards to temperature rise and overloads on all tappings and with the voltage of the secondary winding at the specified nominal voltage.

6.1 General Design of the Equipment

6.1.1 The transformers shall be double-wound, mineral oil immersed naturally cooled (ONAN) as per IEC 60076 and hermetically sealed with suitable tank to accommodate the expansion and contraction of Insulating oil due to variation of load.

6.1.2 The transformers for rating upto 250kVA shall be of pole mounted type and above 400 kVA shall be of plinth mounted type.

6.1.3 No material which can be deleteriously affected by the action of oil under the operating conditions of the transformers shall be used in the transformers or leads or bushings.

6.1.4 Construction features shall permit repairs to be easily carried out at site.

6.1.5 Drying shall be carried out by hot air circulation or low frequency heating to ensure that the core coil assembly moisture content is less than 0.5%. Documentary evidence shall be provided with the offer to confirm this.

6.1.6 Transformers supplied against each order shall be designed to operate in parallel satisfactorily with the others when operating on the same tap position.

6.1.7 To ensure that the core and coils of transformers are seated on the floor of the tank, supporting frames shall be designed to accommodate variations in tank height. However, the active part of the transformer shall be rigidly fixed to the tank top cover where the bushings are mounted. The active part with cover shall be possible to lift together without disconnecting the bushing leads.

6.2 Magnetic Circuit and Windings

6.2.1 The core shall be of high grade non ageing cold rolled grain-oriented silicon steel laminations or Amorphous Material and securely clamped. Necessary actions shall be taken to avoid corrosion in steel laminations. The transformer core shall be of three limbs stacked core type with designed magnetic flux density shall be as 1.6T (for grain-oriented silicon steel) or 1.4T (for Amorphous material) at rated voltage and frequency at nominal tap position.

6.2.2 The primary and secondary windings shall be constructed from high conductivity E.C grade (99.9%) copper. All turns of windings shall be adequately supported to prevent movement.

6.2.3 The core and coil assembly shall be a standard design of the manufacturer with proven records for withstanding short circuit forces. The core/coil assembly shall be mounted on the cover plate so that the assembly could be removed from the tank using the suitably placed lugs provided on the cover plate. All metal parts of the transformer with the exception of the individual core laminations, shall be maintained at same fixed potential.

6.2.4 The magnetic circuit shall be insulated from all structural parts, and shall be capable of withstanding a test voltage to core bolts and to the frame of 2,500 volts of RMS power frequency voltage for one minute. During the assembly stage this test shall be performed for one transformer from each batch.

6.3 Transformer Tank

6.3.1 Each transformer shall be enclosed in a suitable stiffened welded steel tanks such that the transformer can be lifted and transported without permanent deformation or oil leakage. The

construction shall employ weldable mild steel comply with BS EN 10025 and shall be of sufficient strength and rigidity to withstand moving, shipping and handling without deformation.

6.3.2 Lifting lugs shall be provided, suitable for the weight of the transformer, including core and windings, fittings, and with the tank filled with oil.

6.3.3 The base of each tank shall be so designed that it is possible to move the complete transformer unit in any direction without injury when using rollers, plates, or rails.

6.3.4 With the exception of radiator elements, all external joints shall be seam welded. There shall be maximum two vertical seam welds for the fin radiator and the other three vertical corner edges of the transformer shall be formed by bending. Corner ribs shall be avoided for the fin radiator. The bearing surface of the tank to which bushings are clamped shall be substantially flat.

6.3.5 All joints other than those, which may have to be opened, shall be welded. Caulking of defective welded joints may be re-welded subject to the written approval of the CEB's Representative.

The quality of the welded joints is considered established, only if the joints do not exhibit any oil leakage or sweating/leakage for a continuous period of at least 3 months during the guaranteed period. In case of sweating/leakage are observed, supplier shall rectify the same and established for a further period of 3 months of the same. If it is not established during the guaranteed period the guarantee period shall be extended until the performance is established.

6.3.6 Flanges and covers of tanks shall be of sufficient thickness to prevent any depression occurring, which would retain water around the bolts. The horizontal edges of the cover plate shall be bent over the tank flange to facilitate water dripping out of the tank. The bent collar width shall be about 10mm to 15mm.

6.3.7 The tank and cover shall be designed in such a manner as to leave no external pockets in which water can lodge, no internal pockets in which oil can remain when draining the tank or in which air can be trapped when filling the tank, and to provide easy access to all external surfaces for painting. Tilted type cover plates are not acceptable.

6.3.8 Design shall ensure adequate thermal head for circulation of oil to achieve ONAN cooling of the transformer. The transformer shall be fitted with drain valve and pressure relief valve.

6.3.9 Each tank cover shall be of adequate thickness and strength, must not distort when lifted and shall be provided with suitable flanges having sufficient and properly spaced bolts.

6.3.10 It must be possible to remove any bushing without removing the tank cover.

6.3.11 All nuts and bolts used shall be non-magnetic stainless steel and spaced at sufficiently close intervals to avoid buckling of either flange or covers and shall provide reasonably uniform compression of the gasket.

6.4 Transformer Sealing/Gasket

6.4.1 The transformers shall be of the hermetically sealed type and provided with a satisfactory lid sealing gaskets

6.4.2 The gasket shall of the good quality to maintain the sealing effect through its life span and shall prevent seeping of oil due to ageing and extreme operating temperature.

6.4.3 Gaskets provided with the transformers shall be suitable for making oil tight joints, and 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.

6.4.4 Exterior gaskets shall be of rubberized cork material, weatherproof and shall not be affected by strong sunlight.

6.5 Oil Level Indicator

6.5.1 Oil Level Indicator be fitted to the transformer tank to show the oil level at all temperature likely to be experienced in service. It shall be marked with normal level at 30 °C.

6.6 Pressure Relief Device

6.6.1 The transformer tank shall be fitted with a suitable pressure relief valve to operate when the pressure exceeds 0.3 bars to prevent explosion of the transformer due to internal fault.

6.7 Bushings

6.7.1 The transformer shall be provided with outdoor type porcelain insulator bushings, conforming to IEC 60137, from a reputed manufacturer, for 33kV or 11kV phase terminal and 400V phase & neutral terminal.

6.7.2 33kV, 11kV and Neutral bushings shall be mounted on the tank cover in a manner such that the minimum phase to phase clearance and phase to earth clearance shall not be less than those stated in IEC 60076-3.

6.7.3 The porcelain shall not engage directly with the hard metal and gaskets shall be interposed between them and the surface in contact with the gasket shall be unglazed. They shall be installed in a manner to prevent ingress of moisture and to facilitate easy removal. The neutral bushings and stems shall be identical to those provided for phase terminations. Bushing palms shall be made of brass and be suitable for the bolting of conductor compression lugs.

6.7.4 The palms shall be suitably dimensioned, to suit the bushing rod and the holes spaced sufficiently apart to enable tightening of bolts using standard spanners and to prevent overlap of lugs. The bushing palms shall be as indicated in the drawing No. DS&S/2022/098-A1.

6.8 Cable Mounting Bracket

6.8.1 A cable mounting bracket for LV side of the transformer shall be provided if requested in the price schedule. All metal parts shall be hot dipped galvanized as per ISO 1413-2.

6.9 Terminal Leads

6.9.1 Outgoing leads brought out through bushings shall be such that the core and coils could be removed without interference with these leads, and they shall be specially supported inside the transformer to withstand the effects of vibration and short circuits.

6.9.2 The leads shall be so fixed that they do not break at the connection and would not twist and touch each other in case the bushing is turned accidentally.

6.10 Earthing Connections

6.10.1 All metal parts of the transformer such as coil clamping ring, core bolts, clamping plates etc.

shall be earthed and maintained at the same potential. The magnetic circuit shall be earthed to the clamping structure at one point only through a removable link placed in an accessible position just beneath the tank cover. The connection to the link shall be on the same side of the core as the main earth connection.

6.10.2 Main earthing connections shall not be less than 50mm^2 copper stranded conductors. Three bolts of M12 size located on either side of the tank base (two) and on the cover plate (one) shall be provided for earthing.

6.11 Surge Arrester Mounting Bracket

6.11.1 The surge arrester mounting bracket made of steel shall be provided on the transformer main tank, fixed to the cover plate by providing extended bolts without disturbing the cover plate assembly. If mounting bracket is provided, cable box is not required and vice versa.

6.11.2 The bracket shall be hot dip galvanized and suitable to accommodate three Nos. of surge arresters on the 33kV and/or 11kV side as indicated in typical design the drawing No. DS&S/2022/098-A2. Final design shall be approved by CEB.

6.12 Oil

6.12.1 Transformers shall be filled to the required level with new, unused, clean, standard mineral insulating oil compliance with CEB Specification 143:2017

6.13 Internal and External Finish

Interiors of oil tanks shall be thoroughly cleaned by an approved method and, where exposed to corrosion before use, shall be coated with an approved corrosion preventing compound. The exterior shall be thorough cleaned by shot blasting to achieve surface of SA 2.5 and shall be followed by a zinc rich primer at least 60µm of thickness. The paint system shall be selected as per ISO 12944-5 based on atmospheric corrosivity category defined in clause 3.0.

6.14 Rating Plate

6.14.1 A stainless steel rating plate shall be fitted to each transformer in an accessible position The information shall be deeply etched including the diagram of the connections of the windings, the vector diagram showing the general phase relations of the transformer, and a diagrammatic plan of the transformer cover showing the terminal positions and marking and other essential particulars as per clause 7 of IEC60076-1, indelibly in English language.

6.14.2 Following information in addition to the requirement of clause 7 of IEC60076-1.also shall be marked

a) Type of Insulating oil
b) No load losses
c) Full load losses

6.15 Off Load Tap Changer

6.15.1 Voltage tappings shall be provided on the primary side of each transformer. Tapping step shall be +2.5% to -7.5%. Number of tappings shall be as stipulated in the Clause 5.0 –Technical Requirements and step shall be 2.5%.

6.15.2 The tappings shall be selected by an 'off load' tapping switch with an external hand wheel with provision for locking on to a selected tapping. The shaft shall be adequately sealed so that no seepage of oil occurs under all conditions of service.

6.15.3 The voltage operating positions, together with tap change positions shall be clearly and indelibly marked. Lowest tap number shall represent highest voltage.

7.0 REQUIREMENTS FOR SELECTION

7.1 Quality Assurance

The manufacturer shall possess ISO 9001:2015 or latest Quality Assurance Certification for the manufacture of transformers for the plant where the manufacture of power transformers is done. Bidders shall furnish a copy of the ISO certificate certified as true copy of the original by the manufacturer, along with the offer.

7.2 Manufacturing Experience

The bidder shall ensure that, each transformer offered is manufactured by a manufacturer with a minimum of fifteen (15) years successful experience in manufacturing comparable equipment, in rated or higher voltage and capacity. In addition, minimum of ten years (10) experience shall be in manufacturing for orders outside the country of the manufacturer for comparable equipment.

If the offered equipment is manufactured under license, the manufacturing experience of equipment manufactured by the parent company shall not be counted as manufacturing experience of the licensee equipment.

In addition, the Bidder shall submit a reference list of two or more transformers of same or similar design and rating manufactured and supplied by the manufacturer for orders from outside the country of the manufacture. Offered transformer will only be accepted if transformers identical/similar in design have a minimum of five years (5) field experience.

Notwithstanding to above if the supplier has supplied similar transformers to CEB and they were in satisfactory operation over the last five (5) years those transformers will be considered.

Bidder shall provide adequate evidence of compliance to above requirements. Bids non-complying with above requirements or with incomplete evidence of compliance would be rejected.

7.3 Type Tests and Special Tests

Type Test Certificates and short circuit withstand test reports conforming to the above referred standards, issued by:

Either

(a) an accredited independent testing laboratory

or

(b) an accredited testing laboratory where the type test has been witnessed by an accredited independent inspection body

shall be furnished with the offer. Type Test Certificates and short circuit withstand test reports shall clearly indicate the relevant standard, items concerned, showing the manufacturers identity, type No. /catalogue No. and basic technical parameters.

Proof of accreditation and accredited scope, by a national/ international authority that are full members of ILAC (International Laboratory Accreditation Cooperation), i.e. signatories to the ILAC mutual recognition arrangement (MRA) to assess and accredit:

(a) testing laboratories using ISO/IEC 17025 (in case of accredited independent testing laboratories)

(b) inspection bodies using ISO/IEC 17020 (in case of accredited independent inspection bodies)

shall be forwarded with the offer. Accredited independent laboratory/inspection body shall not be the same entity or associate of the manufacturer.

Test certificates shall be complete including all the pages as issued by the testing authority. Type test certificates and short circuit withstand test reports shall be in English language. Parts of test certificates shall not be acceptable.

7.3.1 Type tests as per IEC 60076-1 for the transformers and "Wet Power Frequency Test" as per IEC 60137 for the transformer bushings shall be furnished with the offer. Type Tests as per above standards done on transformers of same or higher voltage not exceeding 72.5 kV, and capacity of a similar design having uniform insulation will be acceptable.

The Lightning Impulse Type test shall comply with Table 2 (Test voltage levels) of IEC 60076-3. However, the Lightning Impulse levels given in Clause 5.1 (Medium Voltage Characteristics) shall be proven in FAT for the awarded Transformer.

7.3.2 Ability to Withstand Short Circuit

7.3.2.1 General

All transformers shall be capable of withstanding on any tapping and without damage the thermal and dynamic effects of external short circuits under the conditions stated in IEC 60076-5 Clause 4.

Manufacturer shall demonstrate the ability to withstand the thermal effect of short circuit by calculation, and the ability to withstand the dynamic effect of short circuit either by test (as per IEC60076-5 Clause 4.2) or requirement for the test can be waived if the manufacturer has provided short circuit test report as per clause 7.3.2.2.(b) of this specification. In such cases, manufacturer shall furnish documentation as per clause A.3.3.2, A.3.2 and A.3.4 of IEC 60076-5 for comparative evaluation of the availability of withstanding dynamic effects of short circuit.

7.3.2.2 Calculations, Design and Manufacture Considerations

In case of proving ability of withstanding short circuit conditions by calculations, following guidelines shall be followed.

a) Thermal ability to withstand the short circuit

Calculations shall be done according to IEC 60076-5:2006 Clause 4.1 to prove the thermal ability to withstand the short circuit, for at least 2 seconds at rated conditions and after all loading conditions as specified in IEC 60076-7 Clause 7.3.3 and shall be submitted with the offer.

b) Ability to withstand the dynamic forces

During the bidding stage manufacturer shall prove his ability of designing and manufacturing transformers similar in capacity and rated voltage not exceeding 72.5kV which can withstand dynamic effects of short circuit as per IEC 60076-5 by means of complete test reports of short circuit tests. These tests shall be conducted in a test laboratory which is a member of Short circuit Testing Liaison (STL) and the laboratory shall also possess ISO/IEC17025 certification. The similarity of the reference transformer and offered transformer shall be shown/provided in compliance with Annex B of IEC 60076-5.

8.0 ADDITIONAL REQUIREMENTS

8.1 Terminal Marking

All transformers shall have the primary and secondary terminal markings plainly and indelibly marked on the transformer adjacent to the relevant terminal. These markings shall conform to the standard specified and shall be 25mm in height.

8.2 Radio Interference

When operated at voltage even up to 10% in excess of the normal system rating, transformers shall be substantially free from partial discharges (i.e. corona discharges in either internal or external insulation) which are likely to cause interference with radio or telephone communication.

8.3 Spare Parts and Tools

The supplier shall specify the spare parts required for proper and continuous functioning of the transformers. The supplier shall also specify if any special tools are required for the maintenance of transformers. A schedule of prices and quantities of spare parts and special tools shall be given by the supplier. Cost of spares and special tools shall not be taken for the evaluation.

8.4 Outline Drawings, Maintenance Manual

A comprehensive maintenance manual shall be provided with each transformer and it shall include.

- A hard cover suitable for normal handling.
- A comprehensive index of all materials in the manual.
- Instructions for the routine maintenance of the equipment and associated auxiliary equipment.
- Outline drawings and other necessary drawings baring an effect on customers' installation.
- A photograph from each side and end of the associated core and windings and of the fully erected unit. The photographs should be about 200 mm x 150 mm in size.
- Copies of routine test certificates.

9.0 INFORMATION TO BE FURNISHED WITH THE OFFER

a) Guaranteed Technical Particulars requested in Annex – B1.
b) Constructional features and materials used for components.
c) Separate explanatory drawings and dimensions of tap changer.
d) Overall dimensional drawings
e) Drawing of rating plate to scale incorporating the particulars called for.
f) Certified copy of the quality assurance conforming to ISO 9001:2015 or latest.
g) Documents to prove manufacturer's experience in accordance with Clause 7.2.
h) Documents in accordance with Clause 6.1.5
i) A schedule of prices and quantities of spare parts and special tools shall be given by the supplier in accordance with Clause 8.3.
j) Type and special test certificates in accordance with clause 7.3
k) Ability to withstand short-circuit in accordance with clause 7.3.2

10.0 INSPECTION AND TESTING

10.1 Inspection

The selected Bidder shall make necessary arrangements for inspection of the equipment by an Engineer appointed by the CEB and also to carry out in his presence necessary Acceptance / sample tests of the materials and equipment, offered.

10.2 Acceptance Tests

The following acceptance tests shall be performed on all transformers at the manufacturer's works and the tests shall be witnessed by the representative nominated by the CEB.

a) Measurement of winding resistance
b) Measurement of voltage ratio and check of voltage vector relationship
c) Measurement of short circuit impedance and load loss
d) Measurement of no-load loss and current
e) Dielectric routine tests
f) Oil breakdown test
g) Dimensional test
h) Measurement of dry film thickness of paints
i) Measurement of Zero sequence impedance
j) Pressure test at 0.25 bar above atmospheric
k) Temperature rise test (at least for one sample of the lot)

10.3 Criteria for Factory Acceptance Tests

If the test results of the inspection are not within the acceptable limits of Clause 5, CEB shall have the right to reject the transformer as defective. If any defect arises during the testing of the transformer and CEB representative for the inspection considered the defect as a major defect then the transformer will be rejected as defective, will not be accepted after the repairs by the manufacturer. In which case the manufacturer shall agree to replace the transformer with a new design without any additional cost. However, if the CEB representative considers the defect as a minor defect, the manufacturer's request for re-inspection and repairs may be considered subjected to the following.

a) Dismantling and inspection of the transformer for repairs shall be done in the presence of an Engineer nominated by General Manager of Ceylon Electricity Board.

b) All the Routine & Special Tests specified above must be repeated. Manufacturer shall agree to bear the cost of travelling and accommodation of the representative nominated by CEB for the period of inspection, repairs and testing of the defective transformer.

11.0 ANNEX

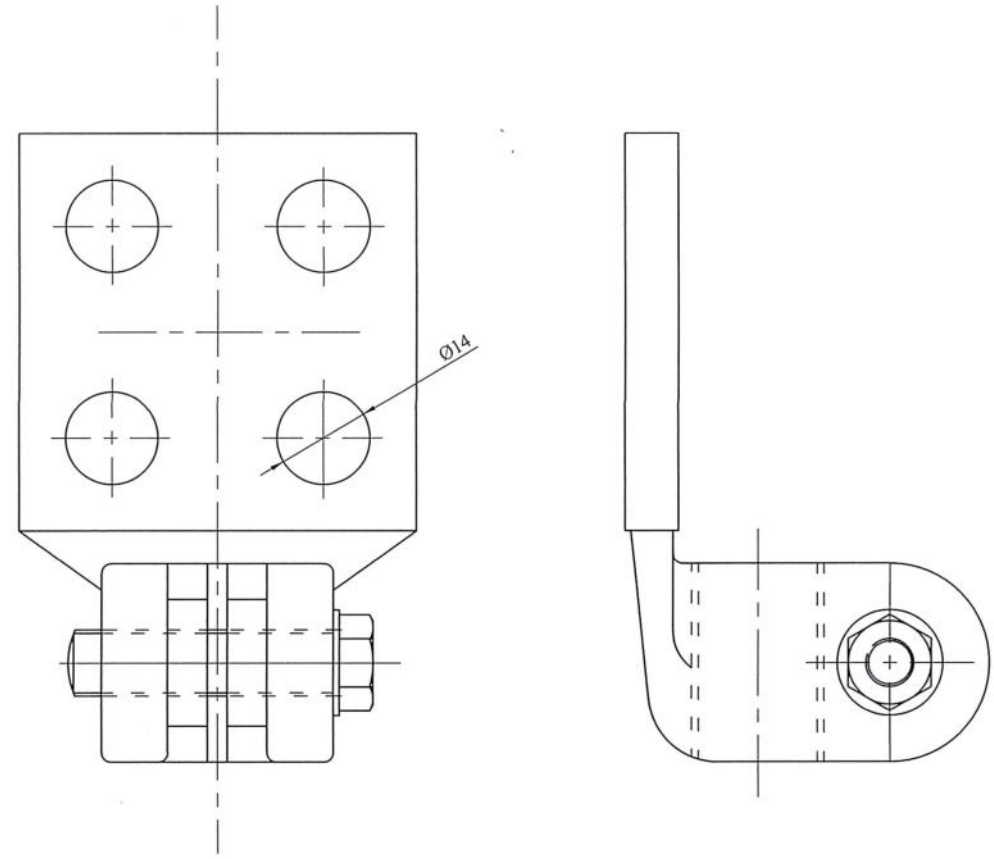
Annex - A1 : Drawing of Surge Arrestor Mounting Bracket

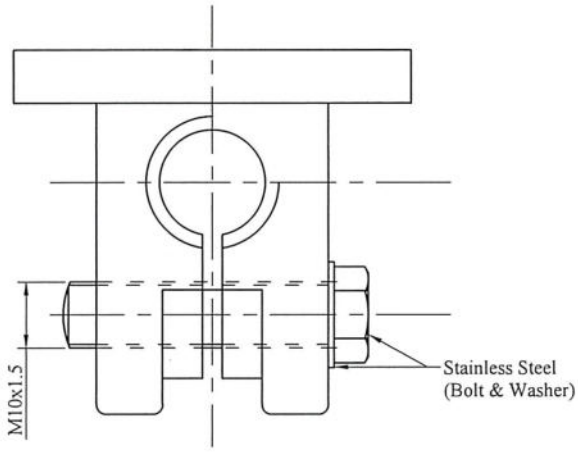
Annex - A2 : Details of Bushing Flag

Annex – B1 : Schedule of Guaranteed Technical Particulars

Annex – B2 : Other Technical Requirements

Annex – C : Non-Compliance Schedule

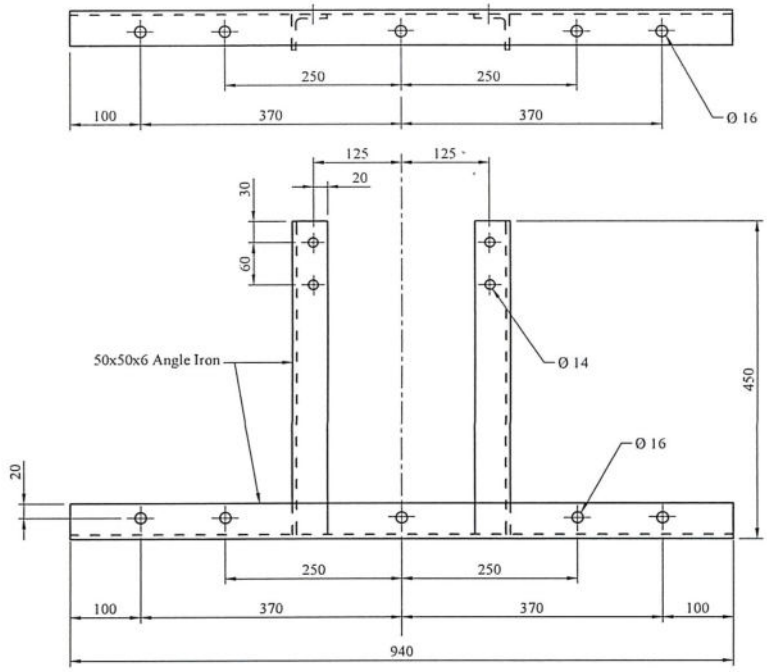




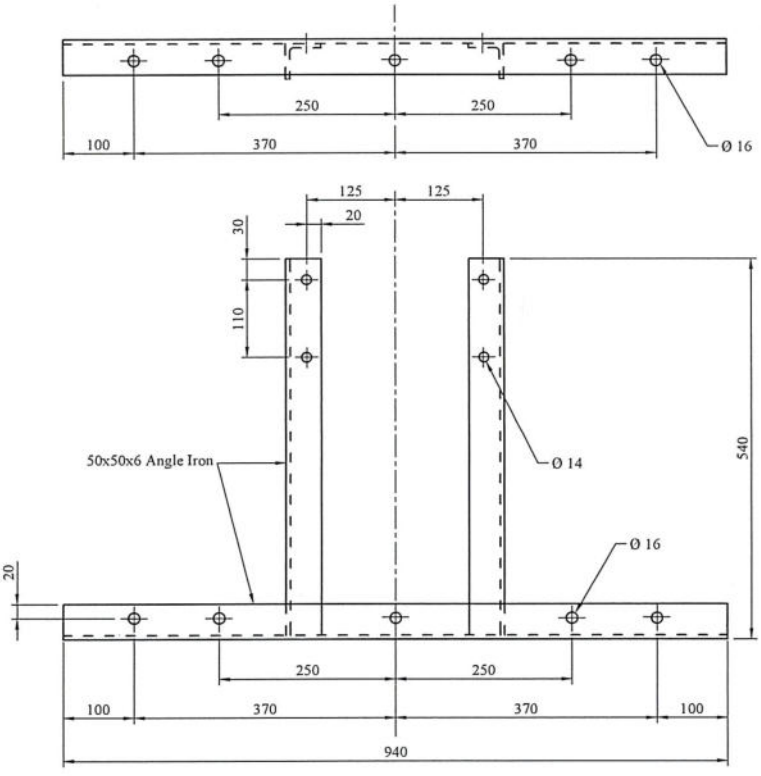
NOTE
Material : Tin Plated Brass

ALL DIMENSIONS ARE IN MILLIMETRES

CEYLON ELECTRICITY BOARD	DISTRIBUTION STANDARDS & SPECIFICATIONS	SCALE : NOT TO SCALE
	SCHEMATIC DIAGRAM OF BUSHING FLAG FOR DISTRIBUTION TRANSFORMER	DRAWN : HARSHA
		DATE : JUL. 2023
	DESIGNED BY / APPROVED BY	DRG. NO : DS&S/2023/098A1
DISTRIBUTION COORDINATION BRANCH	EE (DC) / CHAIRMAN, SPECIFICATION COMMITTEE	SDOURCE : DS&S/2000/098A



100 - 400 kVA 11,33 kV /415 V TRANSFORMERS



630 - 1000 kVA 11,33 kV /415 V TRANSFORMERS

ALL DIMENSIONS ARE IN MILLIMETRES

CEB Approved Specification
11/09/23
Chairman Dist. Coordination Committee

CEYLON ELECTRICITY BOARD	DISTRIBUTION STANDARDS & SPECIFICATIONS	SCALE : NOT TO SCALE
	SURGE ARRESTOR MOUNTING BRACKT	DRAWN : HARSHA
		DATE : JUL. 2023
	DESIGNED BY / APPROVED BY	DRG. NO : DS&S/2023/098A2
DISTRIBUTION COORDINATION BRANCH	EE (DC) / CHAIRMAN, SPECIFICATION COMMITTEE	SDOURCE : DS&S/2000/098B

Annex- B1

SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS

(Following Information shall be furnished with the offer for each capacity of transformer offered)

			CEB Requirement	Offered
1.	a) Name of manufacturer			
	b) Country of origin			
	c) Brand name			
2.	Applicable Standards		As per clause 4.0	
3.	Voltage rating	kV		
4.	Capacity	kVA		
5.	Vector group		Dyn11	
6.	Impedance	%		
7.	Frequency	Hz	50	
8.	Cooling type		ONAN	
9.	Insulation temperature class		Class A	
10.	Average winding temperature rise (by resistance measurement) at steady state continuous MCR at annual average ambient temperature (30°C) under normal service condition.	K	55	
11.	Top oil temperature rise at annual average ambient temperature (30°C) under normal service condition.	K	50	
12.	Minimum Short circuit impedance voltage at 75^{0}C	%	As per cl. 5.0	
13.	Corrected average A-weighted Sound Pressure level	dB	As per cl. 5.0	
14.	No load Loss at 75 ^{0}C	W		
15.	Load Loss at 75 ^{0}C	W		
16	Lightning impulse withstand voltage (peak)			
	i. HV side	kV	200 or 95 as applicable	
	ii. LV side	kV	6	
17.	Wet power frequency withstand voltage (for transformer bushings)			
	i. HV side	kV	70 or 28 as applicable	
	ii. LV side	kV	3	
18.	Total creepage distance of			
	i. 33kV bushings	mm	900	
	ii. 11kV side bushings	mm	300	

19.	Type of Oil Level Indicator provided		As	
20.	Type of Pressure Relief Device provided		As per clause 6.6	
24.	Valves Provided			
	a) Drain Valve	Yes/No	Yes	
	b) Pressure relief valve	Yes/No	Yes	
25.	Whether the offered transformers fully conform with CEB Specification?	Yes/No	Yes	
	a) Clause 6.1 - General Design of the Equipment?	Yes/No	Yes	
	b) Clause 6.3 - Transformer Tank?	Yes/No	Yes	
	c) Clause 6.4 - Transformer Sealing?	Yes/No	Yes	
	d) Clause 6.13 - Internal & External Finish ?	Yes/No	Yes	
	e) Clause 6.14 - Rating Plate?	Yes/No	Yes	
	f) Clause 6.7 - Bushings ?	Yes/No	Yes	
	g) Clause 6.9 -Terminal Leads?	Yes/No	Yes	
	h) Clause 6.10 - Earthing Connections?	Yes/No	Yes	
	i) Clause 6.12- Oil?	Yes/No	Yes	
	j) Clause 6.6 - Pressure Relief Valve?	Yes/No	Yes	
	k) Clause 8.1– Terminal Making ?	Yes/No	Yes	
	l) Clause 8.2 – Radio Interference ?	Yes/No	Yes	
26.	Off Load Tap Changer		As per clause 6.15	
	a) Tap changer Steps	%		
	b) Number of steps			
28.	Indicate the particulars of Spares to be supplied with each transformers			
29.	Whether the information as per Clause 9 is furnished with the offer?	Yes/No	Yes	
30.	Whether the complete Type Test Certificates as per Clause 7.3 are furnished with the offer?	Yes/No	Yes	
31.	Whether the report on demonstration on ability to withstand short circuit as per clause 7.3.2 is furnished with the offer?	Yes/No	Yes	
32.	Whether the Acceptance /Sample Tests as per Clause 10.2 will be carried out?	Yes/No	Yes	
33.	Place of testing			
34.	The value of Magnetizing Current at principle tap (as a % of full load current at HV winding)	%		
35.	Whether the certificate of ISO 9001:2015 or latest quality Assurance furnished?	Yes/No	Yes	
36.	Total weight of oil	kg		
37.	Insulating Oil Volume/Weight	Liters/kg		

38.	Total Weight of the Transformer	kg		
39.	Whether the Complete dimensional drawing furnished?	Yes/No	Yes	

.....
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 B2: OTHER TECHNICAL REQUIREMENTS

Note: Compatibility issues with the existing SCADA system and any other technical requirements, if required have to be mentioned here by the procurement entity.

Annex – C

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 and seal of the Manufacturer

.....
Date

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

.....
Signature and seal of the Bidder

.....
Date