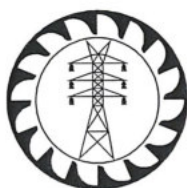


108-2: 2018

CEB
SPECIFICATION

**33 kV/11 kV THREE PHASE POWER
TRANSFORMERS
(HERMETICALLY SEALED TYPE)**

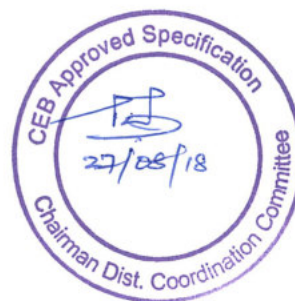


**CEYLON ELECTRICITY BOARD
SRI LANKA**



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SPECIFICATION FOR 33kV/11kV THREE PHASE POWER TRANSFORMERS (HERMETICALLY SEALED TYPE)

1.0 SCOPE

This specification covers the general requirements of design, manufacture, testing, supply and delivery of following 33/11 kV three phase power transformers intended to use in medium voltage distribution system of Ceylon Electricity Board.

1 MVA /2 MVA, transformer with off load tap changer with/without cable box on 11kV side, with/without cable box on 33kV side.

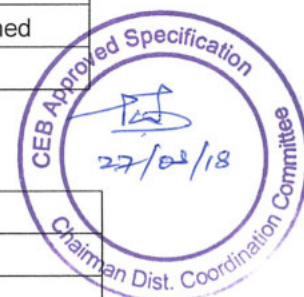
The required transformer capacity shall be indicated in the price schedule.

2.0 SYSTEM PARAMETERS

(a)	Nominal voltage	11kV	33kV
(b)	System highest voltage	12kV	36kV
(c)	System frequency	50 Hz	50 Hz
(d)	Number of phases	03	03
(e)	Method of earthing	Effectively earthed	Non effectively earthed
(f)	System fault level	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	C5 - M



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 60076-3:2013	Power transformers - Part 3: Insulation levels, dielectric tests and external clearances in air
(d)	IEC 60076-5:2006	Power transformers - Part 5: Ability to withstand short circuit
(e)	IEC 60076-7:2005	Power transformers - Part 7: Loading guide for oil-immersed power transformers
(f)	IEC 60076-8:1997	Power transformers - Part 8: Application guide
(g)	IEC 60076-10:2001	Power transformers - Part 10: Determination of sound levels

(h)	IEC 60137:2008	Insulated bushings for alternating voltages above 1 000 V
(i)	IEC 60156:1995	Insulating liquids - Determination of the breakdown voltage at power frequency - Test method
(j)	IEC 60296:2012	Fluids for electrotechnical applications - Unused mineral insulating oils for transformers and switchgear
(k)	IEC 60616:1978	Terminal and tapping markings for power transformers
(l)	IEC 60815:2008	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions
(m)	BS 2562:1997	Specification for cable boxes for transformers and reactors
(n)	BS EN 10025:2009	Hot rolled products of structural steels
(o)	BS 5493:1997	Code of practice for protective coating of iron and steel structures against corrosion
(p)	ISO 12944:2018	Paints and Varnishes

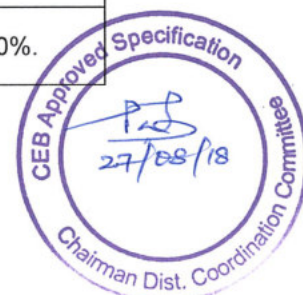
5.0 TECHNICAL REQUIREMENTS

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	170kV
(d)	One minute power frequency withstand voltage	28kV	70kV
(e)	OFF load tapping (High Voltage Side)	+5% to -7.5% (in steps of 2.5%)	
(f)	Insulator creepage distance	300mm	900mm

5.2 Other Performance Characteristics

	Performance Characteristic	Transformer Capacity	
		1 MVA	2 MVA
(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	5.0%.	6.0%.



(h)	Corrected average A-weighted sound pressure level measured	<62 dB
(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. However the total loss of the transformer at 60% of CMR shall be less than 0.5%.	

5.3 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 FOR ALL TRANSFORMER TYPES

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°C 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 tapplings 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 Transformer shall have a base (Skid) suitable for plinth mounting application.
- 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 vapor phase treatment or Oil Circulation or Vacuum Pressure Impregnation 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.

6.2 Magnetic Circuit and Windings

- 6.2.1 The core shall be of high grade non ageing cold rolled grain oriented silicon steel laminations and securely clamped. The transformer core shall be of three limbs stacked core type with designed magnetic flux density shall be as 1.6T 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 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.

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. Each tank shall be provided with jacking lugs suitably positioned for transport.
- 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 All joints other than those, which may have to be opened, shall be welded. Caulking of



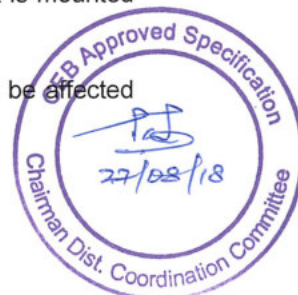
defective welded joints may be re-welded subject to the written approval of the CEB's Representative.

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.

- 6.3.5 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.
- 6.3.6 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.
- 6.3.7 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. Inspection openings shall be provided to give access to the internal connections of bushings, winding connections and earthing links. Each opening shall be correctly located and must be of ample size for the purpose of which it is intended. All inspection covers shall be provided with lifting handles.
- 6.3.8 It must be possible to remove any bushing without removing the tank cover.
- 6.3.9 Pockets shall be provided for a stem type thermometer and for the bulbs of temperature indicators where specified. These pockets shall be located in the position of maximum oil temperature and it must be possible to remove any bulb without lowering the oil level in the tank. Captive screwed caps shall be provided to prevent the ingress of water to the thermometer pockets when they are not in use.
- 6.3.10 All nuts and bolts used shall be hot dip galvanized and spaced at sufficiently close intervals to avoid buckling of either flange or covers and shall provide reasonably uniform compression of the gasket.
- 6.3.11 The transformer tank shall be capable of withstanding, without permanent deflection, a vacuum of 2 millibar pressure when empty of oil or the vacuum required by the recommended drying-out procedure, whichever is the greater.

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 be 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 Pressure Relief Device

- 6.5.1 Pressure relief device of suitable size shall be mounted on the tank cover (with a skirt to protrude at least 2.5mm in to the tank to prevent gas accumulation) for the rapid release of any pressure that may be generated in the tank.
- 6.5.2 The device shall be capable of maintaining the oil tightness of the transformer under all conditions of normal service. It shall prevent the ingress of rain/moisture or oil flow from the transformer after the operation of the device to relieve an internally generated pressure.

6.6 Gas and oil-Activated Indicators and Relays

Following indicators and relays which will be inputs to the SCADA system shall be provided.

- Oil level
- Oil temperature
- Over pressure indicator with relay outputs
- Gas release indicator with relay outputs

The Relays shall be mounted in such a way that all gas arising from the tanks shall freely pass into the gas & oil activated relay. They shall have alarm contacts to close on collection of gas and trip contacts to close following oil surge or low oil level conditions. Gas and Oil-activated Relay shall have provision for checking its operation. (Gas releasing valve should be fitted with suitable operating height from the ground level.)

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 phase terminal and 11kV 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/2018/108-2b.

6.8 Cable Box

- 6.8.1 A detachable cable box shall be provided if requested on the tank cover plate of the transformer to house the 33kV and 11kV phase bushings. It shall be so designed to facilitate, direct vertical termination of the 33kV and 11kV single core cable easily with heat shrinkable cable terminations, and inspection without disturbing the gland plate or incoming cable. The spacing between the bushing shall conform to the standards specified.
- 6.8.2 The cable box shall be fitted with suitable means to clamp the armour wires.



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 50mm² 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 the drawing No. DS&S/2018/108-2a

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 141:2017

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
- Type of Insulating oil
 - No load losses
 - Full load losses
 - Vacuum withstand capability

9/20



6.15 Off Load Tap Changer

- 6.15.1 Voltage tapplings shall be provided on the primary side of each transformer. Tapping step shall be +5% to -7.5%. Number of tapplings shall be as stipulated in the Clause 5.0 –Technical Requirements and step shall be 2.5%.
- 6.15.2 The tapplings 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

7.0 ADDITIONAL REQUIREMENTS

7.1 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 voltage and capacity. In addition, minimum of ten years (10) experience shall be in manufacturing for orders from outside the country of the manufacturer.

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.

7.2 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.

7.3 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.

7.4 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.

7.5 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 including data for the calibration of winding temperature indicators.
- Detailed description including required plant for the vacuum / oil filling procedure.
- Outline drawings and other necessary drawings bearing 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.

8.0 QUALITY ASSURANCE

The manufacturer shall possess ISO 9001:2008 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.

9.0 INSPECTION AND TESTING

9.1 Following Type tests, Ability to withstand short circuit certificates by an accredited independent test laboratory acceptable to CEB shall be furnished with the offer.

9.1.1 The following Certificates of Type tests as per IEC 60076-1 and IEC 60137 by an accredited independent test laboratory acceptable to CEB shall be furnished with the offer. Type Tests as per above standards done on a transformer of same or higher voltage and capacity of a similar design will be acceptable.

Type tests as per IEC 60076-1 for the transformer

- Lightning Impulse withstand voltage test
- Temperature-rise test
- Acoustic sound level measurements

Type tests as per IEC 60137 for the transformer bushings

- One minute wet power frequency withstand voltage test

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.

9.1.2 Ability to Withstand Short Circuit

9.1.2.1 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 calculation, design and manufacture considerations (as per 11.1.2.2 below). The method of demonstration of the ability to withstand the dynamic effects of short circuit shall be stated in the bid.

9.1.2.2 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 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 effect of short circuit
 - I. Ability to withstand the dynamic effect of short circuit shall be demonstrated according to Annex A of IEC 60076-5 of 2006. The results of the design for dynamic forces shall be submitted with the bid according to the Table A.1 or Table A.2 of the Annex A of IEC 60076-5. If the comparison is done with successfully tested similar transformers, Test reports of the successfully short circuit tested similar transformers (According to Annex B of IEC 60076-5 of 2006) shall be submitted with the bid. At least one of such short circuit tested similar transformers shall have the accreditation of a third party such as KEMA.
 - II. If the manufacturer intends to prove the short circuit ability of the offered transformers in accordance with the design rules of the manufacturer, he should furnish the details specified in the clause A.3.3.3.1 of the Annex A of IEC 60076-5 together with the calculated results as per Table A.1 or Table A.2 of Annex A of IEC

For above two cases manufacturer shall facilitate and provide all the documents including all necessary technical data, such as electromagnetic design data sheets, calculations of short-circuit currents, electromagnetic forces and mechanical stresses, supplemented by drawings, material specifications, manufacturing practices and process instructions, etc. required for the design review process as per clause A.3.2 of IEC 60076-5. For case II, above mentioned documents shall be provided for both offered transformer and reference transformer.

Bidder shall submit details of at least one transformer of similar design installed during the last five years and if he intends to prove the design by giving additional references (may not be similar type but with similar design philosophy) he may do so.

At the time of bidding, manufacturer shall provide the supporting documents including calculations and test reports for proving Thermal and Dynamic Short Circuit withstand ability of transformer as per IEC 60076-5:2006. If any of document or documents could not be provided due to proprietary nature of information, manufacturer shall show those documents to Engineer appointed by CEB at CEBs' premises or manufacturers' premises.

9.2 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.

9.3 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) Temperature rise test
- b) Measurement of winding resistance
- c) Measurement of voltage ratio and check of voltage vector relationship
- d) Measurement of short-circuit impedance and load loss
- e) Measurement of no-load loss and current
- f) Dielectric routine tests
- g) Oil breakdown test
- h) Dimensional test
- i) Measurement of dry film thickness of paints
- j) Measurement of Tan δ



- k) Measurement of Zero sequence impedance
- l) Partial discharge test
- m) DGA and Moisture content in paper and oil after temperature rise test
- n) Measurement of sound level (As per IEC 60076-10-1)
- o) Paint Thickness and review of paint method and material.

Note: 1. Temperature rise test shall be applicable for one transformer in a single order and tests f), j), l), m), n) shall be performed after the temperature rise test on that transformer.

9.4 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.

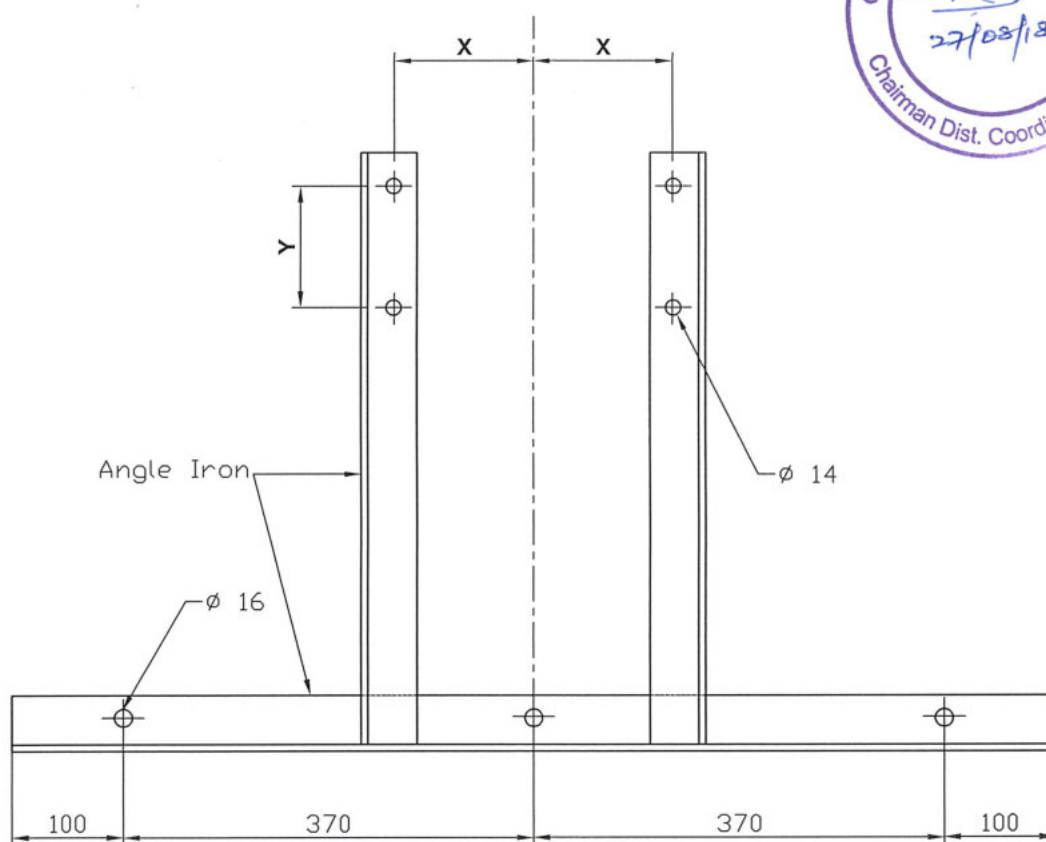
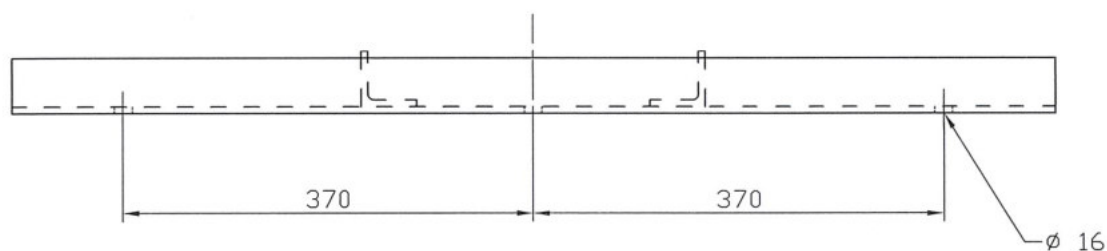
10.0 INFORMATION TO BE FURNISHED WITH THE OFFER

- a) Particulars requested in Annex - B.
- 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 9001:2008 or latest.
- g) Documents to prove manufacturer's experience in accordance with Clause 7.1
- 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 7.4.
- j) Type test certificates in accordance with clause 9.1
- k) Report on demonstration on ability to withstand short-circuit in accordance with clause 9.1.2

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



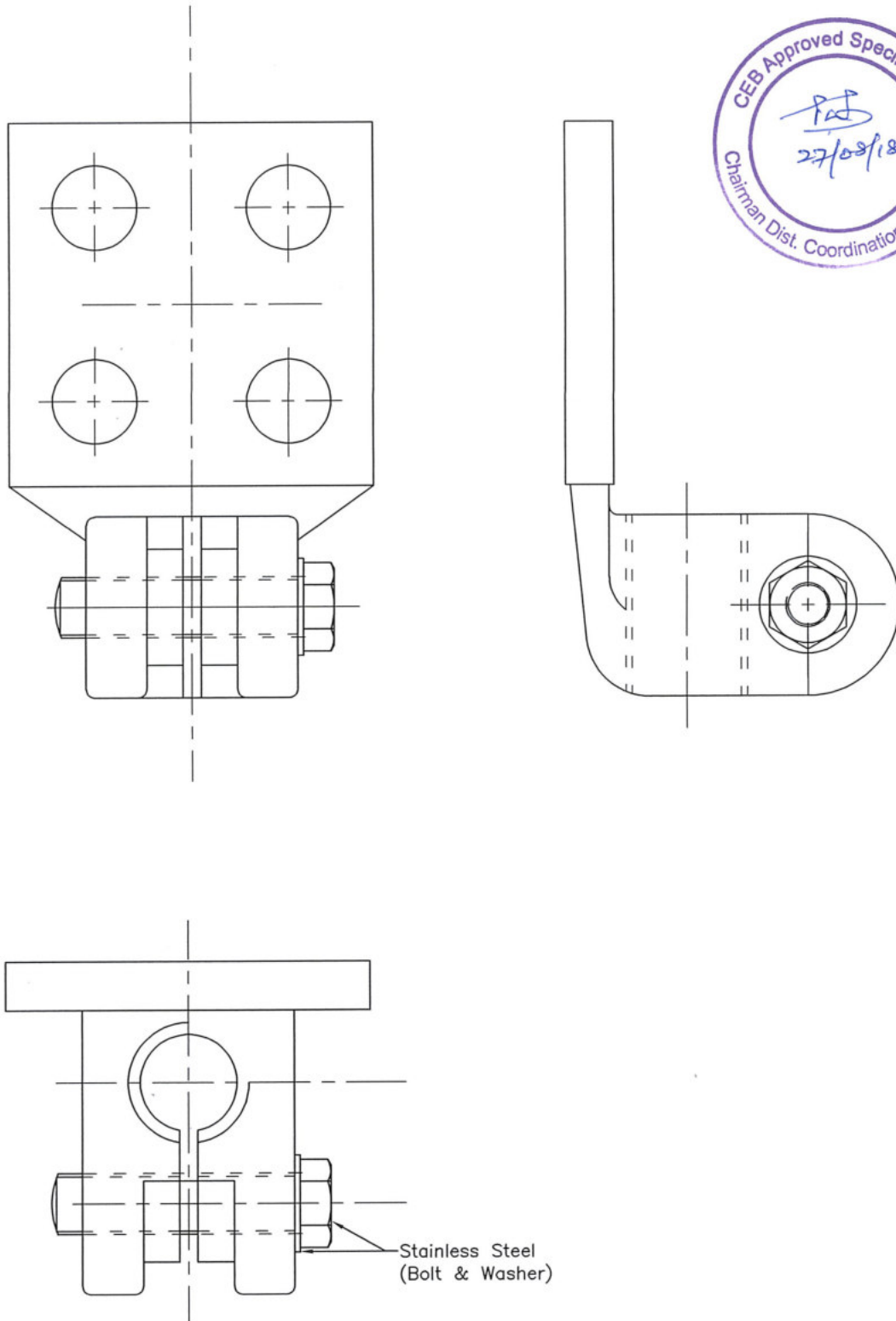


33/11 kV, 1MVA & 2MVA POWER TRANSFORMERS

Note : " X " and " Y " depend on mounting points at the T/F body or Top Plate

All dimensions are in mm.

 CEYLON ELECTRICITY BOARD DISTRIBUTION COORDINATION BRANCH	DISTRIBUTION STANDARDS & SPECIFICATION		SCALE : NOT TO SCALE
	SURGE ARRESTOR MOUNTING BRACKET		DRAWN : EE(DC)
	DESIGNED BY	APPROVED BY	DATE : Jan. 2018
	EE (DC)	CHAIRMAN, SPECIFICATION COMMITTEE	DRG. NO : DS&S/2018/108-2a
			CAD NO :



NOTE
Material : Tin Plated Brass

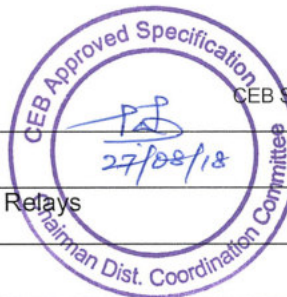
 CEYLON ELECTRICITY BOARD DISTRIBUTION COORDINATION BRANCH	DISTRIBUTION STANDARDS & SPECIFICATION		SCALE : NOT TO SCALE
	DETAILS OF BUSHING FLAGS		DRAWN : EE(DC)
	DESIGNED BY	APPROVED BY	DATE : Jan. 2018
			DRG. NO : DS&S/2018/108-2b
	EE (DC)	CHAIRMAN, SPECIFICATION COMMITTEE	CAD NO :



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		
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°C %	5% for 1MVA transformers 6% for 2MVA transformers	
13.	Corrected average A-weighted Sound Pressure level dB	< 62	
14.	No load Loss at 75 °C W		
15.	Load Loss at 75 °C W		
16.	Lightning impulse withstand voltage (peak)		
	i. 33kV side kV	170	
	ii. 11kV side kV	95	
17.	Wet power frequency withstand voltage (for transformer bushings)		
	i. 33kV side kV		
	ii. 11kV side kV		
18.	Total creepage distance of		
	i. 33kV side mm	900	
	ii. 11kV side mm	300	
19.	Type of Oil Level Indicator provided		



20.	Type of Pressure Relief Device provided		As per clause 6.5	
21.	Whether the Gas & oil Activated Indicators and Relays 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 6.5 - Pressure Relief Valve?	Yes/No	Yes	
	k) Clause 7.2 – Terminal Making ?	Yes/No	Yes	
	l) Clause 7.3 – 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 10 is furnished with the offer?	Yes/No	Yes	
30.	Whether the complete Type Test Certificates as per Clause 9.1 are furnished with the offer?	Yes/No	Yes	
31.	Whether the report on demonstration on ability to withstand short circuit as per clause 9.1.2 is furnished with the offer?	Yes/No	Yes	
32.	Whether the Acceptance /Sample Tests as per Clause 9.3 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 9001:2008 or latest quality Assurance furnished? Yes/No			
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.



**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