MAHAVITARAN
Maharashtra State Electricity Distribution Co. Ltd.

Maharashtra State Electricity Distribution Company Limited

TECHNICAL SPECIFICATION

FOR

TECHNICAL SPECIFICATION OF 315KVA, 630 KVA, 1000 KVA, 1250KVA, 1600KVA, 2000KVA & 2500 KVA, 11/0.433 KV, 22/0.433 KV, 33/0.433 KV, Energy Efficiency Level - 2 THREE PHASE, INDOOR TYPE OIL IMMERSED DISTRIBUTION TRANSFORMERS.

TECHNICAL SPECIFICATION NO.

CE/T&QC/MSC-I/3Phase/DT/T/2019,

Amended on Date: 20.11.2019

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TECHNICAL SPECIFICATION OF 315KVA, 630 KVA, 1000 KVA, 1250KVA, 1600KVA, 2000KVA & 2500 KVA, 11/0.433 KV, 22/0.433 KV, 33/0.433 KV, Energy Efficiency Level -2 THREE PHASE, INDOOR TYPE OIL IMMERSED DISTRIBUTION TRANSFORMERS.

CE/T & QC/MSC-I/3Phase/DT/T/2019

1 Scope:-

1.1 This specification covers design, manufacturing, testing and delivery of **315KVA, 630 KVA, 1000 KVA, 1250KVA, 1600KVA, 2000KVA & 2500 KVA, 11/0.433kV , 22/ 0.433 kV & 33/0.433 kV, Energy Efficiency Level -2 three phase oil immersed, Oil Natural (ONAN) Indoor Type Distribution Transformers** suitable for 11 kV, 22 kV & 33 kV, 50 Hz, Distribution system.

1.2 The equipment offered shall be complete with all parts necessary for their effective and trouble-free operation. Such parts will be deemed to be within the scope of the supply irrespective of whether they are specifically indicated in the commercial order or not.

1.3 It is not the intent to specify herein complete details of design and construction. The equipment offered shall conform to the relevant standards and be of high quality, sturdy, robust and of good design and workmanship complete in all respects and capable to perform continuous and satisfactory operations in the actual service conditions at site and shall have sufficiently long life in service as per statutory requirements.

1.4 The design and constructional aspects of materials shall not withstanding any anomalies, discrepancies, omissions, in-completeness, etc. in these specifications and will be subject to good engineering practice in conformity with the required quality of the product, and to such tolerances, allowances and requirements for clearances etc. as are necessary by virtue of various stipulations in that respect in the relevant Indian Standards, IEC standards, I.E. Rules, I.E. Act and other statutory provisions.

1.5 The Bidder/supplier shall bind himself to abide by these considerations to the entire satisfaction of the purchaser and will be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.

1.6 Tolerances:

The tolerance of guaranteed performance figures shall be as specified in the (Part-I) table 1 of latest issue of IS 2026 **except losses** or relevant International Standard except wherever specified otherwise in this specification.

2 System Particulars:-

The transformers shall be suitable for INDOOR installation with following system particulars and they should be suitable for service under fluctuations in supply voltage as permissible under Indian Electricity Rules

2.1	Nominal System Voltage	:	11 kV or 22 kV or 33 kV
2.2	Corresponding Highest System Voltage	:	12 kV or 24 kV or 36 kV
2.3	Rated Basic Insulation Level	:	75 KVp or 125 KVp or 170 KVp
2.4	Neutral earthing	:	Solidly earthed
2.5	Frequency	:	50 Hz with ± 3 % tolerance
2.6	Number of Phases	:	3

3 SERVICE CONDITIONS:

3.1 Equipment supplied against the specification shall be suitable for satisfactory operation under the following tropical conditions:-

i	Max. ambient air temperature	:	50 Deg. C
ii	Max. relative humidity	:	100 %
iii	Max. annual rainfall	:	1450 mm
iv	Max. wind pressure	:	150 kg/sq.m.
v	Max. altitude above mean sea level	:	1000 mtrs.
vi	Isoceraunic level	:	50
vii	Seismic level(Horizontal acceleration)	:	0.3 g.
viii	Climatic Condition		Moderately hot and humid tropical climate conducive to rust and fungus growth.
ix	Reference Ambient Temperature for temperature rise	:	50 Deg C

3.2 The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.

3.3 The equipment shall be for use in moderately hot and humid tropical climate conducive to rust and fungus growth.

3.4 The Distribution Transformer shall be mark with standard mark governed by BIS as per clause 13.4 of IS 1180(Part 1):2014] .

3.5 The Distribution Transformer shall bear Star 1 rating label approved by BEE (Bureau of Energy Efficiency).

3.6 The Distribution Transformer shall bear EEL - 2 (star 1 of BEE) ratings label approved by BIS (Bureau of Indian Standard) as per IS 1180 (Part-1):2014.

3.7 The Bidder/ Manufacturer shall possess the BIS license for offered product.

4 APPLICABLE STANDARDS:-

4.1 The design, manufacture and performance of the equipment shall comply with all currently applicable statutes, regulations and safety codes. Nothing in this specification shall be construed to relieve the bidder off his responsibilities.

4.2 The Distribution Transformers shall conform to IS: 1180 (Part 1) : 2014 amended up to date or other International Standards for equal or better performance. Unless otherwise modified in this specification the Distribution Transformers shall comply with the Indian Standard Specification IS 1180 latest.

4.3 Unless otherwise specified, the equipment offered shall conform to amended up to date Indian, IEC, British or U.S.A. Standards and in particular, to the following:-

4.4 The applicable standards are as follows :

Sr.No.	*IS number*	IS name
1.	IS:1180(Part-1) : 2014 amended upto date	Oil immersed distribution transformers up to and including 2500 kVA, 33KV.
2.	IS:2026(Part I to IV)	Specification for power transformer
3.	IS:335/2018	New insulating oil- Specification (fifth revision)
4.	IS:2099/1986, IS: 7421-1988, IS:3347 (Part-I /Sec-2)-1979, IS:3347 (Part-I /Sec-1)-1982 amended up to date	Bushing
5.	IS 5	Colours for ready mixed paints and enamels.
6.	IS 13730 (Part-27)1996	Specification for particular types of winding wires.
7.	IS: 3073/1974, IS: 3070(Part-II)	Specifications for L.A‘s
8.	CEA Guidelines August -2008	Manual on transformers
9.	CBIP Publication No.295:2006	Manual on transformers

4.5 In case of conflict arising out due to variations between the applicable standard and the standards specified herein the provisions of this specification should prevail.

5 Specific Technical requirement:

5.1 Standard kVA Ratings:-

The standard ratings for transformer shall be 315 kVA & above and upto 2500 kVA as per IS 1180 (Part-I):2014

5.2 Nominal voltage ratings

i Primary voltage : 11 kV/ 22 kV/33 kV

ii Secondary voltage : 0.433 kV

5.2.1 Winding connections:-

i. H.V. Winding : Delta (Δ)

ii. L.V. Winding : Star (Y)

so as to produce a positive phase displacement of 30 degrees from the primary to the secondary vectors of the same phase. The neutral of the L.V. winding shall be brought out to a separate insulated terminal. The voltage group shall be Dyn-11 (IS 2026 Part I).

5.3 Temperature Rise:

i The temperature rise for top oil over an ambient temperature of 50° C should be 40°C maximum [measured by thermometer in accordance with IS 1180 (Part 1) & IS 2026 (Part 2)].

ii Temperature rise for winding over an ambient temperature of 50° C should be 45° C maximum [measured by resistance method in accordance with IS 1180 (Part 1) IS 2026 (Part 2)].

5.4 No load voltage ratio:-

The no load voltage ratio shall be 11000/433 Volts, 22000/433 Volts & 33000/433 Volts.

6 Design & construction

a. The spring washers must be used for fixing core with tie rod.

b. Core base & bottom Yoke shall be supported with 75 mm X 40 mm X6 mm MS Channel with proper bolting. The core assembly shall be fixed by four locking bolts.

c. The maximum flux density in any part of the core and yoke at rated voltage and frequency shall be such that the flux density with +12.5 % combined voltage and frequency variation with rated voltage and frequency does not exceed 1.9 Tesla. Flux density should not be more than 1.69 Tesla at rated voltage and frequency.

d. The No load current at rated voltage shall not exceed the percentage as given below.

e. The no load current of 315 kVA & above and upto 2500 kVA transformer shall not exceed **2%** the full load current and will be measured by energizing the transformer at rated voltage and frequency. Increase of 12.5 percent of rated voltage shall not increase the no load current by **5%** of full load current.(As per IS 1180 (Part1):2014)

6.1 Core

i The core shall be stacked/ wound type.

a) **For Stack core** :- The core shall be of high grade cold rolled grain oriented (C.R.G.O) annealed steel lamination having low loss and good grain properties, coated with hot oil proof insulation, bolted together to the frames firmly to prevent vibration or noise. All core clamping bolts shall be effectively insulated. The complete design of core must ensure

permanency of the core losses with continuous working of the transformers.

b) For Wound core :-

The core shall be 'C' type construction of high grade cold rolled grain oriented (C.R.G.O.) annealed steel lamination having low loss and good grain properties, coated hot oil proof insulation. The complete design of core must ensure permanency of the core losses with continuous working of the transformers. The core material shall not be brittle in case of CRGO material.

Core clamping for C.R.G.O. Wound core type transformers shall be as follows:

1. Core clamping shall be with top and bottom U- shaped core clamps made of sheet steel clamped.
2. M.S. core clamps shall be painted with oil-resistant paint.
3. Suitable provision shall be made in the bottom core clamp / bottom plate of the transformer to arrest movement of the active part.
4. Core shall be clamped by M16 diameter MS Tie rods.

ii. The grade of core laminations shall be M4 or better.

iii The successful bidder, shall be required to submit the manufacturer's test report showing the Watt Loss per kg and the thickness of the core lamination, to ascertain the quality of Core materials.
The purchaser reserves the right to get sample of the core material tested at any Government recognized laboratory.

iv The transformer core shall not be saturated for any value of V/f ratio to the extent of 112.5% of the rated value of V/f ratio (i.e. 11000/50 or 22000/50) (due to combined effect of voltage and frequency) up to 12.5% without injurious heating at full load conditions and will not get saturated. The bidder shall furnish necessary design data in support of this situation.

v Flux density:-

The maximum flux density in any part of the core and yoke at rated voltage and frequency shall be such that the flux density with +12.5 % combined voltage and frequency variation with rated voltage and frequency does not exceed 1.9 Tesla. Flux density should not be more than 1.69 Tesla at rated voltage and frequency.

vi. Number of steps of stack core shall be as follows

Sr. No.	Rating (kVA)	Number of steps
1	315	Min. 7 standard steps

2	630	Min. 9 standard steps
3	1000	Min. 9 standard steps
4	1250	Min. 11 standard steps
5	1600	Min. 11 standard steps
6	2000	Min. 13 standard steps
7	2500	Min. 13 standard steps

vii. Core clamping:

a. M.S channel for clamping core shall be 150 mm x 75 mm for 315 kVA to 1250 kV and 200 X 75 mm from 1600 kVA to 2500 kVA transformers.
b. M.S. Core base support channel shall be 100 mm x 50 mm.
c. M16 (min) dia, 2 nos High Tensile Bolts for 315,630, 1000, 1250, 1600, 2000 & 2500 kVA in parallel at each end will be used.
d. The top yoke channels to be reinforced by adequate size of M.S. flat with thickness not less than 8 mm, at equidistance if holes cutting are one for LT lead so as to avoid bending of channel.
e. M S channels are to be painted by heat resistant paint.
f. Core clamping shall be with top and bottom U- shaped core clamps made of sheet steel clamped.
g. Suitable provision shall be made in the bottom core clamp / bottom plate of the transformer to arrest movement of the active part.

viii. **Tie bolts:**

a. 8 nos. of tie rods of M16 dia. high tensile steel in vertical formation.
b. All top and bottom yoke nut bolts, if any, shall be MS and painted with heat and corrosion resistant paint before use.
c. Drawing of the building of core to be approved before start of work.
d. The base channels of the core shall not be cut channel.

6.2 Winding:-

The material for winding shall be Copper.

i Materials:- Double paper covered Copper conductor shall be used for HV and LV winding for 11 kV , 22 kV & 33 kV with respective class.

ii Current Density:- Current density for HV and LV winding should not be more than 2.8 Amp/sq. mm for Copper.

iii L.V. Neutral formation shall be at top.

6.3 Losses :

The total losses (no-load + load losses at 75 deg. Centigrade) at 50% of rated load & total losses at 100% of rated load shall not exceed the maximum total loss values indicated as

below:

(As per Gazette notification issued by Ministry Of Power on Dated 16.12.2016 the respective losses capacity wise revised).

TABLE – 1

Rating	Impedance (Percent)	Maximum total losses in watts up to 11 kV Class (For ratings above 315 kVA)	
		50% Load	100% Load
315	4.50	1025	3100
630	4.50	1860	5300
1000	5.00	2790	7700
1250	5.00	3300	9200
1600	6.25	4200	11800
2000	6.25	5050	15000
2500	6.25	6150	18500

Note:- 1) For Transformer having voltage class above 11 kV and up to and including 22 kV, the permissible total loss values shall not exceed by 5 percent of the maximum total loss values mentioned in above table. (Ref Clause 7.8.1.1.2 of IS 1180: Part- I/2014)

2) For Transformer having voltage class above 22 kV and up to and including 33 kV, the permissible total loss values shall not exceed by7½ percent of the maximum total loss values mentioned in above table. (Ref Clause 7.8.1.1.3 of IS 1180: Part-I/2014)

Tolerances:

No positive tolerance shall be allowed on the maximum losses given in the above table for both 50 % & 100 % loading values. In case the actual loss values exceed the above guaranteed values, the transformers shall be rejected at the risk, cost and responsibility of the supplier. The bidder should guarantee individual No load losses without any positive tolerance.

The values guaranteed in G.T.P. for flux density, no load current at rated voltage, no load current at 100 % & 112.5% of rated voltage and no load loss at rated voltage shall be individually met.

The tolerance on electrical performance excluding losses shall be as given in IS 2026(Part 1).

6.4 Insulation material & clearances:

i Materials - Makes of Electrical grade insulating craft paper, Press Board, Perma wood/ Haldi wood insulation shall be declared in GTP by the bidder. The test reports for all properties as per relevant I.S. amended up to date shall be submitted during inspection.

ii Thickness of locking spacers and thickness of comb teeth between HV coils HV Disc – Minimum 3 mm. (minimum)up to 1000 kVA and 10 mm (minimum) above 1000 kVA Distribution transformers and minimum

clearance for cross over coil shall be 10 mm upto 1000 kVA and 12mm above 1000 kVA.

iii Internal Clearances:

a) Radial clearances of LV coil (bare conductor) to core shall be minimum 3.5 mm for 11kV and minimum 4 mm for 22 kV transformers.

b) Radial clearance between HV & LV winding shall be minimum 11mm for 11kV and minimum 14mm for 22kV.

c) Phase to Phase clearance between HV conductor shall be minimum 10mm for 11kV and minimum 15mm for 22kV

d) Minimum end insulation to Earth shall be 25 mm for 11kV and 40 mm for 22KV.

e) The electrical clearance between the winding and body of the tank (between inside surface of the tank and outside edge of the windings) should not be less than 30mm and 40 mm for 11kV and 22 kV class transformers respectively.

6.5 Impedance Value -

The percentage impedance at 75 º C. for different ratings shall be as per Table-1 at clause no. 6.3.

6.6 Tank

6.6.1 The transformer tank shall be made up of prime quality M.S. sheets of rectangular shape. No other shape will be accepted. The transformer tank shall be of robust construction. All joints of tank and fittings should be oil tight and no bulging shall occur during service. The tank design shall be such that the core and windings can be lifted freely. The tank plates shall be of such strength that the complete transformer when filled with oil may be lifted bodily by means of the lifting lugs provided. Tank inside shall be painted by varnish or oil resistant paint. Top cover plate shall be slightly sloping; approximately 5 to 10 deg. towards HV bushing and edges of cover plate should be bent downwards so as to avoid entry of water through the cover plate gasket. The width of bend plate shall be 25 mm min. The top cover shall have no cut at point of lifting lug. The rectangular tank shall be fabricated by welding at corners.

6.6.2 The transformer tank of corrugation is also acceptable, however shape of tank shall be rectangular only. The corrugation sheets thickness shall be of minimum 1.25 mm. Corrugation panel shall be used for cooling. The transformer shall be capable of giving continuous rated output without exceeding the specified temperature rise. Bidder shall submit the detailed calculation sheet alongwith offer. The safe guard angle frame 50X50X5 mm shall be welded for corrugated side to the tank.

6.6.3 In rectangular shape tanks, horizontal or vertical joints in tank side walls and its bottom or top cover will be not allowed. In addition the cover of the main tank shall be provided with an air release plug to enable air trapped within to be released.

Side wall thickness : 4 mm. (min.)

Top and bottom plate thickness : 6 mm. (min.) from 315 kVA to 1600 kVA

: 8 mm (min) from 2000 kVA & 2500 kVA

6.6.4 For plain tank transformers above 315 kVA ratings shall be capable of withstanding a pressure of 80 kPa and a vacuum of 500 mm of mercury .Limiting values of deflection are specified in clause no. 20.4 of technical specification.

6.6.5 Reinforced by welded angle 50X75X5 MM upto 1250 kVA & 70X75X5 MM upto 2500 kVA on all the outside walls on the edge of tank to form two equal compartments.

6.6.6 When transformer tank without oil is subject to air pressure of 35 KPa above atmospheric pressure for 30 min. Pressure test shall be performed carefully at the time of 1st stage inspection only to confirm the adequacy of reinforcement angle and gauge of the tank and certified by E.E. (IW).

6.6.7 All welding operations to be carried out by MIG process.(Metal Inert Gas Welding)

6.6.8 Lifting lugs: 4 nos. welded heavy duty lifting lugs of MS plate of 12mm thickness upto 1600 kVA & 16 mm thickness upto 2500 kVA , suitably reinforced by vertical supporting flat of same thickness as of lug welded edgewise below the lug on the side wall, up to reinforcing angle and for top cover 8 mm thickness upto 1600 kVA and 10 mm thickness upto 2500 kVA. They shall be so extended that cutting of bend plate is not required.

6.6.9 Pulling lugs: 4 nos. of welded heavy duty pulling lugs of MS plate of 8mm & 10 mm thickness for upto 1600 kVA & 2500 kVA respectively, shall be provided to pull the transformer horizontally.

6.6.10 All bolts / nuts / washers exposed to atmosphere shall be as follows:[Clause no.15.3 of IS 1180 (Part 1):2014]

i] Size 12mm or below—stainless steel.

ii. Above 12mm --- steel with suitable finish like electro galvanized with passivation or hot dip galvanized and for Top cover fixing nut bolts of 1/2" diameter (min) with one plain washer shall be used spaced at 4" apart. 6 mm neoprene bonded cork oil resistance gaskets conforming to type B/C IS 4253 Part-II amended up to date will be placed between tank and cover plate.

6.6.11 The transformer tank shall be of adequate mechanical strength to withstand positive and negative pressures built up inside the tank while the transformer is in operation.

6.6.12 The tank design shall be such that the core and windings can be lifted freely.

6.6.13 Plain tank shall be capable of withstanding a pressure of 80kPa for 30 minutes and a vacuum of 500 mm of mercury for 30 minutes (Type Test). The permanent deflection of flat plates shall not exceed the values given in IS 1180(Part 1): 2014 clause no. 21.5.2.1.

6.6.14 Thermometer pocket with cap must be located at centre of top cover or high side of tank height for true valve of max top oil temperature.

6.6.15 Pressure release device or explosion vent shall be placed at top cover of of the transformer.

6.7 Off Load Taps:

6.7.1 The standard tapping ranges, when taps are provided, shall be as follows: Winding tapped : HV
Number of tap positions 7
Voltage variations : (+) 5 percent to (-) 10 percent in steps of 2.5 percentfor variation of HV Voltage
(As per IS 1180 (Part1):2014 Clause 7.7.1).

6.7.2 For rating 1000 kVA and above ON Load tap changers shall be provided for variation of HV voltage from (+) 5% to (-)15 % in steps of 2.5 %. (As per IS1180 (Part1):2014 Clause 7.7.3)

6.7.3 The standard tapping range and tapping steps arrangement shall not be required up to 630 KVA capacity.

6.7.4 Tapping Method: Off circuit tap-changing arrangement shall be either by means of links or by means of an externally-operated switch with mechanical locking device and a position indicator. Arrangement for pad-locking shall be provided. (As per IS 1180 (Part1):2014 Clause 7.7.2)

6.7.5 Tap changing shall be carried out by means of an externally operated self position switch and when the transformer is in de-energised condition switch position No.1 shall correspond to the maximum plus tapping. Each tap change shall result in variation of 2.5 % in voltage. Provision shall be made for locking the taping switch handle in position. Suitable aluminium anodized plate shall be fixed for tap changing switch to know the position number of tap.

6.7.6 The Transformer shall be capable of being operated without danger on any tapping at the rated kVA with voltage variation ± 10% corresponding to the voltage of that tapping.

7.0 Efficiency:

The efficiency is the ratio of output in KW to the input in KW.

$$\text{Efficiency} = \frac{\text{(Input in KW – Total Losses in KW)}}{\text{Input in KW}}$$

Total loss comprise of No-load loss and Load loss at 75 deg C.

8.0 Heat Dissipation:

a) Heat dissipation by tank walls excluding top and bottom should be 500 W/ sq.m.
b) Heat dissipation by fin type radiator 1.25 mm thick will be worked out on the basis of manufacturers data sheet. The bidder shall submit the calculation sheet with the offer or the offer shall stand rejected.
c. Radiators shall be welded on tank wall in a such a way there should not oil leakage.
d) Radiators shall be provided on both HV and LV bushing side of the transformer tank wall and shall be of fin type. They should be fixed at right angle to the sides

and not diagonally. The size of the radiator shall be such that it covers at least 50% of the bottom yoke, full core and complete top yoke.

e) The transformer shall be capable of giving continuous rated output without exceeding the specified temperature rise. Bidder shall submit the detailed calculation sheet along with offer.

f) Heat dissipation by Corrugation panel 1.25 mm thick will be worked out on the basis of manufacturer's data sheet. The bidder shall submit the calculation sheet with the offer or the offer shall stand rejected

9.0 Total Minimum Oil Volume :

The firm should maintain the minimum oil volume in all supplied transformers as mentioned below or oil up to mark indicator level whichever is more.

Sr.No.	KVA rating	Oil in liters (exclusive of oil absorbed in core & coil assembly)		
		Voltage rating 11/0.433 kV	Voltage rating 22/0.433 kV	Voltage rating 33/0.433 kV
1	315	500	550	580
2	630	750	800	840
3	1000	850	900	950
4	1250	1000	1050	1100
5	1600	1300	1350	1400
6	2000	1550	1600	1650
7	2500	1900	1950	2000

10.0 Conservator:

a) The total volume of conservator shall be such as to contain 10% of total quantity of oil. Normally 3% quantity of the total oil will be contained in the conservator. Dimension of the conservator shall be indicated on the General Arrangement Drawing. The capacity of the conservator tank shall be designed keeping in view the total quantity of oil and its contraction and expansion due to the temperature variations.

b) Oil level indicator shall be provided on the side which will be with fully covered detachable flange with single gasket and tightened with MS nut-bolt. Level indication by colour shall not be accepted.

c) The inside diameter of the pipe connecting the conservator to the main tank shall be within 20 to 32 mm and it should be project into the conservator in such way that its

end is approximately 20 mm above the total of the conservator so as to create a sump for collection of impurities. The minimum oil level (corresponding to (-) 5 deg.) should be above the sump level & filling hole (32mm dia) with cover.

d) There shall be minimum -5deg, normal 30deg and maximum 90deg marking on the oil gauge indicator of the conservator.

e) Buchholz Relay:- Above 1 MVA transformer as per Clause 20.1 V of IS 1180 is necessary.

11.0 Breather:

a) The material used for breather shall be only of Poly propylene

b) The dehydrating Silica Gel breather shall be provided. The volume of breather shall be suitable for 1kg silica gel confirming to IS 3401 up to 1MVA and 2 kg for more than 1 MVA.

Makes of the breather shall be subject to purchaser's approval. The make and design of breather shall be subject to approval of C.E. (T&QC).

12.0 Bushing Terminals:

a. The rating of Brass Rod for H.V Bushing & Copper Rods for L.V Bushing shall be as per relevant IS for different capacity of Transformer. [Following (b) and (c) are indicative and shall be confirmed with relevant IS)]

b. HV Bushing terminal shall be 12 mm. diameter Brass rods with Bimetallic terminal connectors provided with necessary nuts, check-nuts and plain thick tinned washers.

c. LV Bushing terminal shall be Tinned Copper Rods with M20 diameter for 315&630 kVA, M30 diameter for 1000 kVA & 1250kVA, M42 diameter upto 1600 kVA and M48 diameter above 1600 kVA distribution transformers for LT extension with Bimetallic terminal connectors suitable to cable box with suitable necessary nuts, check-nuts and plain thick tinned washers.

13.0. Bushings & Connections:

13.1 For Indoor type transformers HV and LV Bushings of **Porcelain/ Epoxy** of appropriate voltage and current ratings **shall be mounted on opposite side of transformer tank in HV and LV cable box** The high voltage bushings (3nos.) shall be provided with R-Y-B colour coding marking & shall conform to IS 2099. The low voltage bushings shall conform to IS 7421. Alternatively, the low voltage cable box shall be made suitable for adoption of **single core XLPE** cables. The dimensions shall conform to IS 1180(Part 1): 2014 clause no. 10.1.5.

13.2 The LV bushings shall be made in two parts. The outer bushing shall be of porcelain The dimensions of the outer bushing shall confirm to the relevant Part/Section of IS 3347 depending on the voltage class. The internal bushing shall be of either porcelain or tough insulating material, like epoxy and shall have embedded stem Metal portion of the internal HV and LV bushing inside the tank shall remain dipped in oil in all operating conditions

13.3 The epoxy type HV and LV Bushings with suitable terminals shall be used as per relevant standards.

13.4 Gaskets shall be made of Nitrile rubber or synthetic rubberized cork resistant to hot transformer oil shall be provided to HV and LV Bushing.

13.5 For 11 kV class 12 kV bushing, for 22 kV class 24 kV & 33 kV class 36 kV bushing shall be used and for 433 volts 1.0 kV bushing shall be used. Bushings of the same

voltage class shall be interchangeable. Bushings with plain shed shall be as per relevant IS:3347 amended up to date. HV bushings & LV bushings shall be mounted on the sides of the transformer tank.

13.6 Supporting clamps for LT cable should be provided to avoid the weight of cable on the Bushing.

13.7 The minimum creepage distance for both HV & LV Bushings shall not be less than 25 mm per kV.

13.8 Rectangular shaped, M.S. Sheet thickness 2 mm , weather , vermin and dustproof HV/LV Cable box shall be fitted on opposite sides of the tank of transformer. (Indoor application) : as per details given below.

HV 11kV:- Air filled cable box suitable for 3 core XLPE aluminum cables up to **300 sq.mm**. & glands suitable for above cables

HV 22kV:- Air filled cable box suitable for 3 core XLPE aluminum cables up to **300 sq.mm**. & glands suitable for above cables

HV 33kV:- Air filled cable box suitable for 3 core XLPE aluminum cables up to **300 sq.mm**. & glands suitable for above cables

LV 0.433 kV:- Air filled Cable Box suitable to **single Core 300 sq.mm. XLPE aluminum cable i.e 2 cable run/Phase & 1 cable run for neutral for 315 kVA distribution transformer**

Air filled Cable Box suitable to **single Core 400 sq.mm. XLPE Aluminum cable i.e 3 cable run/Phase & 1 cable run for neutral for 630 kVA dist transformer**

However for 315 kVA & 630 kVA dist transformer,the LV Bushings shall be provided with suitable Aluminium Busbar Extensions to take off circuits with necessary nuts and bolts with resin cast support insulators.Separate Bushing for Earthing connection shall be provided to cable box with suitable wire mesh . The aluminium non magnetic gland plates shall be provided

13.09. Minimum external clearances for Indoor Bushing terminals in HV and LV Cable Box (as per IS 1180: part I 2014 clause no. 11.1 table no 11.)

		11 kV	22 kV
HV	Ph to Ph	130 mm	240 mm
	Ph to E	80 mm	140 mm
LV	Ph-to-Ph	25 mm.	25 mm
	Ph to E	20 mm.	20 mm

14.0 Internal connections:

14.1 H.V. Winding :

i. Leads should be taken through Kraft paper / Creep paper / Bakelite tubes.

ii. Inter coil spacers between HV sections by dovetailed paper block min.8mm to avoid displacement of coil during transportation.

iii. The copper strip/foil used for core earthing at two locations shall be tinned copper.

iv .In case of H.V. winding all jumpers from winding to bushing shall have cross section larger than winding conductor.

v. Inter coil connection shall be by crimping and brazing.

vi.In case of Copper Winding Delta joints shall be with crimping and Brazing only.

vii. Lead from delta joint shall be connected to bushing rod by brazing only.

14.2 L.V. Winding :

i. For Copper windings crimping & silver brazing alloy shall be used.

ii. L.T. Star point shall be formed of Copper flat of sufficient length. Lead from winding shall be connected to the flat by crimping and brazing.

iii. Firm connections of L.T. winding to bushing shall be made of adequate size of `L' shaped flat. Connection of L.T. Coil lead to `L' shape flat shall be by crimping and brazing. Alternatively `L' shape lug of adequate capacity effectively crimped shall be acceptable.

iv. `L' shape flat/lug shall be clamped to L.V. Bushing metal part by using nut, lock-nut and washers.

15.0 Tank base channel / Mounting Arrangement:

The under-base of the transformer shall be provided as per clause 14.2 of IS 1180(Part1):2014

16.0 Terminal Marking Plates and Rating Plates :

a) All Transformer HV terminals shall be provided terminal marking plated to Tank. Each terminal, including with neutral, shall be distinctly marked on both primary & secondary in accordance with the connection diagram fixed upon the transformer which shall conformed to latest 1S-2026 (part- IV).

b) Each Transformer shall be provided with rating plate having marking as per IS 1180 (part-l):2014 clause no 13 clearly indicating max. total losses at 50% rated load in watts and maximum total losses at 100% rated load in watts

c) Rating & terminal marking plates shall be combined into one plate and shall be mark with standard mark Govern by the provisions of the BIS act 1986.

d) Terminals shall be provided with terminal marking plates. The transformer shall be provided with riveted rating plate of minimum 18 SWG aluminum anodized

material sheet in a visible position. The entries of the rating plate shall be in indelibly marked (i.e. by etching, engraving or stamping).

e) Marking as `M.S.E.D.C.L'S and `Sr. No.' of transformer shall be engraved on transformer main tank below L.T. bushings.

f) The name of the company, order No., capacity, month and year of manufacturing shall be engraved on separate plate which shall be firmly welded to main tank and shall form integral part of the tank.

g) The distribution transformer may also be marked with the Standard Mark. The use of Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules Regulations made thereunder.

Besides other particulars, following details shall also be given on the name plate.

- ISI Mark.
- BEE Energy Efficiency Star label
- BIS Energy Efficiency level.
- Order No. – Month & year.
- Sr. No. of transformer.
- Date of manufacturing – Month & year.
- Date of expiry of guarantee period – month & year.
- Maximum guaranteed 50% load loss & 100 % load loss figures.
- Name and full address of the manufacturer.
- Capacity.
- Rating.

(All details on the rating and diagram plate shall be indeligibly marked i.e. by engraving or stamping or etching).

17.1 Fittings:

The following standard fittings shall be provided.

1	Rating and diagram plate	1 no.
2	Earthing terminals with lugs.	2 nos.
3	Lifting lugs	6 nos. (4 nos for tank and 2 nos for top plate of the transformer)
4	Oil filling hole with cap (on conservator)	1 no
5	Drain valve – 32mm for all T/Fs (It shall be covered with metallic box spot welded to tank) IS554	1 no
6	Conservator with drain plug.	1 no

7	The pipe connecting the conservator to the main tank.	1 no
8	Thermometer pocket with cap	1 no
9	Air release device.	1 no
10	Explosion vent with diaphragm	1 no
11	Silica gel breather 1kg /2 kg	1 no
12	Platform mounting channel (with hole suitable for axle of rollers)	2 nos
13	Oil level gauge indicating 3 positions of oil marked as below :	1no
	Minimum (-) 5 deg.C.	
	Normal 30 deg.C	
	Maximum 98 deg.C.	
14	HT & LT bushing and terminal connectors	3 nos. of HT bushing and 4 nos. of LT bushing shall be provided with bimetallic T –type terminal connector & necessary nuts, check-nuts and plain thick tinned washer of adequate capacity shall be connected to L.V & HV side
15	Radiators	As per Cl. No. 8 of tech spec.
16	Pulling lugs	4 nos
17	Rollers	4 nos
18	Five year guarantee plate	1 no.
19	Filter valve (32 mm dia)	1 no.
20	Anti-theft stainless steel fastners with breakaway nut at top cover	4 nos.
21	Jacking pad for transformer above 1600KVA.	1 Set
22	Magnetic oil level guage with low oil level alarm contact for above 1600KVA transformer.	1 no.

Any other fitting necessary for satisfactory performance.

17.2 Fasterners.

- All bolts, studs, screw threads, pipe threads, bolt heads and nuts shall comply with the appropriate Indian standards for metric threads or the technical equivalent.
- Bolts or studs shall not be less than 6 mm in diameter except when used for small wiring terminals.

- All nuts and pins shall be adequately locked.
- Wherever possible bolts shall be fitted in such a manner that in the event of failure of locking resulting in the nuts working loose and falling off, the bolt will remain in position.
- All ferrous bolts, nuts and washers placed in INDOOR positions shall be treated to prevent corrosion by hot dip galvanizing except high tensile steel bolts and spring washers, which shall be Electro, galvanized. Appropriate precautions shall be taken to prevent electrolytic action between dissimilar materials.
- Each bolt or stud shall project at least one thread but not more than three threads through the nut, except when otherwise approved for terminal board studs or relay stems. If bolts are provided at inaccessible places for ordinary spanners, special spanners shall be provided.
- The length of screwed portion of the bolts shall be such that no screw thread may form part of a sheer plane between members.
- Taper washers may be provided where necessary. Protective washers of suitable material shall be provided front and back of the securing screws.
- LT side should be of Pad type terminal.

18.0 Lightening Arrestors (only for out door type transformers)

The Lightening Arrestors (Disconnector type) of high surge capacity of 9 kV(Vrms), 5 kA(8/20 micro wave shape) for 11 kV class transformers and 18 kV(Vrms), 5 kA (8/20 micro wave shape) for 22 kV class transformers & 27 kV, 10 kA (8/20 micro wave shape) for 33 kV , conforming to IS: 3070/1993 shall be mounted on the HV bushings of transformer, clamped securely to the tank, to protect the transformer and associated line equipment from the occasional high voltage surges resulting from lighting or switching operations. The earthing terminal of the lightening arresters shall be grounded separately.

Random sample of LA shall be destructively tested by breaking the LA to confirm availability of inside component.

19.0 Transformer Oil

Transformer oil to be used in all the Distribution transformers shall comply with the requirements of latest IS 335/2018 amended up to date thereof.

The **Unused Mineral Insulating Oils (type II)**are obtained by distillation and refining of crude petroleum as required to meet the properties specified below.

Sr. No.	Property	Test Method	Permissible Values
A. Function			
1.	Viscosity at 40°C	IS : 1448 (Part 25)	15 mm^2/s, Max.
2.	Viscosity at 0°C	IS : 1448 (Part 25)	1800 mm^2/s, Max.
3.	Pour – Point	IS : 1448 (Part 10/Sec2)	- 10°C, Max. , to be based on LCSET
4.	Water content	IEC 60814	30 mg/kg , Max. / 40 mg/kg, Max.
5.	Breakdown voltage	IS : 6792	30kV / 70kV, Min.
6.	Density at 20°C	IS : 1448 (Part 16)	0.895 g / ml. Max.
7.	DDF at 90°C	IS : 16086	0.005, Max.

8.	Particle content	IS : 13236	No general requirement.
B. Refining / stability			
9.	Appearance	----	Clear, free from sediment and suspended matter.
10.	Acidity	IEC 62021-1	0.01 mg.KOH / g, Max.
11.	Interfacial tension	ASTM D 971	No general requirement.
12.	Total sulphur content	ISO 14596 or ASTM D 4294	No general requirement.
13.	Corrosive sulphur	DIN 51353	Not corrosive.
14.	Potentially corrosive sulphur	IS : 16310	Not corrosive.
15.	DBDS	IS : 16497 (Part 1)	Not detectable (<5mg/kg)
16.	Inhibitors according to IS : 13631 / IEC : 60666	IS : 13631	(U) Uninhibited oil: not detectable (<0.01%)
			(T) Trace inhibited oil : <0.08%
			(I) Inhibited oils : 0.08%-0.40%
17.	Metal passivator additives according to IS : 13631 / IEC : 60666	IS : 13631	Not detectable (<5mg/kg)
18.	Other additives	---	See 7
19.	2-Furfural and related compounds content	IS : 15668	Not detectable (<5mg/kg) For each individual compound.
C. Performance			
20.	Oxidation stability	IS : 15668(Method C) (U) Uninhibited oil : 164h (T) Trace inhibited oil :332h (I) Inhibited oil :500h	For oils with other antioxidant additives and metal passivator.
a)	• Total acidity,9	1.9.4 of IS : 12422	1.2mg KOH/g, Max.
b)	• Sludge,9	1.9.1 of IS : 12422	0.8%, Max.
c)	• DDF at 90°C. 9	1.9.6 of IS : 12422	0.500, Max
21.	Gassing tendency	IEC : 60628, Method A	No general requirement.
22.	ECT	--	No general requirement.
D. Health, Safety and Environment (HSE)			
23.	Flash point	IS : 1448 (Part 21)	135°C, Min.
24.	PCA content	IP : 346	3%, Max.
25.	PCB content	IS : 16082	Not detectable (<2mg/kg)

Refer Note to table no. 2 of IS: 335; 2018

20.0 Test and Inspection:- All routine, type and special tests as described in Clause 21.2 to 21.4 of IS 1180 (Part 1):2014 shall be performed as per relevant parts of IS 2026. Pressure and oil leakage test shall be conducted as per Clause 21.5 of IS 1180 (Part1):2014.

20.1 Routine Tests (to be conducted on all units):- The following shall constitute the routine tests:

a) Measurement of winding resistance [IS 2026 (Part 1)].

b) Measurement of voltage ratio and check of phase displacement [IS 2026 (Part 1)].
c) Measurement of short circuit impedance (principal tapping, when applicable) and load loss at 50 percent and 100 percent load [IS 2026 (Part 1)].
d) Measurement of no load loss and current [IS 2026 (Part 1)].
e) Measurement of insulation resistance [IS 2026 (Part 1)].
f) Induced over-voltage withstand test [IS 2026 (Part 3)].
g) Separate-source voltage withstand test [IS 2026 (Part 3)].
h) Pressure test
i) Oil leakage test

20.2 Type Tests (to be conducted on one unit):- The following shall constitute the type tests:

a) Lightening impulse test [IS 2026 (Part 3)].
b) Temperature-rise test [IS 2026 (Part 2)].
Note – Maximum measured total loss (No load at rated excitation + load loss at maximum current tap converted to 75 Deg.Celcius reference temperature) at 100 percent loading shall be supplied during temperature rise test.
c) Short-circuit withstand test [IS 2026 (Part 5)]. (above 200 kVA)
d) Pressure test.

20.3 Special Tests (to be conducted on one unit):- The following shall constitute the special tests which shall be carried out by mutual agreement between the user and the supplier.

a) Determination of sound levels [IS 2026 (Part 10)].
b) Short-circuit withstand test [IS 2026 (Part 5)]. (above 200 kVA).
NOTE :- Routine tests before and after short circuit test shall be conducted as per IS 2026 (Part 1)
c) No load current 112.5 percent voltage [refer clause 7.9.2 of IS 1180(Part 1): 2014].

20.4 Pressure and Oil leakage Test :-

20.4.1 Pressure Test (Type Test) : For non-sealed and sealed type transformers, the transformer tank subjected to air pressure of 80 kPa for 30 min and vacuum of 500 mm of mercury for 30 min. The permanent deflection of flat plate, after pressure/vacuum has been released, shall not exceed the values given below.

Length of Plate	Deflection
Up to 750 mm	5.0 mm
751 mm to 1250 mm	6.5 mm
1251 to 1750 mm	8.0 mm
Above 1751 mm	9.0 mm

20.4.2. Pressure Test (Routine Test) :

a) Plain tanks : The transformer tank with welded / bolted cover shall be tested at a pressure of 35 kPa above atmospheric pressure maintained inside the tank for 10 min. There should be no leakage at any point .

b) Corrugated tanks : The corrugated transformer tank shall be tested for air pressure of 15 kPa above atmospheric pressure maintained inside the tank for 10 min. There should be no leakage at any point .

20.4.3 Oil leakage Test (routine Test) : The assembled transformer for non-sealed and sealed type with all fittings including bushing in position shall be tested at a pressure equivalent to twice the normal head measured at the base of the tank for 8 h. There should be no leakage at any point. Tank with corrugations shall be tested for oil leakage test a pressure of 15 kPa measured at the top of the tank for 6 h. There should be no leakage at any point.

All the routine tests shall be conducted in the suppliers' laboratory at their own cost.

i) Heat run test shall be arranged free of cost on the unit selected from the 1st lot by Executive Engineer/Authorized Representative.

ii) The calculations to confirm the thermal ability IS or equivalent International Standard shall be submitted to Executive Engineer (IW).

21.0 Challenge Testing:

The manufacturer can also request challenge testing for any test based on specification and losses. The challenger would request for testing with testing fees. The challenge test fees are proposed at least three times the cost of testing. This is likely to deter unnecessary challenges. The challenger would have the opportunity to select the sample from the store and any such challenge should be made with in the guarantee period. The party challenged, challenger and the utility could witness the challenge testing.

The challenge testing would cover following tests:

1. Measurement of magnetizing current.
2. No load losses test.
3. Load losses test (at 50 % loading or as per routine test).
4. Temperature rise test.

The challenge test could be conducted at NABL Laboratory, like ERDA and CPRI. If the values are within the limits the products gets confirmed else not confirmed. No positive tolerances in losses is permitted. If the product is not confirmed the manufacturer would pay the challenge fee and challenger would get the fee refunded.

However as a redressal system the challenger would be allow to ask for fresh testing of two or more samples from the store and the same be tested in NABL Laboratory in presence of party challenge, challenger and the utility.

If any one of the above sample does not confirm the test, then the product is said to have failed the test. In such cases the manufacturer will be declared as unsuccessful manufacturer for the said product with wide publicity and would not allow to complete in tenders of the MSEDCL for the period of three years and heavy penalty would be imposed.

22.0 Type Tests

22.1 The Type Tests as per Clause 20.2 above shall be successfully carried out at laboratories accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) in accordance with IS 1180(Part 1):2014 as amended from time to time and technical specifications, within the last 5 (five) years prior to the date of offer.

22.2 The type test reports should be submitted and got approved from the Chief Engineer (T & QC) before commencement of supply.

22.3 In case of any of the following, the offer may be considered for evaluation only.

i) If above tests are carried out beyond 5 years

ii) Impulse Voltage Withstand test ,Dynamic Short Circuit test, Temperature rise Test & Pressure Test carried out not from NABL approved Laboratory.

iii) If there is any change in the design/ type of old type tested transformers to be offered against this specification.

Note: *However, In that case successful bidders have to carry out the type tests at the laboratories accredited by NABL before commencement of supply at their own expense on the sample drawn by the purchaser from the lot offered for first Stage Inspection.*

22.4 In respect of the successful bidder, the purchaser reserves the right to demand repetition of some or all the type tests in presence of the purchaser‘s representative. In case the unit fails in the type tests, the complete supply shall be rejected. The bidders are therefore requested to quote unit rates for carrying out each type test, which however, will not be considered for evaluation of the offer.

23.0 Drawings & Calculation sheet:-

23.1 A set of following drawings with all dimensions shall be submitted by the Bidder along with the offer:

i. General Dimensional drawing.

ii. Rating & Diagram Plate Drawing.

iii. Internal Construction Drawing

iv. Technical Detail drawing.

v. Core Assembly drawing

vi. HV& LV Bushings Assembly drawing

ix. Creepage distances distance drawing of HV& LV Bushing
x. Silica gel Breather drawing.
vii. Calculation sheet for flux density

xi. Heat dissipation

xii. Oil absorption

xiii. Thermal time constant.

23.2 The drawings shall be of A-3 (420 x 297 mm) size only. The bidder should also supply along with his offer the pamphlets/literatures etc. for fittings / accessories.

23.3 The bidder should not change design once offered as per A/T, Approved drawings and Type Test Reports.

23.4 The successful Bidders shall submit complete set of Drawings (as listed in Cl.No.23.1) of transformer in triplicate indicating dimensions to CE (T & QC) for approval and get approved it before offering 1st stage inspection.

24.0 Rejection :-

24.1 Apart from rejection due to failure of the transformer to meet the specified test requirements the transformer shall be liable for rejection on any one of the following reasons.

i. Maximum load losses at 50 % load & 100% Load loss exceeds the specified values mentioned in Cl. No.6.3 above.

ii. Impedance voltage value exceeds the Guaranteed value plus tolerances as mentioned at Cl..No.6.5 above.

iii Type test are not carried out as per clause no. 22.0 of the specification.

iv. Drawings are not submitted as per clause no. 23.0 of the specification.

v. GTP not submitted as per clause no. 26.0 of the specification.

vi Heat dissipation calculation sheet are not submitted as per clause no.8.0 of the specification.

25.0 Cleaning and Painting.

i. The external surfaces shall be painted one coat of epoxy primer followed by two coats of polyurethane (finish coat) for (outside) and Inside of the tank shall be painted with hot oil resistant paint/varnish with one coat with dry film thickness as mentioned in Table 12, clause 15.5 of IS 1180(Part 1):2014.
ii. The certificate shall be produce by the manufacturer if seven tank facilities are availed from the other vendor about availability of the adequate size of tank for treatment.
iii. The test of measurement of paint thickness shall be carried out cross hatch test, chemical test and other as per IS 13871:1993

iv. The surface of the tank shall be properly pre-treated / phosphated in a seven tank process before painting and the shade of paint shall be **Aircraft Blue** colour (shade No. 108 as per IS 5) with minimum 40 micron thickness.

v. The seven tank process facility shall be enhance to ensure proper quality for INDOOR application.

vi. The month and year of supply shall be painted in red bold **Marathi** lettering at two places, one on conservator and other at sum conspicuous place on the transformer which shall be clearly visible from the ground.

26.0 Guaranteed & Technical Particulars:

The bidder should fill up all the details in GTP parameter list, the statement such as –as per drawings enclosed‖, –as per MSEDCL's requirement‖ –as per IS‖ etc. shall be considered as details are not furnished and such offers shall liable for rejection.

27.0 Testing facility

The bidder should have adequate testing facility for all routine and acceptance tests and also arrangement for measurement of losses, resistance, etc. details of which will be enumerated in the tender.

28.0 Submission Routine Test Certificate

a. The successful bidder shall submit the routine test certificate along with documentary evidence for having paid the Excise Duty for the following raw materials viz. Oil, Aluminum, copper for conductors, insulating materials, core materials, bushings at the time of routine testing of the fully assembled transformer

b. Instruction and operation Manual

The successful bidder shall be required to submit 5 copies of instruction and Operation manual for each lot of 100 Transformers (or part thereof) supplied. This instruction manual should give complete details about the pre-commissioning tests/checks and the details of preventive maintenance etc.

29.0 Stage Inspection :-

29.1 Supplier shall give 15 days' advance intimation to the Chief Engineer (MMC) and S.E. (MM) to organize stage inspection in which assembly of core, windings and other core materials etc. would be inspected. In respect of raw materials such as core stamping, winding conductor, oil etc. successful bidder shall use these materials manufactured/supplied by the standard manufacturers and furnish the manufacturer's test certificates, as well as, proof of purchase from those manufacturers documentary evidence for having paid the excise duty for the information of the department.

29.2 Chief Engineer (MM Cell) will depute representatives from testing and inspection wing at the time of Stage inspection.

29.3 10 % of the transformers from the offered lot will be tested for acceptance tests at factory, in the presence of purchaser's representative before dispatch.

29.4 The inspection may be carried out by the purchaser at any stage of manufacture. The successful bidder shall grant free access to the purchaser's representatives at a reasonable time when the work is in progress. Inspection and acceptance of any

equipment under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications and shall not prevent subsequent rejection if the equipment is found to be defective.

29.5 The purchaser may at its option, open a transformer supplied to the Stores, in presence of supplier at site or at Stores. If any of the technical particulars are seen to be in variance than the guaranteed technical particulars, the whole lot of transformer will be rejected without any liability on purchaser.

29.6 In addition to the above, the purchaser may pick up any transformer and decide to get it type tested from any laboratory accredited by NABL at purchaser's cost. The Bidder will have to organize packing of the transformer at company's Stores for which they will be paid necessary charges. If the transformer fails to meet the requirement of type tests, the quantity of transformers ordered on them will be forthwith rejected and the purchaser may purchase these transformers at the risk and cost of the supplier.

30.0 Testing of all Distribution Transformers for losses at 50% load and 100% load:

After inspection of new transformers at factory for acceptance of the lot, all distribution transformers from the lot will be tested for 50% load and 100% load at all stores. Tenderer has liberty to be present at the time of testing.

31.0 Random Sample Testing (RST)

The tenderer should intimate to C.E. (MM Cell), M.S.E.D.C.L of completion of dispatches of whole lot of Distribution Transformers to stores against this tender.
C.E. (MM Cell), M.S.E.D.C.L for will select the stores for Random Sample Testing (RST) and depute E.E. (Testing) to carry out RST of the lot.

E.E. (Testing) will select a transformer from the lot of transformers already tested for 50 % load and 100 % load.15 days advance intimation will be given to tenderer for joint inspection. The date of RST will not be altered to the convenience or request of supplier. If supplier‘s representative fails to attend on the date fixed for RST, the RST will be carried out in his absence and results of RST will be binding on supplier. In case the selected transformer fails in any of the tests, complete lot of transformers will be rejected.

32.0 Inspection & Testing of Transformer Oil:

The tenderer shall make arrangements for testing of transformer oil to be used in the transformers and testing will be done in presence of purchaser's representative.
To ascertain the quality of transformer oil, original manufacturer's test report should be furnished to EE (Testing) at the time of factory inspection for acceptance of the lot.

33.0 Quality Assurance

33.1 The bidder shall invariably furnish following information along with the offer failing to which the offer will be rejected.

33.2 Certificates of following materials.

i. Copper conductor
ii. Transformer oil
iii. Core

iv. Insulating paper.
v. Porcelain/Epoxy Bushings
vi Steel Plate used for Tank

33.3 Names of the supplier for the raw material, list of standard accordingly to which the raw materials are tested, list of test normally carried out on raw materials in presence of bidder‘s representatives, copies of type test certificates to be furnished.

33.4 Information and copies of test certificate as in (33.3) above respect of bought out accessories including terminal connectors.

33.5 List of manufacturing facilities available, in this list the bidder shall specifically mention whether lapping machine, vacuum drying plant, air conditioned dust free room with positive air pressure for provision of insulation and winding etc are available with him.

33.6 Level of automation achieved and list of areas where manual processing still exists.

33.7 List of areas in manufacturing process where stage inspection are normally carried out for quality control and details of such tests and inspections.

33.8 Special features provided in the equipments to make it maintenance free

33.9 List of testing equipment available with the bidder for final testing of transformers and test plant limitation, if any, vis-à-vis the type, special acceptance and routine tests specified in the relevant standards and the present specification.

33.10 The successful bidder shall submit the Routine Test Certificate along with documentary evidence having paid for the excise duty for the following raw materials viz Oil, Copper for conductors, insulating materials, Core materials, Bushing at the time of routine Testing of the fully assembled transformer.

34.0 Qualifying Requirement: As per Tender

35.0 Final Inspection

10 % of the transformers offered will be tested for all tests without opening the transformer. Heat Run Test will have to be carried out on the transformer having maximum no load and full load losses taken together. Chief Engineer (MM Cell) will depute his representatives from testing and inspection wing at the time of final inspection.

35.1 Leakage test on sample transformer shall be carried out during final inspection as per relevant IS.

36.0 Performance Guarantee:

All transformers supplied against this specification shall be guaranteed for a period of 66 months from the date of receipt at the consignee‘s Stores Center or 60 months from the date of commissioning, whichever is earlier. However, any engineering error, omission, wrong provisions, etc. which do not have any effect on the time period, shall be attended to as and when observed/ pointed out without any price implication.

37.0 COST DATA SHEET:-

The bidders shall submit the cost data sheets indicating the break up prices and quantity of each raw material and components along with the unit rates required for manufacture the offered transformers along with the offer. The cost data sheet

format is enclosed herewith.. If the rates quoted are not justified with the cost data sheets, the offer shall not be considered for evaluation and placement of the order.

The cost data sheets shall be scrutinized by MM Cell section.

FORMAT FOR COST DATA ITEM ------ KVA , ------- KV DISTRIBUTION TRANSFORMER					
Sr. No.	PARTICULARS	UNIT	UNIT RATES Rs.	QTY	AMT (Rs.)
1	CORE (M4 or better)	KG			
2	ALUMINIUM/COPPER WITH DPC FOR HV WINDING	KG			
3	ALUMINIUM/COPPER WITH DPC FOR LV WINDING				
3	INSULATION PAPER	Meter			
4	OIL	LTRS			
5	TANK	NO			
6	CHANNELS	KG			
7	INSULATORS/BUSHINGS	KG			
8.	OTHERS	LUMP SUM			
				TOTAL	
	WASTAGE @ %				

38.0 Schedules

38.1 The bidder shall fill in the following schedules which form part of the tender specification and offer. If the schedules are not submitted duly filled in with the offer, the offer shall be rejected.

Schedule `A' -Guaranteed Technical Particulars.

38.2 The discrepancies between the specification and the catalogs, Literatures and indicative drawings which are subject to change, submitted as part of the offer, shall not be considered and representation in this regard will not be entertained.

Schedule `A'

GUARANTEED TECHNICAL PARTICULARS

SCHEDULE – A Guaranteed technical particular

630 KVA, 22/0.433 KV ONAN Cu. Wound I/D Distribution Transformer Star 1 (Level-2)			
Sr. No	**GTP Parameters**	**REMARK**	To be offered by Bidder
1	Name of Manufacturer		Text
2	Reference Standards	IS-1180 Part-1 (2014)	Text
3	Rating of Transformer in KVA	630 KVA	Numerical
4	Primary voltage in kV	22 KV	Numerical
5	Secondary voltage in kV	0.433 KV	Numerical
6	Transformer shall be Oil Natural Air Natural (ONAN) type Yes/No	ONAN	Text
7	Transformer shall be suitable for Indoor application. (Yes/No)	INDOOR	Text
9	Highest System Voltage in kV	24 KV	Numerical
10	Frequency in HZ.	50 Hz	Numerical
11	Transformer shall be suitable for solid neutral earthing (Yes/No)	Yes	Boolean
12	Service condition shall be applicable as per Technical specification	Yes	Boolean
13	Transformer Colour as per IS:5	Air craft Blue, IS-5,Shade-108	Text
14	Type of connection for H.V. Winding (Delta) (Yes/No).	Delta	Text
15	Type of connection for L.V. Winding (Star) (Yes/No)	Star	Text
16	Vector Group Dyn-11 (Yes/No)	Dyn11	Text
17	Name Plate details are as per the requirement specified in tender (Yes/No)	Yes	Boolean
18	Thickness of Name plate (in SWG)	18 SWG	Numerical
19	Maximum temperature rise of Windings over an Ambient temp. of 50°C in °C	45°C	Numerical
20	Maximum temperature rise of oil over an Ambient temp. of 50°C in °C	40°C	Numerical
21	Approximate overall length of the Transformer in mm	Mfg to specify	Numerical
22	Approximate overall breadth of the Transformer in mm	Mfg to specify	Numerical

23	Approximate overall height of the Transformer in mm	Mfg to specify	Numerical
24	Approximate length of the Transformer tank in mm	Mfg to specify	Numerical
25	Approximate breadth of the Transformer tank in mm	Mfg to specify	Numerical
26	Approximate height of the Transformer tank in mm	Mfg to specify	Numerical
27	Thickness of the side of transformer tank plates in mm	4 mm	Numerical
28	Thickness of the bottom of transformer tank plates in mm	6 mm	Numerical
29	Thickness of the top of transformer tank plates in mm	6 mm	Numerical
30	Size of reinforced welded angle to the Transformer Tank in mm.	50 x 75 x 5 mm	Text
31	Degree of slope to the top plate of Transformer.	5° to 10° towards HV	Text
32	Shape of transformer Tank	Rectangular	Text
33	Type of Tank (Corrugated/ Conventional)	Corrugated or Conventional. Mfg to specify	Text
34	In case of corrugated tank, thickness of corrugated sheet (in mm)	NA	
35	Size of Transformer Base Channel in mm.	125 x 65 mm	Text
36	Size (diameter & width) and No. of Rollers provided to the Transformer	100x 40 mm, 4 Nos	Text
37	Conservator tank to the transformer with oil level indicator (showing three levels) and drain plug is provided (Yes/ No)	Yes	Boolean
38	Dimensions of conservator Tank (LxD) in mm	Mfg to be specify	Text
39	Drain Valve size (32 mm) provided to the transformer tank (Yes/No)	32 mm	Numerical
40	Size of Oil filling hole with cap in mm. (on conservator) is provided.	32 mm	Numerical
42	Size of filter valve in mm. is provided.	32 mm	Numerical
43	No. & Size in mm of Lifting lugs provided to transformer	4 Nos, 12 mm	Text
44	No. & Size in mm of pulling lugs provided to transformer	4 Nos, 8 mm	Text
45	No. & Size in mm of transformer top cover lifting lugs provided to transformer	2 Nos, 8 mm	Text
46	No. of Earthing terminals with suitable size in (SWG)	2 Nos	Numerical

47	Thermometer pocket is provided (Yes/No)	Yes	Boolean
48	Quantity of Silica-Gel filled in breather (in gm) & make of breather	1000gm, ,Yogya Enterprises/ Press 'n' Forge or equivalent other makes shall specified by mfg.	Text
49	Explosion vent with diaphragm. (Yes/No)	Yes	Boolean
50	No of radiators both on HV & LV side provided and location with arrangement & size.	4 Nos (2 on HV Side & 2 on LV Side), 900 x 300 mm	Text
51	Thickness of the radiator of transformer in mm. and fin size	1.25 mm Thk.	Text
52	No of radiator fins.	Mfg to specify	Numerical
53	(A) Radiating surface of radiators in Sq. Mtrs.	Mfg to specify	Numerical
54	(B) Radiating surface of Tank only in Sq. Mtrs.	Mfg to specify	Numerical
55	Total radiating surface of transformer tank in Sq. mtrs.	Mfg to specify	Numerical
57	Weight of Core in kgs	Mfg to specify	Numerical
58	Weight of copper (Winding) in Kgs.	Mfg to specify	Numerical
59	Weight of Transformer Tank with fittings in Kgs.	Mfg to specify	Numerical
60	Weight of Oil in kgs	Mfg to specify	Numerical
61	Volume of Oil in Ltrs	Mfg to specify	Numerical
62	Total weight of Transformer in Kgs	Mfg to specify	Numerical
63	Rating of Lightening Arrestors and Make thereof (kV, kA)	NA	
64	Reference Standard of Lightening Arrestors.	NA	
65	Min. External Clearances of HV Bushing terminals between Ph to Ph (in mm)	240 mm	Numerical
66	Min. External Clearances of HV Bushing terminals between Ph to E (in mm) (Indoor)	140 mm	Numerical
67	Min. External Clearances of LV Bushing terminals between Ph to Ph (in mm)	25 mm	Numerical
68	Min. External Clearances of LV Bushing terminals between Ph to E (in mm)	20 mm	Numerical
69	The temperature shall in no case reach a value that will damage the core itself , other parts or adjacent materials (Yes/No)	Yes	Boolean
70	Type of Core (stacked/ wound)	Stacked/ wound to be specified by mfg	Text
71	Core material used & its grade	CRGO, M-4 or better	Text

72	Thickness of core lamination in mm	0.27 or Thinner	Numerical
73	No of steps used in CRGO Core	Mfg to be specify	Numerical
74	Diameter of the core (in mm)	Mfg to be specify	Numerical
75	Effective Core Area (Sq. cm)	Mfg to be specify	Numerical
76	Flux density at normal voltage and frequency in Tesla	1.69 T Max	Numerical
77	Material of H.V. Winding	Electrolytic Copper	Text
78	Material of L.V. Winding	Electrolytic Copper	Text
79	Size/diameter of conductor used for HV winding in mm	Mfg to specify	Numerical
80	Total cross section area of HV Winding in sq mm.	Mfg to specify	Numerical
81	Size of strip used for LV winding conductor in mm	Mfg to specify	Text
82	Total cross section of Copper used in LV Winding in sq. mm	Mfg to specify	Numerical
83	No. of conductors in parallel for LV winding	Mfg to specify	Numerical
84	Current density of HV winding , in Amps/sq. mm.	2.8 A/sq.mm (Max)	Numerical
85	Current density of LV winding, in Amps / sq.mm.	2.8 A/sq.mm (Max)	Numerical
86	No of HV winding Turns	Mfg to be specify	Numerical
87	No of LV winding Turns	Mfg to be specify	Numerical
88	No of H.V. coils /phase	Mfg to be specify	Numerical
89	No. of L.V. coils/phase	Mfg to be specify	Numerical
90	Resistance of HV winding at 20 º C in Ohm/phase	Mfg to specify	Numerical
91	Resistance of LV winding at 20 º C in Ohm/phase	Mfg to specify	Numerical
92	% impedance value at 75º C	4.5% (± IS Tol)	Numerical
93	Name of manufacturers of oil	Apar / Savita or equivalent other makes shall be specified by mfg.	Text
94	Grade of Oil	Mineral Oil as per IS 335 Updated	Text
95	A. Minimum volume of oil in liters as per tech. specification	Mfg to specify	Numerical
96	B. Quantity of total oil absorption (in Ltrs) in first filling	Mfg to specify	Numerical
97	Total oil Volume including Total Oil absorption in liters i.e. (A+B)	Mfg to specify	Numerical

98	Breakdown value of oil at the time of first filling (KV/mm) considering 2.5 mm gap	30 kv/mm (min)	Numerical
99	Total volume of conservator shall be such as to content 10% of total quantity of oil (Yes/No)	Yes	Boolean
100	No load losses at rated voltage and frequency in Watts	Mfg to specify	Numerical
101	Max. Total losses (No load loss + Load Loss) at 50 % loading in Watts at 75ºC	1953 Watt	Numerical
102	Max. Total losses (No load loss + Load Loss) at 100 % loading in Watts at 75ºC	5565 Watt	Numerical
103	Magnetizing current (No load) in Amps & its % of full load current & rated voltage referred to LV side	16.8 Amp at 2 %	Text
104	Magnetizing current (No load) in amps & its % of full load current at maximum voltage (112.5% of rated voltage) referred to LV side	42Amp at 5%	Text
105	Min Clearance between Core & L.V. in mm	4 mm (Radial)	Numerical
106	MinClearances between L.V. & H.V. in mm	12 mm (Radial)	Numerical
107	Min Clearances between winding to body of tank in mm	40 mm	Numerical
108	Min Clearance between HV phase to phase in mm	18 mm	Numerical
109	Min Clearances between end insulation to Earth in mm	40 mm	Numerical
110	Insulation materials provided for core	Carlite coating	Text
111	Insulation materials provided for H.V. Conductor	Double paper covered	Text
112	Insulation materials provided for L.V. Conductor	Double paper covered	Text
113	Thickness of locking spacers between HV coils in mm	3 mm	Numerical
114	Inter layer insulation provided in H.V winding to design for Top & bottom layer	Electrical grade insulating Kraft paper	Text
115	Inter layer insulation provided in L.V winding to design for Top & bottom layer	Electrical grade insulating Kraft paper	Text
116	Inter layer insulation provided in between all layer in H.V winding	Electrical grade insulating Kraft paper	Text
117	Inter layer insulation provided in between all layer in L.V winding	Electrical grade insulating Kraft paper	Text
118	Details of end insulation (thickness in mm)	30 mm	Numerical
119	Whether wedges are Provided at 50% turns of the Coil (Yes/ No)	No	Boolean

120	Thickness of insulating paper	0.25 mm	Numerical
121	Regulation at 0.8 P.F. lag (in %)	3.29%	Numerical
122	Regulation at 0.8 P.F. leading (in %)	-2.00%	Numerical
123	Regulation at unity P.F.. (in %)	0.82%	Numerical
124	Reference standard of Bushing	IS-3347	Text
125	Material of HV and L.V Bushings	Porcelain /Epoxy	Text
126	Makes of HV and L.V Bushings	Genisis / CJI or equivalent other makes shall be specified by mfg.	Text
127	Rating of HV Bushing (in KV,A)	24 KV, 250 Amps.	Text
128	Rating of LV Bushing (in KV,A)	1 KV, 1000 Amps.	Text
129	Minimum Creepage Distance of HV Bushings in mm (min 25mm/kV)	600 mm	Numerical
130	Minimum Creepage Distance of LV Bushings in mm (min 25mm/kV)	75 mm	Numerical
131	Power frequency withstand voltage dry & wet in kV(rms) for HV Bushings	50 kV(rms)	Numerical
132	Dry lighting impulse withstand voltage test in kV (Peak) stating the waveform adopted for HV Bushing.	125 kV (peak)	Numerical
133	Separate source power frequency withstand test for HV for 1minute in kV(min)	50 Kv rms for 1 min	Numerical
134	Separate source power frequency withstand test for LV for 1minute in kV(min)	3 Kv rms for 1 min	Numerical
135	Induced over voltage withstand test for 1 min. specify voltage frequency, time for test.	44/0.866 kV for 1 minute	Text
136	Impulse test value (in kVp) .	125 Kvp	Numerical
139	Efficiency at 75 º C at unity P.F. at 125 % Load	Mfg to be specify	Numerical
140	Efficiency at 75 º C at unity P.F at 100 % Load	Mfg to be specify	Numerical
141	Efficiency at 75 º C at unity P.F. at 75 % Load	Mfg to be specify	Numerical
142	Efficiency at 75 º C at unity P.F. at 50 % Load	Mfg to be specify	Numerical
143	Efficiency at 75 º C at 0.8 P.F. lag at 125 % Load	Mfg to be specify	Numerical
144	Efficiency at 75 º C at 0.8 P.F. lag at 100 % Load	Mfg to be specify	Numerical
145	Efficiency at 75 º C at 0.8 P.F. lag at 75 % Load	Mfg to be specify	Numerical

146	Efficiency at 75 º C at 0.8 P.F. lag at 50 % Load	Mfg to be specify	Numerical
147	Efficiency at 75 º C at 0.8 P.F. lag at 25 % Load	Mfg to be specify	Numerical
148	Efficiency at 75 º C at 0.8 P.F. leading at 125 % Load	Mfg to be specify	Numerical
149	Efficiency at 75 º C at 0.8 P.F. leading at 100 % Load	Mfg to be specify	Numerical
150	Efficiency at 75 º C at 0.8 P.F. leading at 75 % Load	Mfg to be specify	Numerical
151	Efficiency at 75 º C at 0.8 P.F. leading at 50 % Load	Mfg to be specify	Numerical
152	Efficiency at 75 º C at 0.8 P.F. leading at 25 % Load	Mfg to be specify	Numerical
153	The test certificates of copper conductors, core , insulating paper, porcelain Bushings,steel plate used for enclosure of the offered transformer are enclosed with the offer (Yes/No)	Shall be submitted at the time of stage inspection	Boolean
154	All type test report carried out on transformer at NABL laboratory shall be submitted along with the offer as per cl. XXII (c) of Section (I) i.e. Instructions to tenderers. (Yes/No). Firm may attach online.	Mfg to be specify	Boolean
155	Unbalance current test, Air pressure test and temperature rise test shall be conducted as per format enclosed with the technical specification along with the offer (Yes/ No)	N.A.	Boolean
156	All drawings shall be furnished for each offered item separately along with this offer(Yes/ No)	Mfg to be specify	Boolean
157	Oil absorption calculation sheet shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to be specify	Boolean
158	Heat dissipation calculation shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to be specify	Boolean
159	Calculation sheet submitted for Flux density calculations (stating HV & LV turns) for each offered item separately along with the offer (Yes/No)	Mfg to be specify	Boolean
160	Calculation sheet for 112% of rated V/f ratio (Over fluxing) calculation sheet shall be furnished for each item separately along with this offer (Yes/No)	Mfg to be specify	Boolean

161	Required documents, plant and machinery, testing equipment , list of order executed/under execution shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to be specify	Boolean
162	The information required under Quality Assurance shall be submitted with the offer in physical format & soft copy(Yes/ No)	Mfg to be specify	Boolean
163	The cost data in the prescribed format shall be submitted with offer in physical format & soft copy (Yes/ No)	Mfg to be specify	Boolean
164	The performance Guarantee of the transformers in years	5 Years (from the date of commissioning)	Text
165	Dimensions in mm of Air filled HV Cable Box provided suitable for 3 Core XLPE cables up to 300 sq.mm with gland plates as per tech spec. cl.no.13.8	Mfg to specify	Text
166	Dimensions in mm of Air filled LV Cable Box provided suitable for single core 400 sq.mm cable i.e. 3 cable run/ phase and 1cablerun for neutral with gland plates as per tech spec. cl.no.13.8	Mfg to specify	Text
167	HV and LV cable Boxes provided shall be rectangular , M.S.Sheet of 2 mm , weather , vermin, and dustproof	Mfg to specify	Text
168	LV Cable Box shall be provided non magnetic gland plates	Mfg to specify	Boolean

630 KVA, 11/0.433 KV ONAN Cu. Wound I/D Distribution Transformer Star 1 (Level-2)

Sr. No	GTP Parameters	REMARK	To be offered by Bidder
1	Name of Manufacturer		Text
2	Reference Standards	IS-1180 Part-1 (2014)	Text
3	Rating of Transformer in KVA	630 KVA	Numerical
4	Primary voltage in kV	11 KV	Numerical
5	Secondary voltage in kV	0.433 KV	Numerical
6	Transformer shall be Oil Natural Air Natural (ONAN) type Yes/No	Yes(ONAN)	Boolean
7	Transformer shall be suitable for Indoor application. (Yes/No)	Indoor	Boolean
8	Transformer shall be Oil Natural cooled	Yes	Boolean

	type (yes/No)		
9	Highest System Voltage in kV	12 KV	Numerical
10	Frequency in HZ.	50 Hz	Numerical
11	Transformer shall be suitable for solid neutral earthing (Yes/No)	Yes	Boolean
12	Service condition shall be applicable as per Technical specification clause no. 3	Yes	Text
13	Transformer Colour as per IS:5	Air craft Blue, IS-5,Shade-108	Text
14	Type of connection for H.V. Winding (Delta) (Yes/No).	Yes(Delta)	Text
15	Type of connection for L.V. Winding (Star) (Yes/No)	Yes(Star)	Text
16	Vector Group Dyn-11 (Yes/No)	Yes(Dyn11)	Text
17	Name Plate details are as per the requirement specified in tender (Yes/No)	Yes	Boolean
18	Thickness of Name plate (in SWG)	18 SWG	Numerical
19	Maximum temperature rise of Windings over an Ambient temp. of 50°C in °C is	45°C	Numerical
20	Maximum temperature rise of oil over an Ambient temp. of 50°C in °C is	40°C	Numerical
21	Approximate overall length of the Transformer in mm	Mfg to specify	Numerical
22	Approximate overall breadth of the Transformer in mm	Mfg to specify	Numerical
23	Approximate overall height of the Transformer in mm	Mfg to specify	Numerical
24	Approximate length of the Transformer tank in mm	Mfg to specify	Numerical
25	Approximate breadth of the Transformer tank in mm	Mfg to specify	Numerical
26	Approximate height of the Transformer tank in mm	Mfg to specify	Numerical
27	Thickness of the side of transformer tank plates in mm	4 mm	Numerical
28	Thickness of the bottom of transformer tank plates in mm	6 mm	Numerical
29	Thickness of the top of transformer tank plates in mm	6 mm	Numerical
30	Size of reinforced welded angle to the Transformer Tank in mm.	50 x 75 x 5 mm	Text
31	Degree of slope to the top plate of Transformer.	5° to 10°	Text

32	Shape of transformer Tank	Rectangular	Text
33	Type of Tank (Corrugated/ Conventional)	Corrugated/Conventional mfg to specify	Text
34	In case of corrugated tank, thickness of corrugated sheet (in mm)	NA	
35	Size of Transformer Base Channel in mm.	100 x 50 mm	Text
36	Size (diameter & width) and No. of Rollers provided to the Transformer	100x 40 mm, 4 Nos	Text
37	Conservator tank to the transformer with oil level indicator (showing three levels) and drain plug is provided (Yes/ No)	Yes	Boolean
38	Dimensions of conservator Tank (LxD) in mm	Mfg to be specify	Text
39	Drain Valve size (32 mm) provided to the transformer tank (Yes/No)	Yes	Numerical
40	Size of Oil filling hole with cap in mm. (on conservator) is provided.	32 mm	Numerical
41	Size of Drain valve in mm. is provided.	32 mm	Numerical
42	Size of filter valve in mm. is provided.	32 mm	Numerical
43	No. & Size in mm of Lifting lugs provided to transformer	4 Nos, 12 mm	Text
44	No. & Size in mm of pulling lugs provided to transformer	4 Nos, 8 mm	Text
45	No. & Size in mm of transformer top cover lifting lugs provided to transformer	2 Nos, 8 mm	Text
46	No. of Earthing terminals with suitable size in (SWG)	2 Nos	Numerical
47	Thermometer pocket is provided (Yes/No)	Yes	Boolean
48	Quantity of Silica-Gel filled in breather (in gm) & make of breather	1 kg, Yogya Enterprises/ Press 'n' Forge or equivalent other makes shall be specified by mfg.	Text
49	Explosion vent with diaphragm. (Yes/No)	Yes	Text
50	No of radiators both on HV & LV side provided and location with arrangement.	4 Nos (2 on HV Side & 2 on LV Side),	Numerical
51	Size and Thickness of the radiator of transformer in mm.	Mfg to be specify size 1.25 mm Thk.	Text
52	No of radiator fins.	Mfg to be specify	Numerical
53	(A) Radiating surface of radiators in Sq.	Mfg to be specify	Numerical

	Mtrs.		
54	(B) Radiating surface of Tank only in Sq. Mtrs.	Mfg to be specify	Numerical
55	Total radiating surface of transformer tank in Sq. mtrs.	Mfg to be specify	Numerical
56	Off Load Tap changer on higher voltage winding for variation of H.V Voltage Within range of (+) 5% to (-) 10 % Insteps of 2.5 % provided (Yes/No)	Mfg to be specify	Text
57	Weight of Core in kgs	Mfg to be specify	Numerical
58	Weight of copper (Winding) in Kgs.	Mfg to be specify	Numerical
59	Weight of Transformer Tank with fittings in Kgs.	Mfg to be specify	Numerical
60	Weight of Oil in kgs	Mfg to be specify	Numerical
61	Volume of Oil in Ltrs	Mfg to be specify	Numerical
62	Total weight of Transformer in Kgs	Mfg to be specify	Numerical
63	Rating of Lightening Arrestors and Make thereof (kV, kA)	N.A.	
64	Reference Standard of Lightening Arrestors.	N.A.	
65	Min. External Clearances of HV Bushing terminals between Ph to Ph (in mm) (Indoor)	130 mm	Numerical
66	Min. External Clearances of HV Bushing terminals between Ph to E (in mm) (Indoor)	80 mm	Numerical
67	Min. External Clearances of LV Bushing terminals between Ph to Ph (in mm)	25 mm	Numerical
68	Min. External Clearances of LV Bushing terminals between Ph to E (in mm)	20 mm	Numerical
69	The temperature shall in no case reach a value that will damage the core itself , other parts or adjacent materials (Yes/No)	Yes	Boolean
70	Type of Core (stacked/ wound)	Stacked/wound Mfg to be specify	Text
71	Core material used & its grade	CRGO, M-4 or better	Text
72	Thickness of core lamination in mm	0.27 or better	Numerical
73	No of steps used in CRGO Core	Mfg to be specify	Numerical
74	Diameter of the core (in mm)	Mfg to be specify	Numerical
75	Effective Core Area (Sq. cm)	Mfg to be specify	Numerical
76	Flux density at normal voltage and frequency in Tesla	1.69 T (max)	Numerical

77	Material of H.V. Winding	Electrolytic Copper	Text
78	Material of L.V. Winding	Electrolytic Copper	Text
79	Size/diameter of conductor used for HV winding in mm	4 mm Dia	Numerical
80	Total cross section area of HV Winding in sq mm.	Mfg to be specify	Numerical
81	Size of strip used for LV winding conductor in mm	Mfg to be specify	Text
82	Total cross section of Copper used in LV Winding in sq. mm	Mfg to be specify	Numerical
83	No. of conductors in parallel for LV winding	Mfg to be specify	Numerical
84	Current density of HV winding , in Amps/sq. mm.	2.8 A/sq.mm (Max)	Numerical
85	Current density of LV winding, in Amps / sq.mm.	2.8 A/sq.mm (Max)	Numerical
86	No of HV winding Turns	Mfg to be specify	Numerical
87	No of LV winding Turns	Mfg to be specify	Numerical
88	No of H.V. coils /phase	Mfg to be specify	Numerical
89	No. of L.V. coils/phase	Mfg to be specify	Numerical
90	Resistance of HV winding at 20 º C in Ohm/phase	Mfg to be specify	Numerical
91	Resistance of LV winding at 20 º C in Ohm/phase	Mfg to be specify	Numerical
92	% impedance value at 75º C	4.5% (± IS Tol)	Numerical
93	Name of manufacturers of oil	Apar / Savita / or equivalent other makes shall be specified by mfg.	Text
94	Grade of Oil	Mineral Oil as per IS 335 Updated	Text
95	A. Minimum volume of oil in liters as per clause No. 9 of tech. specification	Mfg to be specify	Numerical
96	B. Quantity of total oil absorption (in Ltrs) in first filling	Mfg to be specify	Numerical
97	Total oil Volume including Total Oil absorption in liters i.e. (A+B)	Mfg to be specify	Numerical
98	Breakdown value of oil at the time of first filling (KV/mm) considering 2.5 mm gap	30 kv/mm (min)	Numerical
99	Total volume of conservator shall be such as to content 10% of total quantity of oil (Yes/No)	Yes	Boolean
100	No load losses at rated voltage and frequency in Watts	Mfg to be specify	Numerical

101	Max. Total losses (No load loss + Load Loss) at 50 % loading in Watts at 75ºC	1860 Watt	Numerical
102	Max. Total losses (No load loss + Load Loss) at 100 % loading in Watts at 75ºC	5300 Watt	Numerical
103	Magnetizing current (No load) in Amps & its % of full load current & rated voltage referred to LV side	16.8 Amp at 2 %	Text
104	Magnetizing current (No load) in amps & its % of full load current at maximum voltage (112.5% of rated voltage) referred to LV side	42 Amp at 5%	Text
105	MinClearance between Core & L.V. in mm	4 mm (Radial)	Numerical
106	Min Clearances between L.V. & H.V. in mm	11 mm (Radial)	Numerical
107	Min Clearances between winding to body of tank in mm	30 mm	Numerical
108	Min Clearance between HV phase to phase in mm	13 mm	Numerical
109	Min Clearances between end insulation to Earth in mm	30 mm	Numerical
110	Insulation materials provided for core	Carlite coating	Text
111	Insulation materials provided for H.V. Conductor	Double paper covered	Text
112	Insulation materials provided for L.V. Conductor	Double paper covered	Text
113	Thickness of locking spacers between HV coils in mm	3 mm	Numerical
114	Inter layer insulation provided in H.V winding to design for Top & bottom layer	Electrical grade insulating Kraft paper	Text
115	Inter layer insulation provided in L.V winding to design for Top & bottom layer	Electrical grade insulating Kraft paper	Text
116	Inter layer insulation provided in between all layer in H.V winding	Electrical grade insulating Kraft paper	Text
117	Inter layer insulation provided in between all layer in L.V winding	Electrical grade insulating Kraft paper	Text
118	Details of end insulation (thickness in mm)	25 mm	Numerical
119	Whether wedges are Provided at 50% turns of the Coil (Yes/ No)	Yes	Boolean
120	Thickness of insulating paper	0.25 mm	Numerical
121	Regulation at 0.8 P.F. lag (in %)	3.27%	Numerical
122	Regulation at 0.8 P.F. leading (in %)	-2.03%	Numerical

123	Regulation at unity P.F.. (in %)	0.79%	Numerical
124	Reference standard of Bushing	IS-3347	Text
125	Material of HV and L.V Bushings	Porcelain / Epoxy	Text
126	Makes of HV and L.V Bushings	Genisis / CJI /Baroda or equivalent other makes shall be specified by mfg.	Text
127	Rating of HV Bushing (in KV,A)	12 KV, 250 Amps.	Text
128	Rating of LV Bushing (in KV,A)	1.1 KV, 1000 Amps.	Text
129	Minimum Creepage Distance of HV Bushings in mm (min 25mm/kV)	300 mm	Numerical
130	Minimum Creepage Distance of LV Bushings in mm (min 25mm/kV)	66 mm	Numerical
131	Power frequency withstand voltage dry & wet in kV(rms) for HV Bushings	28 kV(rms)	Numerical
132	Dry lighting impulse withstand voltage test in kV (Peak) stating the waveform adopted for HV Bushing.	75 kV (peak)	Numerical
133	Separate source power frequency withstand test for HV for 1minute in kV(min)	28 Kv rms for 1 min	Numerical
134	Separate source power frequency withstand test for LV for 1minute in kV(min)	3 Kv rms for 1 min	Numerical
135	Induced over voltage withstand test for 1 min. specify voltage frequency, time for test.	22/0.866kv for 1 minute	Text
136	Impulse test value (in kVp) .	75 Kvp	Numerical
137	Efficiency at 75 º C at unity P.F. at 125 % Load	Mfg to be specify	Numerical
138	Efficiency at 75 º C at unity P.F at 100 % Load	Mfg to be specify	Numerical
139	Efficiency at 75 º C at unity P.F. at 75 % Load	Mfg to be specify	Numerical
140	Efficiency at 75 º C at unity P.F. at 50 % Load	Mfg to be specify	Numerical
141	Efficiency at 75 º C at 0.8 P.F. lag at 125 % Load	Mfg to be specify	Numerical
142	Efficiency at 75 º C at 0.8 P.F. lag at 100 % Load	Mfg to be specify	Numerical
143	Efficiency at 75 º C at 0.8 P.F. lag at 75 % Load	Mfg to be specify	Numerical
144	Efficiency at 75 º C at 0.8 P.F. lag at 50 % Load	Mfg to be specify	Numerical

145	Efficiency at 75 º C at 0.8 P.F. lag at 25 % Load	Mfg to be specify	Numerical
146	Efficiency at 75 º C at 0.8 P.F. leading at 125 % Load	Mfg to be specify	Numerical
147	Efficiency at 75 º C at 0.8 P.F. leading at 100 % Load	Mfg to be specify	Numerical
148	Efficiency at 75 º C at 0.8 P.F. leading at 75 % Load	Mfg to be specify	Numerical
149	Efficiency at 75 º C at 0.8 P.F. leading at 50 % Load	Mfg to be specify	Numerical
150	Efficiency at 75 º C at 0.8 P.F. leading at 25 % Load	Mfg to be specify	Numerical
151	The test certificates of copper conductors, core , insulating paper, porcelain Bushings,steel plate used for enclosure of the offered transformer are enclosed with the offer (Yes/No)	Mfg to be specify	Boolean
152	All type test report carried out on transformer at NABL laboratory shall be submitted along with the offer as per cl. XXII (c) of Section (I) i.e. Instructions to tenderers. (Yes/No). Firm may attach online.	Mfg to be specify	Boolean
153	Unbalance current test, Air pressure test and temperature rise test shall be conducted as per format enclosed with the technical specification along with the offer (Yes/ No)	N.A.	Boolean
154	All drawings shall be furnished for each offered item separately along with this offer(Yes/ No)	Mfg to be specify	Boolean
155	Oil absorption calculation sheet shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to be specify	Boolean
156	Heat dissipation calculation shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to be specify	Boolean
157	Calculation sheet submitted for Flux density calculations (stating HV & LV turns) for each offered item separately along with the offer (Yes/No)	Mfg to be specify	Boolean
158	Calculation sheet for 112% of rated V/f ratio (Over fluxing) calculation sheet shall be furnished for each item separately along with this offer	Mfg to be specify	Boolean

	(Yes/No)		
159	Required documents, plant and machinery, testing equipment , list of order executed/under execution shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to be specify	Boolean
160	The information required under Quality Assurance shall be submitted with the offer in physical format & soft copy(Yes/ No)	Mfg to be specify	Boolean
161	The cost data in the prescribed format shall be submitted with offer in physical format & soft copy (Yes/ No)	Mfg to be specify	Boolean
162	The performance Guarantee of the transformers in years	5 Years form date of commissioning	Text
163	Dimensions in mm of Air filled HV Cable Box provided suitable for 3 Core XLPE cables up to 300 sq.mm with gland plates as per tech spec. cl.no.13.8	Mfg to specify	Text
164	Dimensions in mm of Air filled LV Cable Box provided suitable for single core 400 sq.mm cable i.e. 3 cable run/ phase and 1cablerun for neutral for ore XLPE cables up to 300 sq.mm with gland plates as per tech spec. cl.no.13.8	Mfg to specify	Text
165	HV and LV cable Boxes provided shall be rectangular , M.S.Sheet of 2 mm , weather , vermin, and dustproof	Mfg to specify	Text
166	LV Cable Box shall be provided non magnetic gland plates	Mfg to specify	Boolean

315 KVA, 22/0.433 KV, ONAN, Cu. Wound, I/D Distribution Transformer Star 1 (Level-2)			
Sr. No	GTP Parameters	REMARK	To be offered by Bidder
1	Name of Manufacturer		Text
2	Reference Standards	IS-1180 Part-1 (2014)	Text
3	Rating of Transformer in KVA	315 KVA	Numerical
4	Primary voltage in kV	22 KV	Numerical
5	Secondary voltage in kV	0.433 KV	Numerical
6	Transformer shall be Oil Natural Air	ONAN	Boolean

	Natural (ONAN) type Yes/No		
7	Transformer shall be suitable for Indoor application. (Yes/No)	Indoor	Boolean
8	Highest System Voltage in kV	24 KV	Numerical
9	Frequency in HZ.	50 Hz	Numerical
10	Transformer shall be suitable for solid neutral earthing (Yes/No)	YES	Boolean
11	Service condition shall be applicable as per Technical specification clause no. 3	YES	Boolean
12	Transformer Colour as per IS:5	Air craft Blue, IS-5,Shade-108	Text
13	Type of connection for H.V. Winding (Delta) (Yes/No).	Delta	Text
14	Type of connection for L.V. Winding (Star) (Yes/No)	Star	Text
15	Vector Group Dyn-11 (Yes/No)	Dyn11	Text
16	Name Plate details are as per the requirement specified in tender (Yes/No)	YES	Boolean
17	Thickness of Name plate (in SWG)	18 SWG	Numerical
18	Maximum temperature rise of Windings over an Ambient temp. of 50°C in °C is	45°c	Numerical
19	Maximum temperature rise of oil over an Ambient temp. of 50°C in °C is	40°c	Numerical
20	Approximate overall length of the Transformer in mm	Mfg to be specify	Numerical
21	Approximate overall breadth of the Transformer in mm	Mfg to be specify	Numerical
22	Approximate overall height of the Transformer in mm	Mfg to be specify	Numerical
23	Approximate length of the Transformer tank in mm	Mfg to be specify	Numerical
24	Approximate breadth of the Transformer tank in mm	Mfg to be specify	Numerical
25	Approximate height of the Transformer tank in mm	Mfg to be specify	Numerical
26	Thickness of the side of transformer tank plates in mm	4 mm	Numerical
27	Thickness of the bottom of transformer tank plates in mm	6 mm	Numerical
28	Thickness of the top of transformer tank plates in mm	6 mm	Numerical
29	Size of reinforced welded angle to the Transformer Tank in mm.	50 X 75 X 5 mm	Text
30	Degree of slope to the top plate of Transformer.	5° to 10° towards HV side	Text

31	Shape of transformer Tank	RECTANGULAR	Text
32	Type of Tank (Corrugated/ Conventional)	Corrugated /CONVENTI0NAL Mfg to be specify	Text
33	In case of corrugated tank, thickness of corrugated sheet (in mm)	N.A	
34	Size of Transformer Base Channel in mm.	100 X 50 mm	Text
35	Size (diameter & width) and No. of Rollers provided to the Transformer	100 x 40 mm, 4 Nos	Text
36	Conservator tank to the transformer with oil level indicator (showing three levels) and drain plug is provided (Yes/ No)	YES	Boolean
37	Dimensions of conservator Tank (LxD) in mm	Mfg to be specify	Text
38	Drain Valve size provided to the transformer tank (Yes/No)	32 mm	Numerical
39	Size of Oil filling hole with cap in mm. (on conservator) is provided.	32 mm	Numerical
40	Size of Drain valve in mm. is provided.	32 mm	Numerical
41	Size of filter valve in mm. is provided.	32 mm	Numerical
42	No. & Size in mm of Lifting lugs provided to transformer	4 Nos, 12 mm	Text
43	No. & Size in mm of pulling lugs provided to transformer	4 Nos, 8 mm	Text
44	No. & Size in mm of transformer top cover lifting lugs provided to transformer	2 Nos, 8 mm	Text
45	No. of Earthing terminals with suitable size in (SWG)	2 Nos	Numerical
46	Thermometer pocket is provided (Yes/No)	Yes	Boolean
47	Quantity of Silica-Gel filled in breather (in gm) & make of breather	1000gm, Yogya Enterprises / Press 'n' Force or equivalent other makes shall be specified by mfg.	Text
48	Explosion vent with diaphragm. (Yes/No)	Yes	Boolean
49	No of radiators both on HV & LV side provided and location with arrangement & size.	4 Nos. (2 On LV & 2 On HV) ,	Text
50	Thickness of the radiator of transformer in mm. and size of fin	1.25 mm mfg to specify size fins	Text
51	No of radiator fins.	mfg to specify	Numerical
52	(A) Radiating surface of radiators in Sq. Mtrs.	mfg to specify	Numerical

53	(B) Radiating surface of Tank only in Sq. Mtrs.	mfg to specify	Numerical
54	Total radiating surface of transformer tank in Sq. mtrs.	mfg to specify	Numerical
55	Weight of Core in kgs	mfg to specify	Numerical
56	Weight of copper (Winding) in Kgs.	mfg to specify	Numerical
57	Weight of Transformer Tank with fittings in Kgs.	mfg to specify	Numerical
58	Weight of Oil in kgs	mfg to specify	Numerical
59	Volume of Oil in Ltrs	mfg to specify	Numerical
60	Total weight of Transformer in Kgs	mfg to specify	Numerical
61	Rating of Lightening Arrestors and Make thereof (kV, kA)	NA	
62	Reference Standard of Lightening Arrestors.	NA	
63	Min. External Clearances of HV Bushing terminals between Ph to Ph (in mm) (Indoor)	240 mm	Numerical
64	Min. External Clearances of HV Bushing terminals between Ph to E (in mm) (Indoor)	140 mm	Numerical
65	Min. External Clearances of LV Bushing terminals between Ph to Ph (in mm)	25 mm	Numerical
66	Min. External Clearances of LV Bushing terminals between Ph to E (in mm)	20 mm	Numerical
67	The temperature shall in no case reach a value that will damage the core itself , other parts or adjacent materials (Yes/No)	Yes	Boolean
68	Type of Core (stacked/ wound)	Stacked	Text
69	Core material used & its grade	CRGO, M-4 or Better	Text
70	Thickness of core lamination in mm	0.27 mm or thinner	Numerical
71	No of steps used in CRGO Core	mfg to specify	Numerical
72	Diameter of the core (in mm)	mfg to specify	Numerical
73	Effective Core Area (Sq. cm)	mfg to specify	Numerical
74	Flux density at normal voltage and frequency in Tesla	1.69 T (Max)	Numerical
75	Material of H.V. Winding	Electrolytic Copper	Text
76	Material of L.V. Winding	Electrolytic Copper	Text
77	Size/diameter of conductor used for HV winding in mm	mfg to specify	Text
78	Total cross section area of HV Winding in sq mm.	mfg to specify	Numerical

79	Size of strip used for LV winding conductor in mm	mfg to specify	Text
80	Total cross section of Copper used in LV Winding in sq. mm	mfg to specify	Numerical
81	No. of conductors in parallel of LV winding	mfg to specify	Numerical
82	Current density of HV winding , in Amps/sq. mm.	2.8 A/sq.mm (Max)	Numerical
83	Current density of LV winding, in Amps / sq.mm.	2.8 A/sq.mm (Max)	Numerical
84	No of HV winding Turns	mfg to specify	Numerical
85	No of LV winding Turns	mfg to specify	Numerical
86	No of H.V. coils /phase	mfg to specify	Numerical
87	No. of L.V. coils/phase	mfg to specify	Numerical
88	Resistance of HV winding at 20 º C in Ohm/phase	mfg to specify	Numerical
89	Resistance of LV winding at 20 º C in Ohm/phase	mfg to specify	Numerical
90	% impedance value at 75º C	4.5%(±IS TOL)	Numerical
91	Name of manufacturers of oil	Apar/ Savita or equivalent other makes shall be specified by mfg.	Text
92	Grade of Oil	Mineral oil as per IS:335 Updated	Text
93	A. Minimum volume of oil in liters as per clause No. 9 of tech. specification	Mfg to specify	Numerical
94	B. Quantity of total oil absorption (in Ltrs) in first filling	Mfg to specify	Numerical
95	Total oil Volume including Total Oil absorption in liters i.e. (A+B)	Mfg to specify	Numerical
96	Breakdown value of oil at the time of first filling (KV/mm) considering 2.5 mm gap	30 kV/mm (Min)	Numerical
97	Total volume of conservator shall be such as to content 10% of total quantity of oil (Yes/No)	Yes	Boolean
98	No load losses at rated voltage and frequency in Watts	Mfg to specify	Numerical
99	Max. Total losses (No load loss + Load Loss) at 50 % loading in Watts at 75ºC	1076 W	Numerical
100	Max. Total losses (No load loss + Load Loss) at 100 % loading in Watts at 75ºC	3255 W	Numerical
101	Magnetizing current (No load) in Amps & its % of full load current & rated voltage referred to LV side	8.4 Amp at 2%	Text

102	Magnetizing current (No load) in amps & its % of full load current at maximum voltage (112.5% of rated voltage) referred to LV side	21 Amp at 5%	Text
103	Min Clearance between Core & L.V. in mm	4 mm	Numerical
104	Min Clearances between L.V. & H.V. in mm	13 mm	Numerical
105	Min Clearances between winding to body of tank in mm	40 mm	Numerical
106	Min Clearance between HV phase to phase in mm	22 mm	Numerical
107	Min Clearances between end insulation to Earth in mm	40 mm	Numerical
108	Insulation materials provided for core	CARLITE COATING	Text
109	Insulation materials provided for H.V. Conductor	DPC	Text
110	Insulation materials provided for L.V. Conductor	DPC	Text
111	Thickness of locking spacers between HV coils in mm	2 mm	Numerical
112	Inter layer insulation provided in H.V winding to design for Top & bottom layer	Electrical Grade Insulating Kraft Paper	Text
113	Inter layer insulation provided in L.V winding to design for Top & bottom layer	Electrical Grade Insulating Kraft Paper	Text
114	Inter layer insulation provided in between all layer in H.V winding	Electrical Grade Insulating Kraft Paper	Text
115	Inter layer insulation provided in between all layer in L.V winding	Electrical Grade Insulating Kraft Paper	Text
116	Details of end insulation (thickness in mm)	25mm	Numerical
117	Whether wedges are Provided at 50% turns of the Coil (Yes/ No)	NO	Boolean
118	Thickness of insulating paper	0.25mm	Numerical
119	Regulation at 0.8 P.F. lag (in %)	Mfg to specify	Numerical
120	Regulation at 0.8 P.F. leading (in %)	Mfg to specify	Numerical
121	Regulation at unity P.F.. (in %)	Mfg to specify	Numerical
122	Reference standard of Bushing	IS : 3347	Text
123	Material of HV and L.V Bushings	PORCELAIN	Text
124	Makes of HV and L.V Bushings	Mfg to specify	Text
125	Rating of HV Bushing (in KV,A)	24 KV,250Amps	Text
126	Rating of LV Bushing (in KV,A)	1 KV,630Amps	Text

127	Minimum Creepage Distance of HV Bushings in mm (min 25mm/kV)	600 mm	Numerical
128	Minimum Creepage Distance of LV Bushings in mm (min 25mm/kV)	66 mm	Numerical
129	Power frequency withstand voltage dry & wet in kV(rms) for HV Bushings for 1 min	50 KVrms for 1 min	Numerical
130	Dry lighting impulse withstand voltage test in kV (Peak) stating the waveform adopted for HV Bushing.	125 Kvp	Numerical
131	Separate source power frequency withstand test for HV for 1minute in kV(min)	50 KVrms for 1 min	Numerical
132	Separate source power frequency withstand test for LV for 1minute in kV(min)	3 KVrms for 1 min	Numerical
133	Induced over voltage withstand test for 1 min. specify voltage frequency, time for test.	44/0.866 kV for 1min	Text
134	Impulse test value (in kVp) .	125 Kvp	Numerical
135	Efficiency at 75 º C at unity P.F. at 125 % Load	Mfg to specify	Numerical
136	Efficiency at 75 º C at unity P.F at 100 % Load	Mfg to specify	Numerical
137	Efficiency at 75 º C at unity P.F. at 75 % Load	Mfg to specify	Numerical
138	Efficiency at 75 º C at unity P.F. at 50 % Load	Mfg to specify	Numerical
139	Efficiency at 75 º C at 0.8 P.F. lag at 125 % Load	Mfg to specify	Numerical
140	Efficiency at 75 º C at 0.8 P.F. lag at 100 % Load	Mfg to specify	Numerical
141	Efficiency at 75 º C at 0.8 P.F. lag at 75 % Load	Mfg to specify	Numerical
142	Efficiency at 75 º C at 0.8 P.F. lag at 50 % Load	Mfg to specify	Numerical
143	Efficiency at 75 º C at 0.8 P.F. lag at 25 % Load	Mfg to specify	Numerical
144	Efficiency at 75 º C at 0.8 P.F. leading at 125 % Load	Mfg to specify	Numerical
145	Efficiency at 75 º C at 0.8 P.F. leading at 100 % Load	Mfg to specify	Numerical
146	Efficiency at 75 º C at 0.8 P.F. leading at 75 % Load	Mfg to specify	Numerical
147	Efficiency at 75 º C at 0.8 P.F. leading at 50 % Load	Mfg to specify	Numerical

148	Efficiency at 75 º C at 0.8 P.F. leading at 25 % Load	Mfg to specify	Numerical
149	The test certificates of copper conductors, core , insulating paper, porcelain Bushings,steel plate used for enclosure of the offered transformer are enclosed with the offer (Yes/No)	Shall be submitted at the time of stage inspection	Boolean
150	All type test report carried out on transformer at NABL laboratory shall be submitted along with the offer as per cl. XXII (c) of Section (I) i.e. Instructions to tenderers. (Yes/No). Firm may attach online.	Mfg to specify	Boolean
151	Unbalance current test, Air pressure test and temperature rise test shall be conducted as per format enclosed with the technical specification along with the offer (Yes/ No)	Mfg to specify	Boolean
152	All drawings shall be furnished for each offered item separately along with this offer(Yes/ No)	Mfg to specify	Boolean
153	Oil absorption calculation sheet shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean
154	Heat dissipation calculation shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean
155	Calculation sheet submitted for Flux density calculations (stating HV & LV turns) for each offered item separately along with the offer (Yes/No)	Mfg to specify	Boolean
156	Calculation sheet for 112% of rated V/f ratio (Over fluxing) calculation sheet shall be furnished for each item separately along with this offer (Yes/No)	Mfg to specify	Boolean
157	Required documents, plant and machinery, testing equipment , list of order executed/under execution shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean
158	The information required under Quality Assurance shall be submitted with the offer in physical format & soft copy(Yes/ No)	Mfg to specify	Boolean
159	The cost data in the prescribed format shall be submitted with offer in physical format & soft copy (Yes/ No)	Mfg to specify	Boolean

160	The performance Guarantee of the transformers in years	5 YEARS from date of commissioning	Text
165	Dimensions in mm of Air filled HV Cable Box provided suitable for 3 Core XLPE cables up to 300 sq.mm with gland plates as per tech spec. cl.no.13.8	Mfg to specify	Text
166	Dimensions in mm of Air filled LV Cable Box provided suitable for single core 300 sq.mm XLPE cable i.e. 2 cable run/ phase and 1 cable run for neutral with gland plates as per tech spec. cl.no.13.8	Mfg to specify	Text
167	HV and LV cable Boxes provided shall be rectangular , M.S.Sheet of 2 mm , weather , vermin, and dustproof	Mfg to specify	Text
168	LV Cable Box shall be provided non magnetic gland plates	Mfg to specify	Boolean

315 KVA, 11/0.433 KV, ONAN, Cu. Wound, I/D Distribution Transformer Star 1 (Level-2)			
Sr. No	GTP Parameters	REMARK	To be offered by Bidder
1	Name of Manufacturer		Text
2	Reference Standards	IS-1180 Part-1 (2014)	Text
3	Rating of Transformer in KVA	315 KVA	Numerical
4	Primary voltage in kV	11 KV	Numerical
5	Secondary voltage in kV	0.433 KV	Numerical
6	Transformer shall be Oil Natural Air Natural (ONAN) type Yes/No	ONAN	Boolean
7	Transformer shall be suitable for Indoor application. (Yes/No)	Indoor	Boolean
8	Highest System Voltage in kV	12 KV	Numerical
9	Frequency in HZ.	50 Hz	Numerical
10	Transformer shall be suitable for solid neutral earthing (Yes/No)	YES	Boolean
11	Service condition shall be applicable as per Technical specification clause no. 3	YES	Boolean
12	Transformer Colour as per IS:5	Air craft Blue, IS-5,Shade-108	Text
13	Type of connection for H.V. Winding	Delta	Text

	(Delta) (Yes/No).		
14	Type of connection for L.V. Winding (Star) (Yes/No)	Star	Text
15	Vector Group Dyn-11 (Yes/No)	Dyn11	Text
16	Name Plate details are as per the requirement specified in tender (Yes/No)	YES	Boolean
17	Thickness of Name plate (in SWG)	18 SWG	Numerical
18	Maximum temperature rise of Windings over an Ambient temp. of 50°C in °C is	45°c	Numerical
19	Maximum temperature rise of oil over an Ambient temp. of 50°C in °C is	40°c	Numerical
20	Approximate overall length of the Transformer in mm	Mfg to be specify	Numerical
21	Approximate overall breadth of the Transformer in mm	Mfg to be specify	Numerical
22	Approximate overall height of the Transformer in mm	Mfg to be specify	Numerical
23	Approximate length of the Transformer tank in mm	Mfg to be specify	Numerical
24	Approximate breadth of the Transformer tank in mm	Mfg to be specify	Numerical
25	Approximate height of the Transformer tank in mm	Mfg to be specify	Numerical
26	Thickness of the side of transformer tank plates in mm	4 mm	Numerical
27	Thickness of the bottom of transformer tank plates in mm	6 mm	Numerical
28	Thickness of the top of transformer tank plates in mm	6 mm	Numerical
29	Size of reinforced welded angle to the Transformer Tank in mm.	50 X 75 X 5 mm	Text
30	Degree of slope to the top plate of Transformer.	5° to 10° towards HV side	Text
31	Shape of transformer Tank	RECTANGULAR	Text
32	Type of Tank (Corrugated/ Conventional)	Corrugated /CONVENTI0NAL Mfg to be specify	Text
33	In case of corrugated tank, thickness of corrugated sheet (in mm)	N.A	
34	Size of Transformer Base Channel in mm.	100 X 50 mm	Text
35	Size (diameter & width) and No. of Rollers provided to the Transformer	100 x 40 mm, 4 Nos	Text
36	Conservator tank to the transformer with oil level indicator (showing three levels) and drain plug is provided (Yes/ No)	YES	Boolean

37	Dimensions of conservator Tank (LxD) in mm	Mfg to be specify	Text
38	Drain Valve size provided to the transformer tank (Yes/No)	32 mm	Numerical
39	Size of Oil filling hole with cap in mm. (on conservator) is provided.	32 mm	Numerical
40	Size of Drain valve in mm. is provided.	32 mm	Numerical
41	Size of filter valve in mm. is provided.	32 mm	Numerical
42	No. & Size in mm of Lifting lugs provided to transformer	4 Nos, 12 mm	Text
43	No. & Size in mm of pulling lugs provided to transformer	4 Nos, 8 mm	Text
44	No. & Size in mm of transformer top cover lifting lugs provided to transformer	2 Nos, 8 mm	Text
45	No. of Earthing terminals with suitable size in (SWG)	2 Nos	Numerical
46	Thermometer pocket is provided (Yes/No)	Yes	Boolean
47	Quantity of Silica-Gel filled in breather (in gm) & make of breather	1000gm, Yogya Enterprises / Press 'n' Force or equivalent other makes shall be specified by mfg.	Text
48	Explosion vent with diaphragm. (Yes/No)	Yes	Boolean
49	No of radiators both on HV & LV side provided and location with arrangement & size.	4 Nos. (2 On LV & 2 On HV) ,	Text
50	Thickness of the radiator of transformer in mm.	1.25 mm mfg to specify size fins	Text
51	No of radiator fins.	mfg to specify	Numerical
52	(A) Radiating surface of radiators in Sq. Mtrs.	mfg to specify	Numerical
53	(B) Radiating surface of Tank only in Sq. Mtrs.	mfg to specify	Numerical
54	Total radiating surface of transformer tank in Sq. mtrs.	mfg to specify	Numerical
55	Weight of Core in kgs	mfg to specify	Numerical
56	Weight of copper (Winding) in Kgs.	mfg to specify	Numerical
57	Weight of Transformer Tank with fittings in Kgs.	mfg to specify	Numerical
58	Weight of Oil in kgs	mfg to specify	Numerical
59	Volume of Oil in Ltrs	mfg to specify	Numerical
60	Total weight of Transformer in Kgs	mfg to specify	Numerical

61	Rating of Lightening Arrestors and Make thereof (kV, kA)	NA	
62	Reference Standard of Lightening Arrestors.	NA	
63	Min. External Clearances of HV Bushing terminals between Ph to Ph (in mm) (Indoor)	130 mm	Numerical
64	Min. External Clearances of HV Bushing terminals between Ph to E (in mm) (Indoor)	80 mm	Numerical
65	Min. External Clearances of LV Bushing terminals between Ph to Ph (in mm)	25 mm	Numerical
66	Min. External Clearances of LV Bushing terminals between Ph to E (in mm)	20 mm	Numerical
67	The temperature shall in no case reach a value that will damage the core itself , other parts or adjacent materials (Yes/No)	Yes	Boolean
68	Type of Core (stacked/ wound)	Stacked	Text
69	Core material used & its grade	CRGO, M-4 or Better	Text
70	Thickness of core lamination in mm	0.27 mm or thinner	Numerical
71	No of steps used in CRGO Core	mfg to specify	Numerical
72	Diameter of the core (in mm)	mfg to specify	Numerical
73	Effective Core Area (Sq. cm)	mfg to specify	Numerical
74	Flux density at normal voltage and frequency in Tesla	1.69 T (Max)	Numerical
75	Material of H.V. Winding	Electrolytic Copper	Text
76	Material of L.V. Winding	Electrolytic Copper	Text
77	Size/diameter of conductor used for HV winding in mm	mfg to specify	Text
78	Total cross section area of HV Winding in sq mm.	mfg to specify	Numerical
79	Size of strip used for LV winding conductor in mm	mfg to specify	Text
80	Total cross section of Copper used in LV Winding in sq. mm	mfg to specify	Numerical
81	No. of conductors in parallel of LV winding	mfg to specify	Numerical
82	Current density of HV winding , in Amps/sq. mm.	2.8 A/sq.mm (Max)	Numerical
83	Current density of LV winding, in Amps / sq.mm.	2.8 A/sq.mm (Max)	Numerical
84	No of HV winding Turns	mfg to specify	Numerical

85	No of LV winding Turns	mfg to specify	Numerical
86	No of H.V. coils /phase	mfg to specify	Numerical
87	No. of L.V. coils/phase	mfg to specify	Numerical
88	Resistance of HV winding at 20 º C in Ohm/phase	mfg to specify	Numerical
89	Resistance of LV winding at 20 º C in Ohm/phase	mfg to specify	Numerical
90	% impedance value at 75º C	4.5%(±IS TOL)	Numerical
91	Name of manufacturers of oil	Apar/ Savita or equivalent other makes shall be specified by mfg.	Text
92	Grade of Oil	Mineral oil as per IS:335 Updated	Text
93	A. Minimum volume of oil in liters as per clause No. 9 of tech. specification	Mfg to specify	Numerical
94	B. Quantity of total oil absorption (in Ltrs) in first filling	Mfg to specify	Numerical
95	Total oil Volume including Total Oil absorption in liters i.e. (A+B)	Mfg to specify	Numerical
96	Breakdown value of oil at the time of first filling (KV/mm) considering 2.5 mm gap	n	Numerical
97	Total volume of conservator shall be such as to content 10% of total quantity of oil (Yes/No)	Yes	Boolean
98	No load losses at rated voltage and frequency in Watts	Mfg to specify	Numerical
99	Max. Total losses (No load loss + Load Loss) at 50 % loading in Watts at 75ºC	1025 W	Numerical
100	Max. Total losses (No load loss + Load Loss) at 100 % loading in Watts at 75ºC	3100 W	Numerical
101	Magnetizing current (No load) in Amps & its % of full load current & rated voltage referred to LV side	8.4 Amp at 2%	Text
102	Magnetizing current (No load) in amps & its % of full load current at maximum voltage (112.5% of rated voltage) referred to LV side	21 Amp at 5%	Text
103	Min Clearance between Core & L.V. in mm	4 mm (Rad)	Numerical
104	Min Clearances between L.V. & H.V. in mm	11 mm	Numerical
105	Min Clearances between winding to body of tank in mm	30 mm	Numerical

106	Min Clearance between HV phase to phase in mm	15 mm	Numerical
107	Min Clearances between end insulation to Earth in mm	30 mm	Numerical
108	Insulation materials provided for core	CARLITE COATING	Text
109	Insulation materials provided for H.V. Conductor	DPC	Text
110	Insulation materials provided for L.V. Conductor	DPC	Text
111	Thickness of locking spacers between HV coils in mm	2 mm	Numerical
112	Inter layer insulation provided in H.V winding to design for Top & bottom layer	Electrical Grade Insulating Kraft Paper	Text
113	Inter layer insulation provided in L.V winding to design for Top & bottom layer	Electrical Grade Insulating Kraft Paper	Text
114	Inter layer insulation provided in between all layer in H.V winding	Electrical Grade Insulating Kraft Paper	Text
115	Inter layer insulation provided in between all layer in L.V winding	Electrical Grade Insulating Kraft Paper	Text
116	Details of end insulation (thickness in mm)	25mm	Numerical
117	Whether wedges are Provided at 50% turns of the Coil (Yes/ No)	NO	Boolean
118	Thickness of insulating paper	0.25mm	Numerical
119	Regulation at 0.8 P.F. lag (in %)	Mfg to specify	Numerical
120	Regulation at 0.8 P.F. leading (in %)	Mfg to specify	Numerical
121	Regulation at unity P.F.. (in %)	Mfg to specify	Numerical
122	Reference standard of Bushing	IS : 3347	Text
123	Material of HV and L.V Bushings	PORCELAIN	Text
124	Makes of HV and L.V Bushings	Mfg to specify	Text
125	Rating of HV Bushing (in KV,A)	12 KV,250Amps	Text
126	Rating of LV Bushing (in KV,A)	1 KV,630Amps	Text
127	Minimum Creepage Distance of HV Bushings in mm (min 25mm/kV)	300 mm	Numerical
128	Minimum Creepage Distance of LV Bushings in mm (min 25mm/kV)	66 mm	Numerical
129	Power frequency withstand voltage dry & wet in kV(rms) for HV Bushings for 1 min	50 KVrms for 1 min	Numerical

130	Dry lighting impulse withstand voltage test in kV (Peak) stating the waveform adopted for HV Bushing.	125 Kvp	Numerical
131	Separate source power frequency withstand test for HV for 1minute in kV(min)	50 KVrms for 1 min	Numerical
132	Separate source power frequency withstand test for LV for 1minute in kV(min)	3 KVrms for 1 min	Numerical
133	Induced over voltage withstand test for 1 min. specify voltage frequency, time for test.	44/0.866 kV for 1min	Text
134	Impulse test value (in kVp) .	125 Kvp	Numerical
135	Efficiency at 75 º C at unity P.F. at 125 % Load	Mfg to specify	Numerical
136	Efficiency at 75 º C at unity P.F at 100 % Load	Mfg to specify	Numerical
137	Efficiency at 75 º C at unity P.F. at 75 % Load	Mfg to specify	Numerical
138	Efficiency at 75 º C at unity P.F. at 50 % Load	Mfg to specify	Numerical
139	Efficiency at 75 º C at 0.8 P.F. lag at 125 % Load	Mfg to specify	Numerical
140	Efficiency at 75 º C at 0.8 P.F. lag at 100 % Load	Mfg to specify	Numerical
141	Efficiency at 75 º C at 0.8 P.F. lag at 75 % Load	Mfg to specify	Numerical
142	Efficiency at 75 º C at 0.8 P.F. lag at 50 % Load	Mfg to specify	Numerical
143	Efficiency at 75 º C at 0.8 P.F. lag at 25 % Load	Mfg to specify	Numerical
144	Efficiency at 75 º C at 0.8 P.F. leading at 125 % Load	Mfg to specify	Numerical
145	Efficiency at 75 º C at 0.8 P.F. leading at 100 % Load	Mfg to specify	Numerical
146	Efficiency at 75 º C at 0.8 P.F. leading at 75 % Load	Mfg to specify	Numerical
147	Efficiency at 75 º C at 0.8 P.F. leading at 50 % Load	Mfg to specify	Numerical
148	Efficiency at 75 º C at 0.8 P.F. leading at 25 % Load	Mfg to specify	Numerical
149	The test certificates of copper conductors, core , insulating paper, porcelain Bushings,steel plate used for enclosure of the offered transformer are enclosed with the offer (Yes/No)	Shall be submitted at the time of stage inspection	Boolean

150	All type test report carried out on transformer at NABL laboratory shall be submitted along with the offer as per cl. XXII (c) of Section (I) i.e. Instructions to tenderers. (Yes/No). Firm may attach online.	Mfg to specify	Boolean
151	Unbalance current test, Air pressure test and temperature rise test shall be conducted as per format enclosed with the technical specification along with the offer (Yes/ No)	Mfg to specify	Boolean
152	All drawings shall be furnished for each offered item separately along with this offer(Yes/ No)	Mfg to specify	Boolean
153	Oil absorption calculation sheet shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean
154	Heat dissipation calculation shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean
155	Calculation sheet submitted for Flux density calculations (stating HV & LV turns) for each offered item separately along with the offer (Yes/No)	Mfg to specify	Boolean
156	Calculation sheet for 112% of rated V/f ratio (Over fluxing) calculation sheet shall be furnished for each item separately along with this offer (Yes/No)	Mfg to specify	Boolean
157	Required documents, plant and machinery, testing equipment , list of order executed/under execution shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean
158	The information required under Quality Assurance shall be submitted with the offer in physical format & soft copy(Yes/ No)	Mfg to specify	Boolean
159	The cost data in the prescribed format shall be submitted with offer in physical format & soft copy (Yes/ No)	Mfg to specify	Boolean
160	The performance Guarantee of the transformers in years	5 YEARS from date of commissioning	Text
165	Dimensions in mm of Air filled HV Cable Box provided suitable for 3 Core XLPE cables up to 300 sq.mm with gland plates as per tech spec. cl.no.13.8	Mfg to specify	Text

166	Dimensions in mm of Air filled LV Cable Box provided suitable for single core 300 sq.mm XLPE cable i.e. 2 cable run/ phase and 1 cable run for neutral with gland plates as per tech spec. cl.no.13.8	Mfg to specify	Text
167	HV and LV cable Boxes provided shall be rectangular , M.S.Sheet of 2 mm , weather , vermin, and dustproof	Mfg to specify	Text
168	LV Cable Box shall be provided non magnetic gland plates	Mfg to specify	Boolean

Annexure I

Air Pressure Test

Name of Supplier:

Order No.:

Capacity & Voltage Ratio of Distribution Transformer :_____kVA,____/0.433 kV

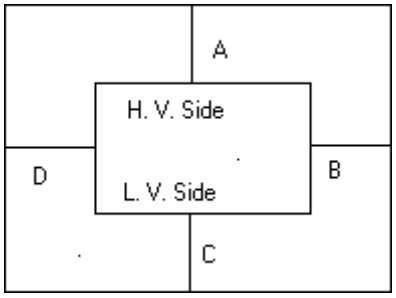
Vector Group Dyn11

Sr. No. of equipment Tested:

Date of Testing:

Reference Standard

All the opening of the transformer tank were closed with suitable gasket, bushing, valves and plugs. The compressor pipe connected at oil filling hole on conservator and a pressure guage was fitted at air vent plug. The parallel string were places around the tank, the distance between string and tank as shown in following diagram were recorded before applying the pressure and after releasing pressure.



Tank Thickness: Side_____mm. Top & Bottom_____mm

Test Pressure :_____kg/cm^2 applied for 30 Minutes.

Test Point	Distance before Test In mm	Distance after release of Pressure in mm	Deflection In mm
A			
B			
C			
D			

Permanent Deflection : _____mm

Permissible Limit of Permanent Deflection as per Specification :_____mm

Test witnessed by Tested by

Annexure II

Unbalance Current Test

Name of Supplier:

Order No.:

Capacity & Voltage Ratio of Distribution Transformer :_____kVA,____/0.433 kV

Vector Group Dyn11

Sr. No. of equipment Tested:

Date of Testing:

Reference Standard

Transformer Secondary terminals 2U, 2V & 2W are shorted. The shorted 2U, 2V & 2W is connected to 2N through Ammeter. The primary terminals 1U, 1V & 1W are connected to supply. The rated current___A is fed to primary and unbalance current is noted on Ammeter.

Unbalance Current Measured in Ammeter :_____ A

Rated current in Secondary Side :_____A

Permissible limits as per specification : 2% of the Rated current in Secondary Side

% of Unbalance current with reference to Rated current in Secondary Side

$$= \frac{\text{Unbalance Current x 100}}{\text{Rated current in Secondary Side}}$$

=

=

Test witnessed by Tested by

Annexure III

Temperature Rise Test

Name of Supplier:
Order No.:
Capacity & Voltage Ratio of Distribution Transformer :_____kVA,____/0.433 kV
Vector Group Dyn11
Sr. No. of equipment Tested:
Date of Testing:
Reference Standard

	H. V. Winding	L. V. Winding
Rated Line Current in Amp		

Guaranteed No Load Losses _____watt
Load Losses _____watt
Total Losses _____watt

P. T. Ratio : _____/____ =
C. T. Ratio : _____/_____ =
Wattmeter Constant =
Total Multiplying Factor (MF) =

TIME	Ambient Temp.				Top Oil Temp. °C	Rise in Top Oil Temp. °C	Line Voltage in Volts	Line Current in Amps	W1 watts	W2 watts	W3 watts	W1+W2+W3 watt	Multiplying Factor (MF)	Total Watt
	T1 °C	T2 °C	T3 °C	Average °C										
Reduced to Rated Current amps														

Calculation of Temperature Rise in Winding

LV Winding : Since the resistance of LV winding is less than 0.005 ohm, Temperature Rise in LV Winding is taken as temperature rise of oil as per clause no. 4.3 of IS:2026 (Part II)/1977

Temperature Rise in LV Winding =_____°C

HV Winding Resistance across 1U1V at_____°C =_____ohm

Measurement of Hot Resistance of HV Winding after Shut Down.

Time	Resistance

Hot winding Resistance at Ambient Temperature_____°C (from graph) = _____ Ohm

Temperature Rise in H. V. Winding is

$$= \frac{\text{Hot Resistance x(235+Cold Ambient Temperature)}}{\text{Cold Resistance}} - (235+\text{Hot Ambient Temperature}$$

=

=

Results :

1) Temperature Rise in Oil = _____°C

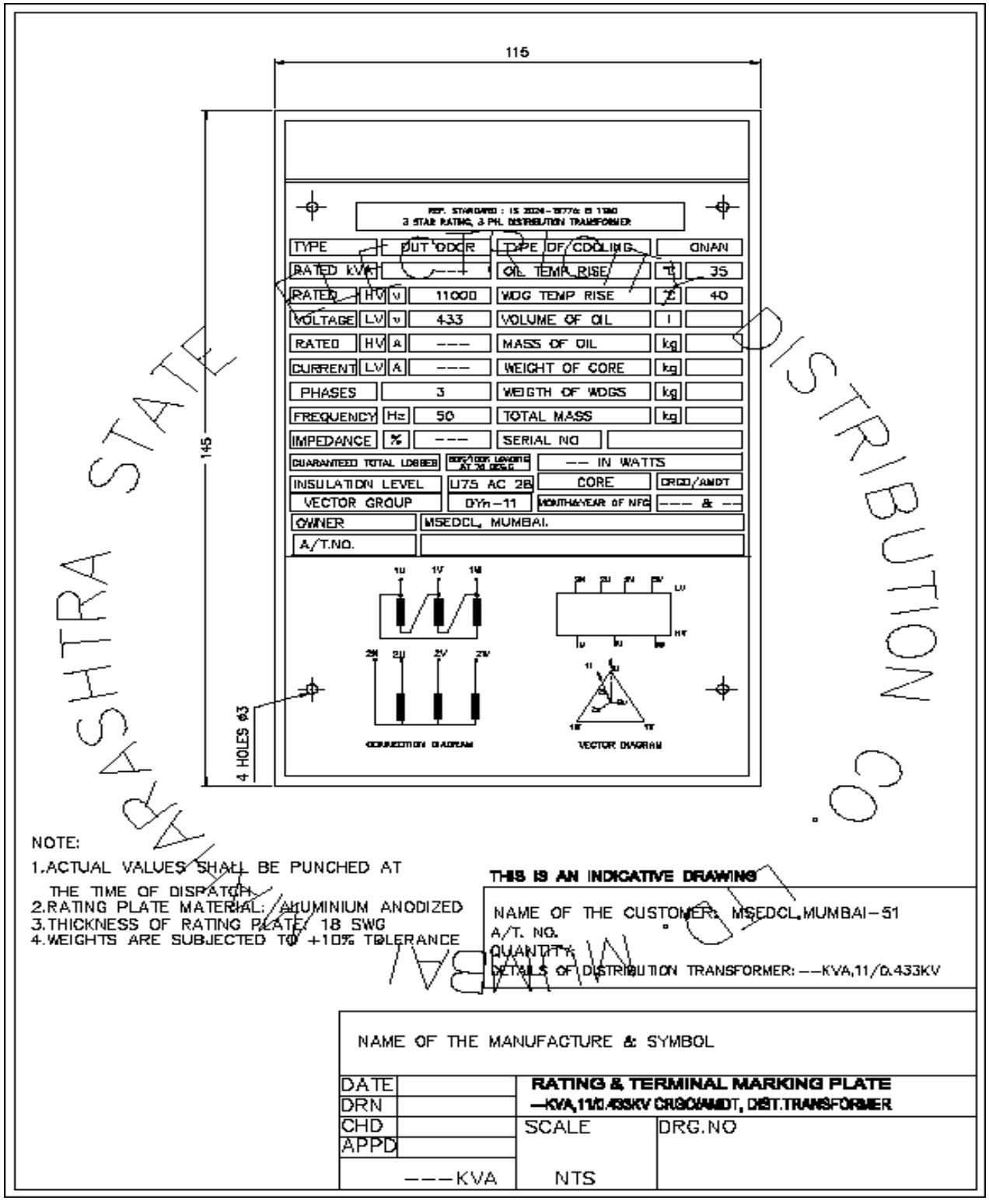
2) Temperature Rise in LV Winding = _____°C

3) Temperature Rise in HV Winding = _____°C

4) Oil leakage test:

The oil leakage test shall be conducted on one unit selected from the offered lot of each rating. Transformer complete in all respects shall be subjected to the pressure of 0.4 kg/cm2 and maintained for 8 hours . No leakage should occur.

Test witnessed by Tested by



NOTE:

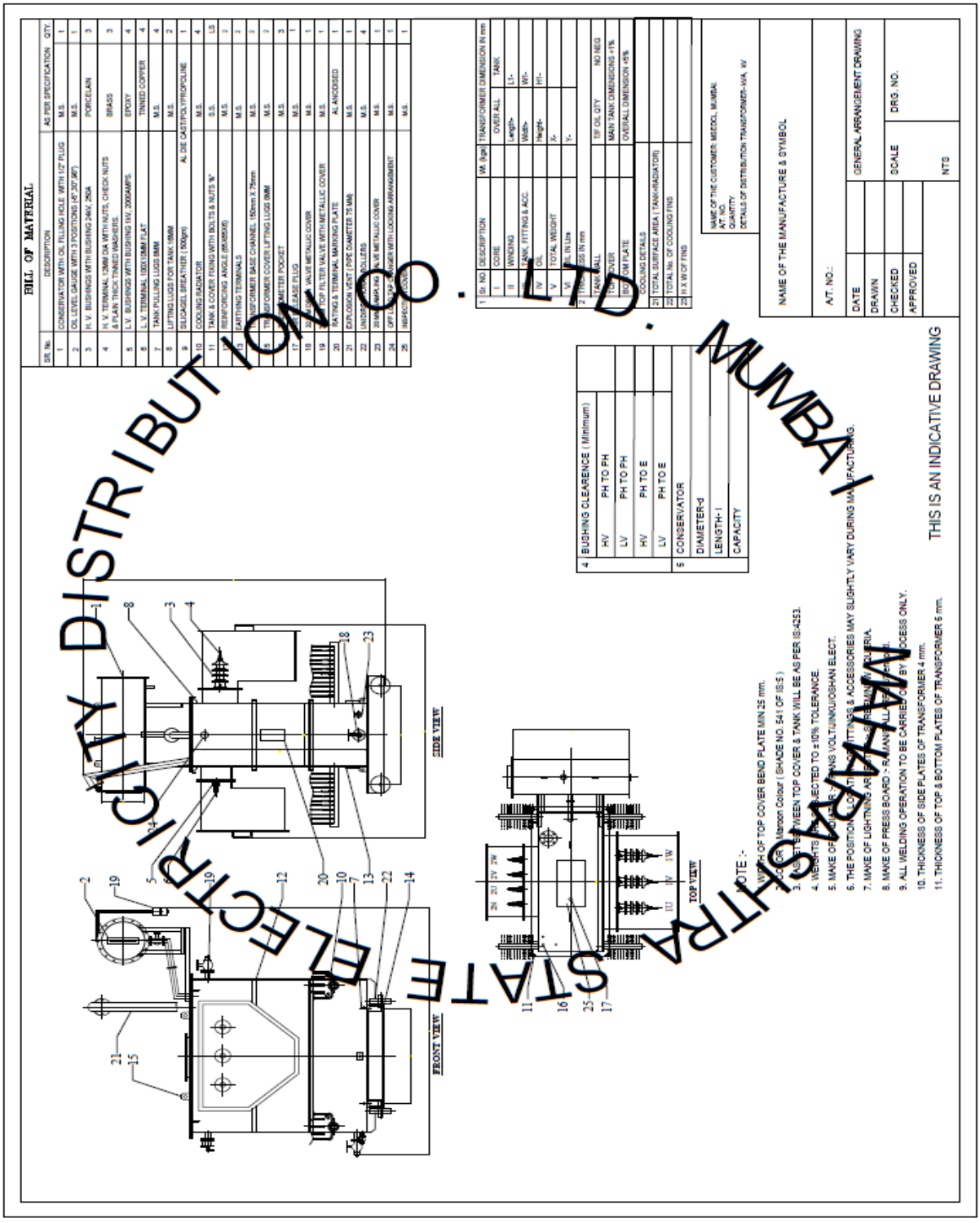
1. ACTUAL VALUES SHALL BE PUNCHED AT THE TIME OF DISPATCH.
2. RATING PLATE MATERIAL: ALUMINIUM ANODIZED
3. THICKNESS OF RATING PLATE: 18 SWG
4. WEIGHTS ARE SUBJECTED TO +10% TOLERANCE

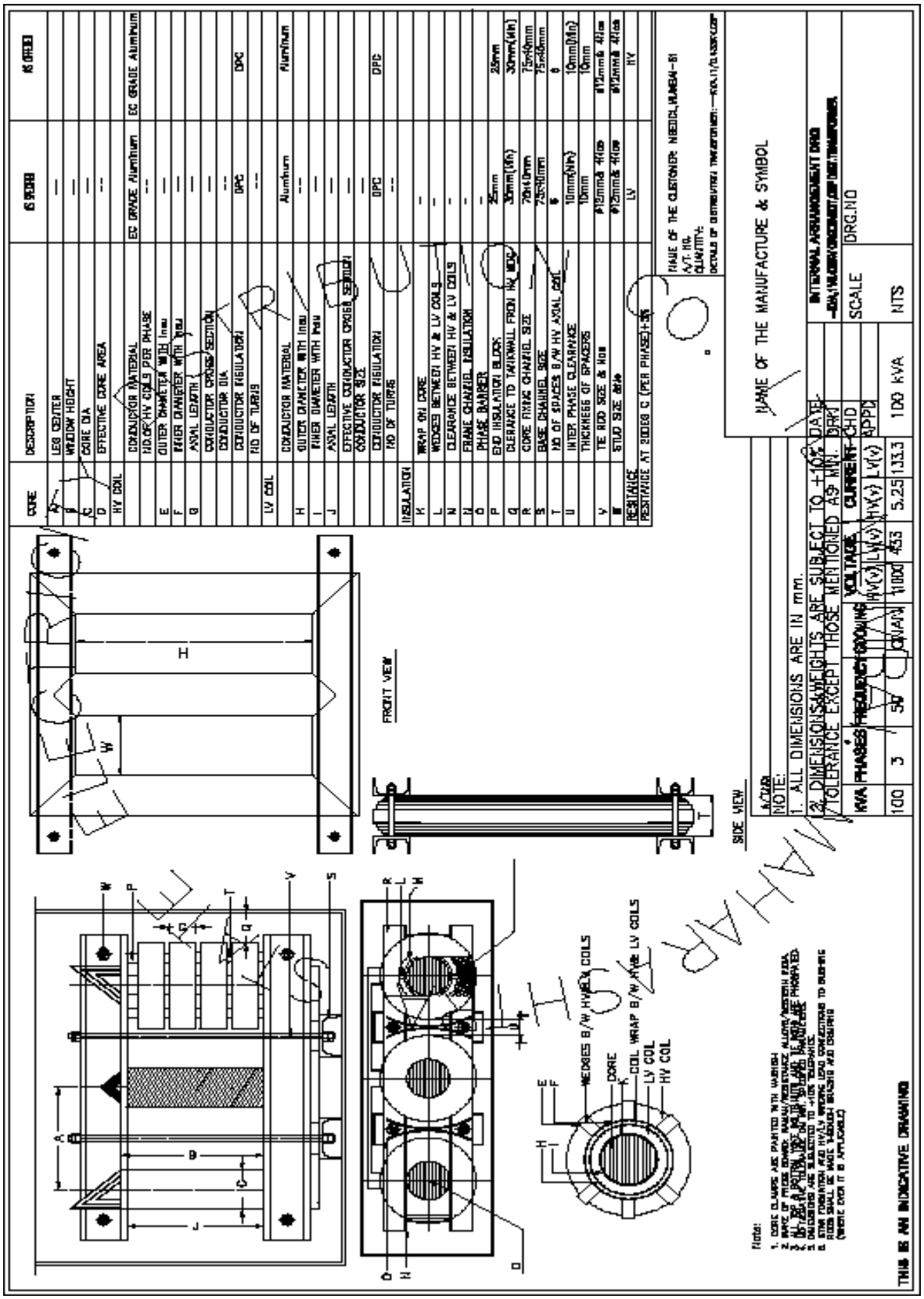
THIS IS AN INDICATIVE DRAWING

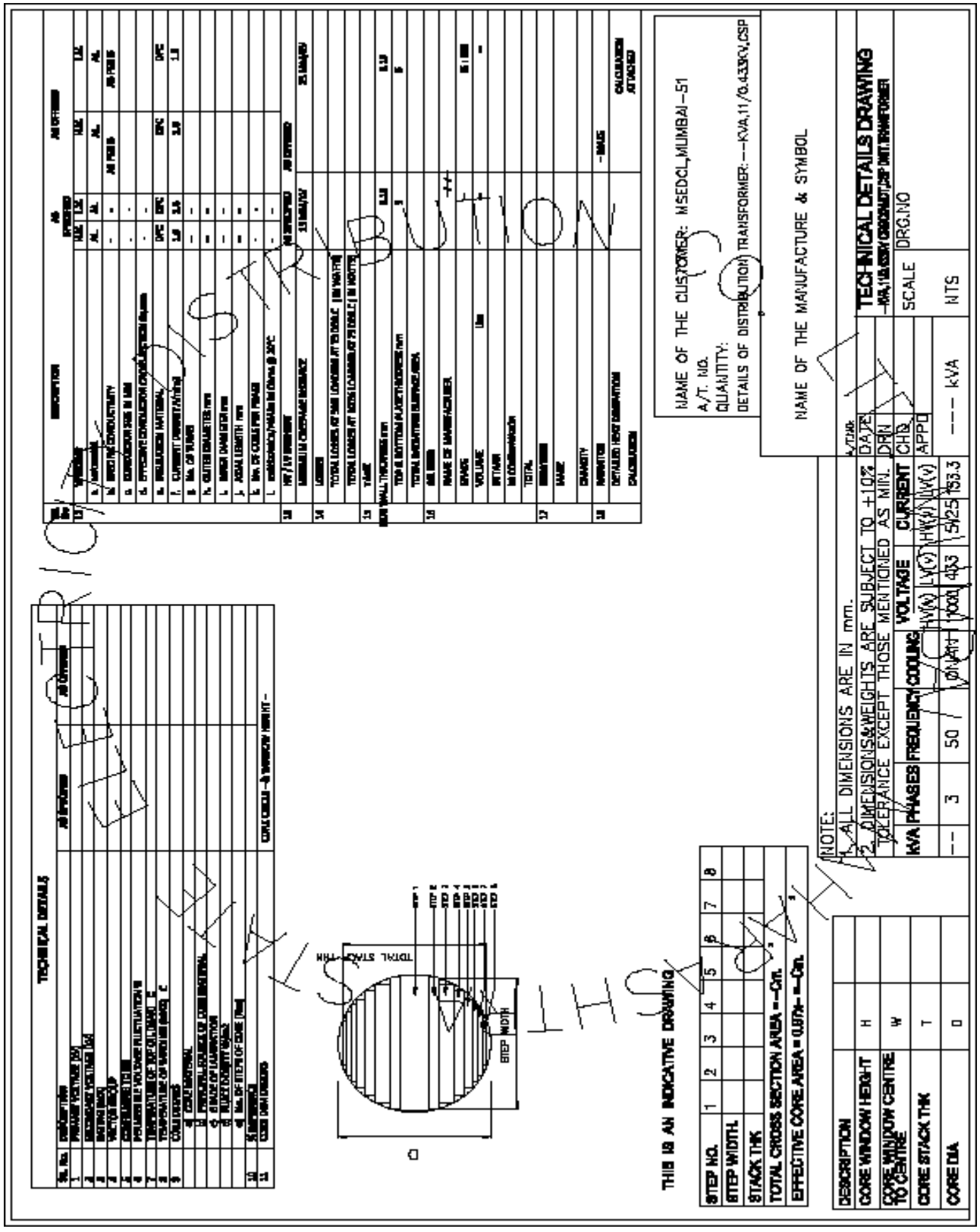
NAME OF THE CUSTOMER: MSEDCL,MUMBAI-51
A/T. NO.
QUANTITY
DETAILS OF DISTRIBUTION TRANSFORMER: --KVA,11/0.433KV

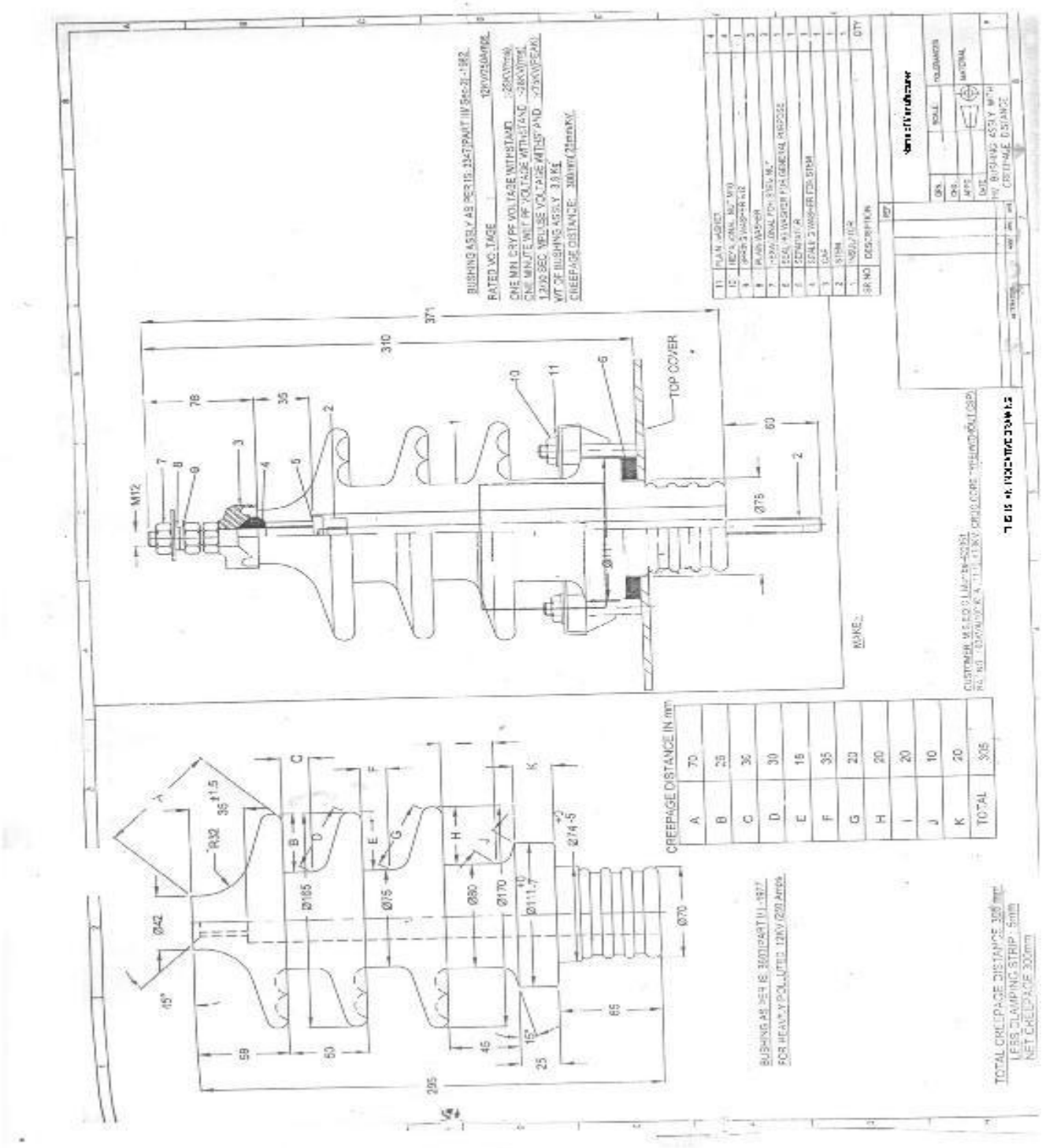
NAME OF THE MANUFACTURE & SYMBOL

DATE		**RATING & TERMINAL MARKING PLATE**	
DRN		**--KVA,11/0.433KV CRGO/AMDT, DIST.TRANSFORMER**	
CHD		SCALE	DRG.NO
APPD			
---KVA		NTS	


BILL OF MATERIAL
Sr. No. | DESCRIPTION | AS PER SPECIFICATION | QTY
1 | CONSERVATOR WITH OIL FILLING HOLE WITH 1/2" PLUG | M.S. | 1
2 | OIL LEVEL GAUGE (WITH 3 POSITIONS (-5°,30°,95°) | M.S. | 1
3 | H. V. BUSHINGS WITH BUSHING 24kV, 250A | PORCELAIN | 3
4 | H.V. TERMINAL CNMM DIA WITH NUTS, CHECK NUTS & FLAT WASHERS (HARDWARE) | BRASS | 3
5 | L.V. BUSHINGS WITH BUSHING 1kV, 2000AMPS. | EPOXY | 4
6 | L.V. TERMINAL 100X10MM FLAT | TINNED COPPER | 4
7 | TANK PULLING LUGS 8MM | M.S. | 4
8 | LIFTING LUGS FOR TANK 16MM | M.S. | 2
9 | BUCHAOLZ BREATHER (500gm) | AL DIE CAST/POLYPROPOLINE | 1
10 | COOLING RADIATOR | M.S. | 4
11 | TANK & COVER FIXING WITH BOLTS & NUTS ¾" | S.S. | LS
12 | REINFORCING ANGLE (65X65X6) | M.S. | 2
13 | EARTHING TERMINALS | M.S. | 2
14 | TRANSFORMER BASE CHANNEL 150mm X 75mm | M.S. | 2
15 | RATING & TERMINAL MARKING PLATE | M.S. | 2
16 | TRANSFORMER COVER LIFTING LUGS 8MM | M.S. | 2
17 | THERMOMETER POCKET | M.S. | 3
18 | DRAIN CASE PLUG | M.S. | 1
19 | FILTER VALVE METALLIC COVER | M.S. | 1
20 | TOP FILTER VALVE WITH METALLIC COVER | M.S. | 1
21 | RATING & TERMINAL MARKING PLATE | ALANODISED | 1
22 | EXPLOSION VENT (PIPE DIAMETER 75 NB) | M.S. | 1
23 | UNIDIRECTIONAL ROLLERS | M.S. | 4
24 | JACKING PAD (M.S. PLATE) | M.S. | 4
25 | OFF LOAD TAP CHANGER WITH LOCKING ARRANGEMENT | M.S. | 1
26 | EARTHING CONNECTOR | M.S. | 1
Sr. No. | DESCRIPTION | Mt. (kgs) | TRANSFORMER DIMENSION IN mm
1 | CORE | | OVER ALL | TANK
2 | WINDING | | Length= | L1=
3 | TANK, FITTING & ACC. | | Width= | W1=
4 | OIL | | Height= | H1=
5 | TOTAL WEIGHT | | X= |
6 | WEIGHT OF CORE WITH COIL IN Lbs | | Y= |
7 | WEIGHT OF CORE WITH COIL IN mm | | |
8 | TANK WALL | | TOP OIL QTY | NO NEG
9 | TOP COVER | | MAIN TANK DIMENSIONS +1% |
10 | BOTTOM PLATE | | OVERALL DIMENSION +5% |
COOLING DETAILS
21 | TOTAL SURFACE AREA (TANK+RADIATOR) | | |
22 | TOTAL No. OF COOLING FINS | | |
23 | H X W OF FINS | | |
4 | BUSHING CLEARENCE (Minimum)
HV | PH TO PH
LV | PH TO PH
HV | PH TO E
LV | PH TO E
5 | CONSERVATOR
DIAMETER=d
LENGTH= l
CAPACITY
NAME OF THE CUSTOMER: MSEDCL, MUMBAI
A/T. NO.:
QUANTITY
DETAILS OF DISTRIBUTION TRANSFORMER= kVA, kV
NAME OF THE MANUFACTURE & SYMBOL
A/T. NO.:
DATE
DRAWN
CHECKED
APPROVED
GENERAL ARRANGEMENT DRAWING
SCALE
NTS
DRG. NO.
THIS IS AN INDICATIVE DRAWING
NOTE :-
1. WIDTH OF TOP COVER BEND PLATE MIN 25 mm.
2. COLOUR : Maroon Colour (SHADE NO. 541 OF IS:5)
3. GASKET BETWEEN TOP COVER & TANK WILL BE AS PER IS:4253.
4. WEIGHTS ARE SUBJECTED TO ±10% TOLERANCE.
5. MAKE OF FITTINGS & ACCESSORIES MAY SLIGHTLY VARY DURING MANUFACTURING.
6. THE POSITION OF LIGHTNING ARRESTER MAY VARY DURING MANUFACTURING.
7. MAKE OF LIGHTNING ARRESTER :- SUPREME / ELPRO / CIRCUITRA
8. MAKE OF PRESS BOARD :- RAMANI / ALTAIR / SHREE
9. ALL WELDING OPERATION TO BE CARRIED OUT BY ARC PROCESS ONLY.
10. THICKNESS OF SIDE PLATES OF TRANSFORMER 4 mm.
11. THICKNESS OF TOP & BOTTOM PLATES OF TRANSFORMER 6 mm.
SIDE VIEW
FRONT VIEW
TOP VIEW
CITY DISTRIBUTION CO. LTD. MUMBAI
STATE ELECTRICITY


CORE
DESCRIPTION
LEG CENTER
WINDOW HEIGHT
CORE DIA
EFFECTIVE CORE AREA
HV COIL
CONDUCTOR MATERIAL
NO.OF HV COILS PER PHASE
OUTER DIAMETER WITH Insu
INNER DIAMETER WITH Insu
AXIAL LENGTH
CONDUCTOR CROSS SECTION
CONDUCTOR DIA
CONDUCTOR INSULATION
NO OF TURNS
LV COIL
CONDUCTOR MATERIAL
OUTER DIAMETER WITH Insu
INNER DIAMETER WITH Insu
AXIAL LENGTH
EFFECTIVE CONDUCTOR CROSS SECTION
CONDUCTOR SIZE
CONDUCTOR INSULATION
NO OF TURNS
INSULATION
WRAP ON CORE
WEDGES BETWEEN HV & LV COILS
CLEARANCE BETWEEN HV & LV COILS
FRAME CHANNEL INSULATION
PHASE BARRIER
END INSULATION BLOCK
CLEARANCE TO TANKWALL FROM HV MOD
CORE FIXING CHANNEL SIZE
BASE CHANNEL SIZE
NO OF SPACES B/W HV AXIAL COIL
INTER PHASE CLEARANCE
THICKNESS OF SPACERS
TIE ROD SIZE & Nos
STUD SIZE &Nos
RESISTANCE
RESISTANCE AT 20DEG C (PER PHASE)+3%
EC GRADE Aluminum
EC GRADE Aluminum
Aluminum
Aluminum
DPC
DPC
DPC
DPC
25mm
30mm(Min)
75x40mm
75x40mm
6
10mm(Min)
10mm
#12mm& 4Nos
#12mm& 4Nos
LV
HV
NAME OF THE CUSTOMER: NBEDCL,MUMBAI-51
A/T. NO.
QUANTITY:
DETAILS OF DISTRIBUTION TRANSFORMER:
NAME OF THE MANUFACTURE & SYMBOL
A/T.NO.
NOTE:
1. ALL DIMENSIONS ARE IN mm.
2. DIMENSIONS&WEIGHTS ARE SUBJECT TO +10% DATE
TOLERANCE EXCEPT THOSE MENTIONED AS MIN. DRN
KVA
PHASES
FREQUENCY
COOLING
VOLTAGE
CURRENT
CHD
APPD
100
3
50
ONAN
1000
433
5.25
133.3
100 KVA
INTERNAL ARRANGEMENT DRG
SCALE
DRG.NO
NTS
FRONT VIEW
SIDE VIEW
WEDGES B/W HV&LV COILS
CORE
COIL WRAP B/W HV& LV COILS
LV COIL
HV COIL
Note:
THIS IS AN INDICATIVE DRAWING


TECHNICAL DETAILS
THIS IS AN INDICATIVE DRAWING
STEP NO.
STEP WIDTH
STACK THK
TOTAL CROSS SECTION AREA = -Cm.
EFFECTIVE CORE AREA = 0.87x = -Cm.
DESCRIPTION
CORE WINDOW HEIGHT
CORE WINDOW CENTRE TO CENTRE
CORE STACK THK
CORE DIA
NOTE:
1. ALL DIMENSIONS ARE IN mm.
2. DIMENSIONS&WEIGHTS ARE SUBJECT TO +10% TOLERANCE EXCEPT THOSE MENTIONED AS MIN.
KVA
PHASES
FREQUENCY
COOLING
VOLTAGE
CURRENT
--- KVA
NAME OF THE CUSTOMER: MSEDCL,MUMBAI-51
A/T. NO.
QUANTITY:
DETAILS OF DISTRIBUTION TRANSFORMER: --KVA,11/0.433KV,CSP
NAME OF THE MANUFACTURE & SYMBOL
TECHNICAL DETAILS DRAWING
SCALE
DRG.NO
NTS


TOP COVER
CREEPAGE DISTANCE IN mm
A 70
B 25
C 30
D 30
E 15
F 35
G 20
H 20
I 20
J 10
K 20
TOTAL 305
TOTAL CREEPAGE DISTANCE 305 mm
LESS CLAMPING STRIP 5mm
NET CREEPAGE 300mm

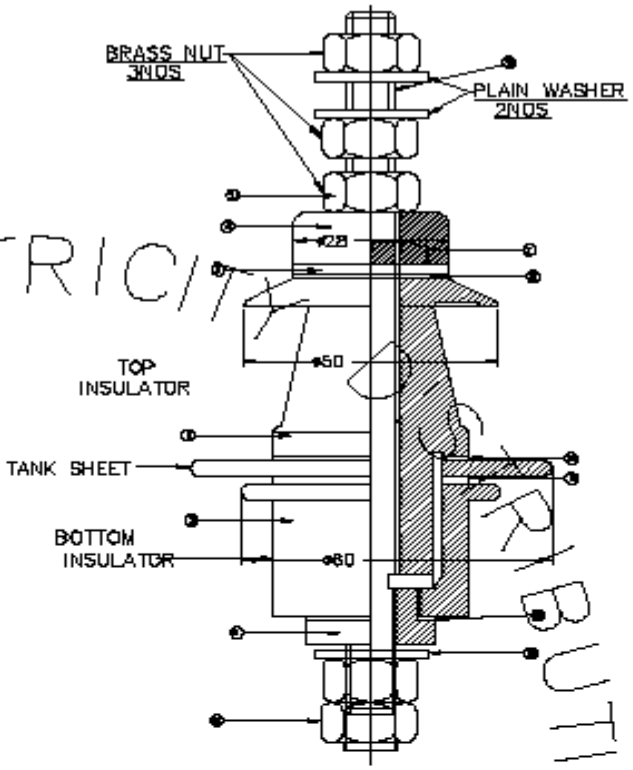
TRANSFORMER BUSHING AS PER IS:3347

ELECTRICAL CHARACTERISTICS:

1. RATED VOLTAGE : 1 KV
2. RATED CURRENT : 250 Amp
3. POWER FREQUENCY WITHSTWND VOLTAGE : 3 KV
4. CREEPAGE DISTANCE : 25 MM. (MIN.)

NOTE:

PERFORMANCE REQUIREMENTS OF THE BUSHING SHALL CONFIRM TO IS: 3347



MAKE: ---/---/---/---

SR. No.	DESCRIPTION	QTY
1	INSULATOR UPPER	1
2	INSULATOR LOWER	1
3	STEM M12	1
4	TOP END WASHER	1
5	STEM WASHER	1
6	BOTTOM NUT	1
7	SEALING WASHER (END)	1
8	SEALING WASHER (PHE-M)	1
9	SEALING WASHER (TYRS-M)	1
10	SEALING WASHER	1
11	HEXNUT-M-12	1
12	HEXLOCK NUT-M-12	1
13	PLAIN WASHER-M-12	1
14	SEALING WASHER (TYPE N)	1

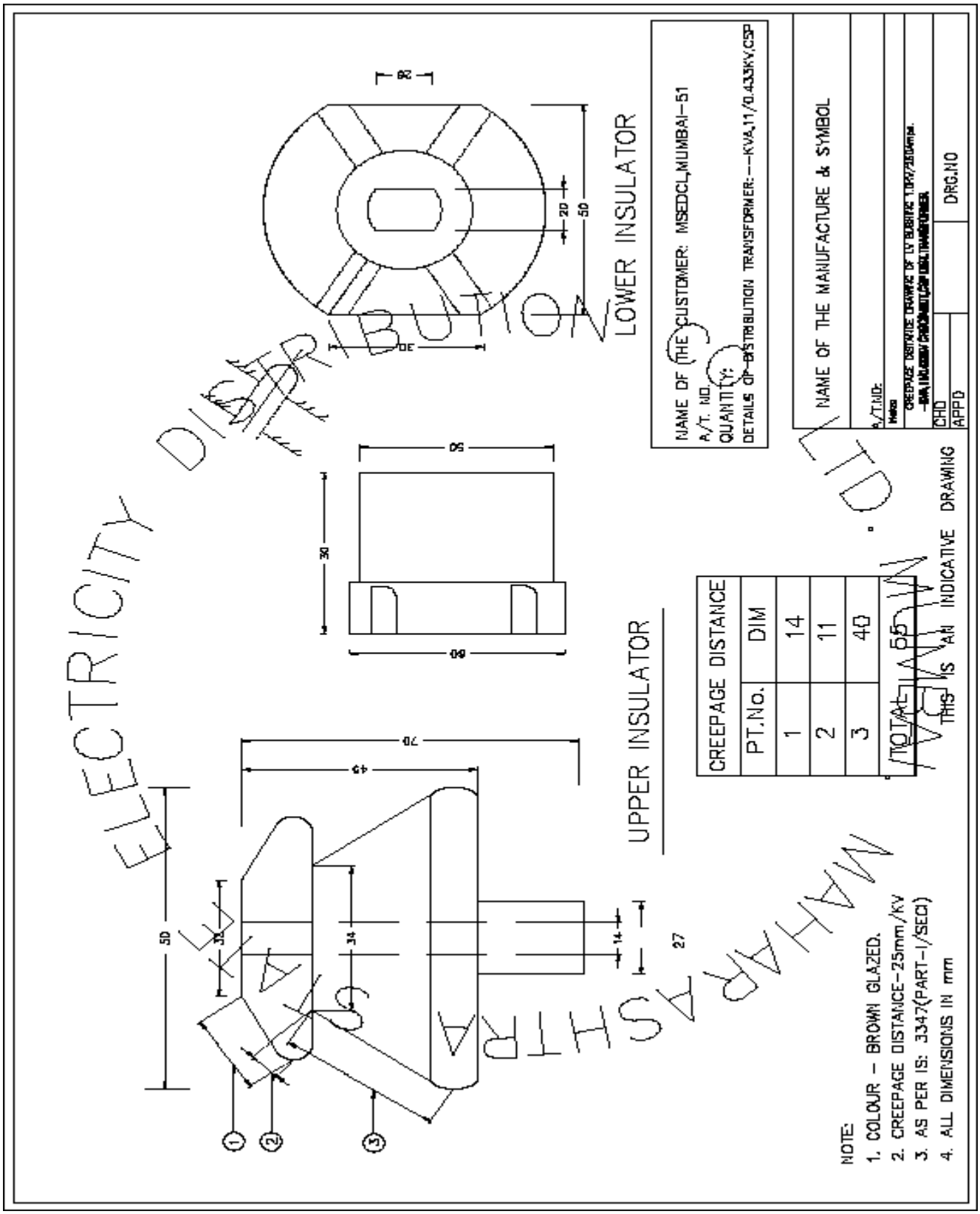
MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD. NOT FOR CONSTRUCTION

NAME OF THE CUSTOMER: MSEDCL,MUMBAI-51
A/T. NO.
QUANTITY:
DETAILS OF DISTRIBUTION TRANSFORMER: 100KVA,11/0.433KV,CSP

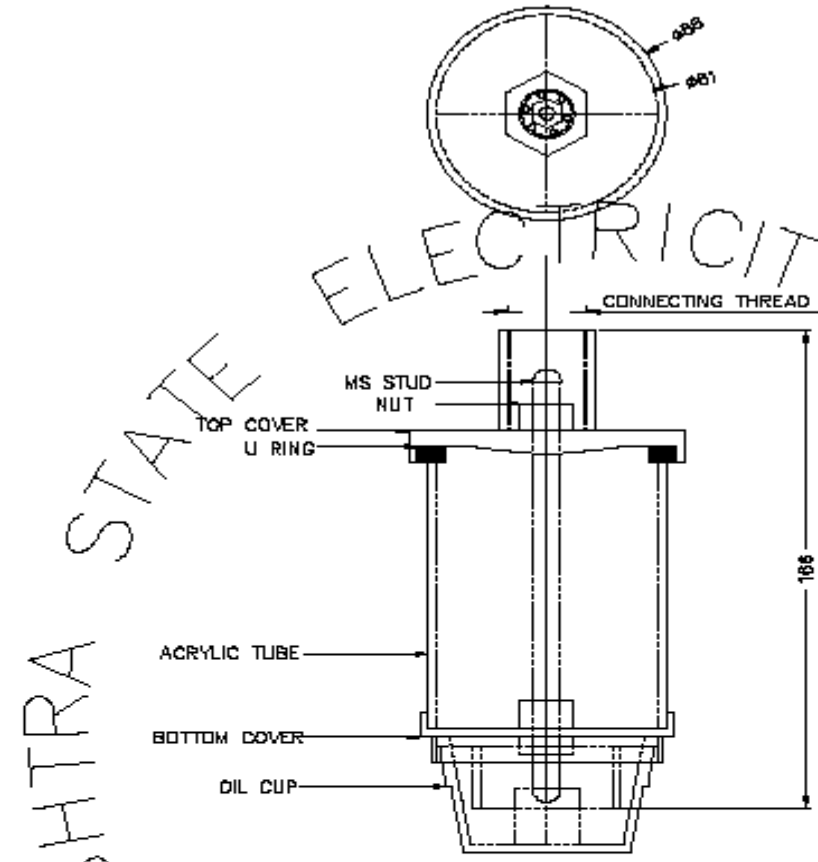
NAME OF THE MANUFACTURE & SYMBOL

A/T.NO:
Note
LV BUSHING ASSEMBLY DRAWING
100KVA,11KV/433V CRGO,CSP DIST.TRANSFORMER
CHD
APPD
DRG.NO

THIS IS AN INDICATIVE DRAWING


ELECTRICITY DISTRIBUTION
MAHARASHTRA STATE
UPPER INSULATOR
LOWER INSULATOR
NAME OF THE CUSTOMER: MSEDCL,MUMBAI-51
A/T. NO.
QUANTITY:
DETAILS OF DISTRIBUTION TRANSFORMER:---KVA,11/0.433KV,CSP
NAME OF THE MANUFACTURE & SYMBOL
A/T.NO:
CHD
APPD
DRG.NO
CREEPAGE DISTANCE
PT.No. DIM
1 14
2 11
3 40
TOTAL 65
THIS IS AN INDICATIVE DRAWING
NOTE:
1. COLOUR - BROWN GLAZED.
2. CREEPAGE DISTANCE-25mm/KV
3. AS PER IS: 3347(PART-I/SEC1)
4. ALL DIMENSIONS IN mm

SILICAGEL BREATHER



MAKE :

SPECIFICATION:

PART NAME	MATERIAL USED
TOP COVER	NYLON
BOTTOM COVER	NYLON
OIL CUP	ACRYLIC

NAME OF THE CUSTOMER: MSEDCL,MUMBAI-51
A/T. NO.
QUANTITY:
DETAILS OF DISTRIBUTION TRANSFORMER: --KVA,11/0.433KV,CSP

NAME OF THE MANUFACTURE & SYMBOL

A/T.NO:

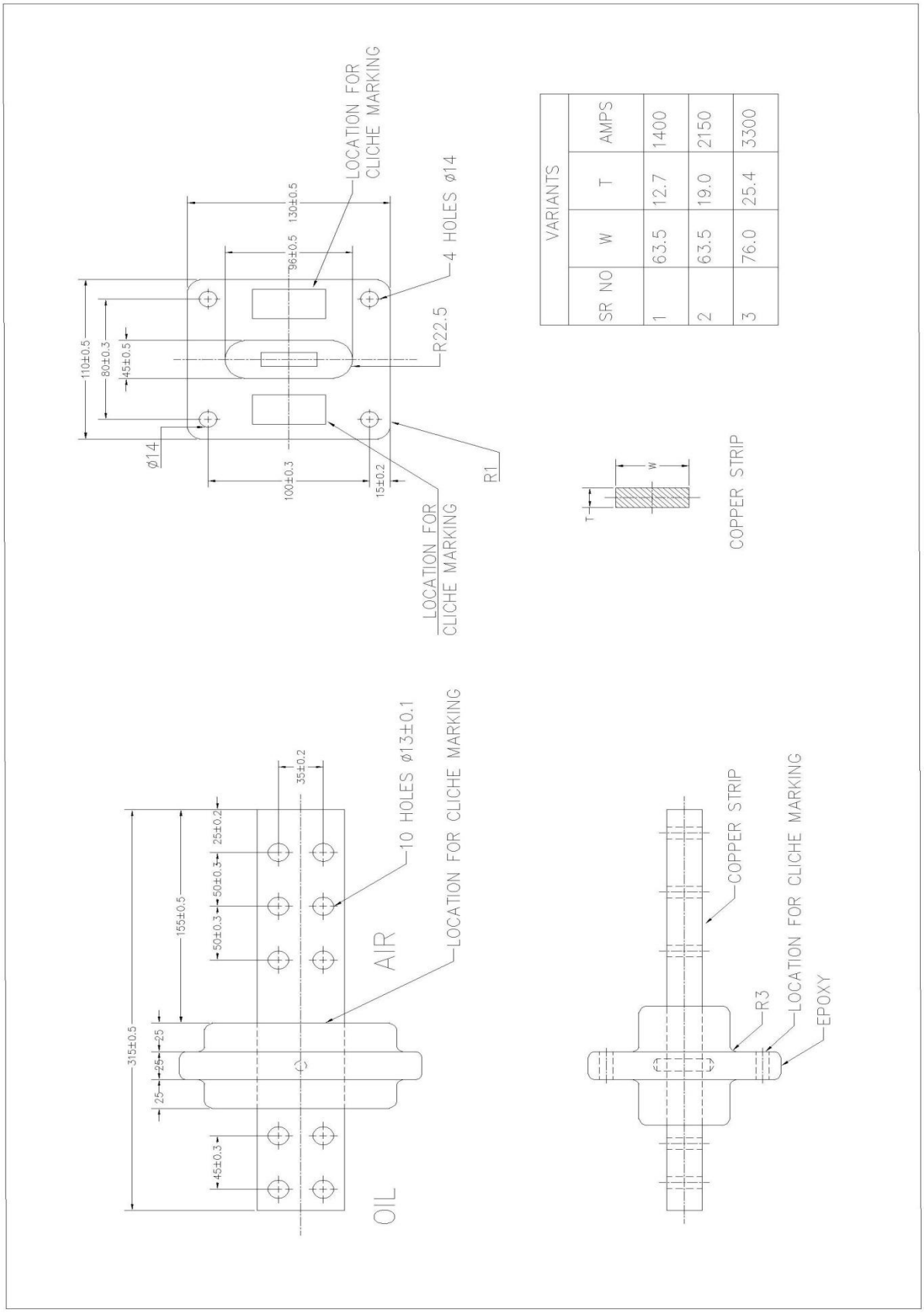
Make:

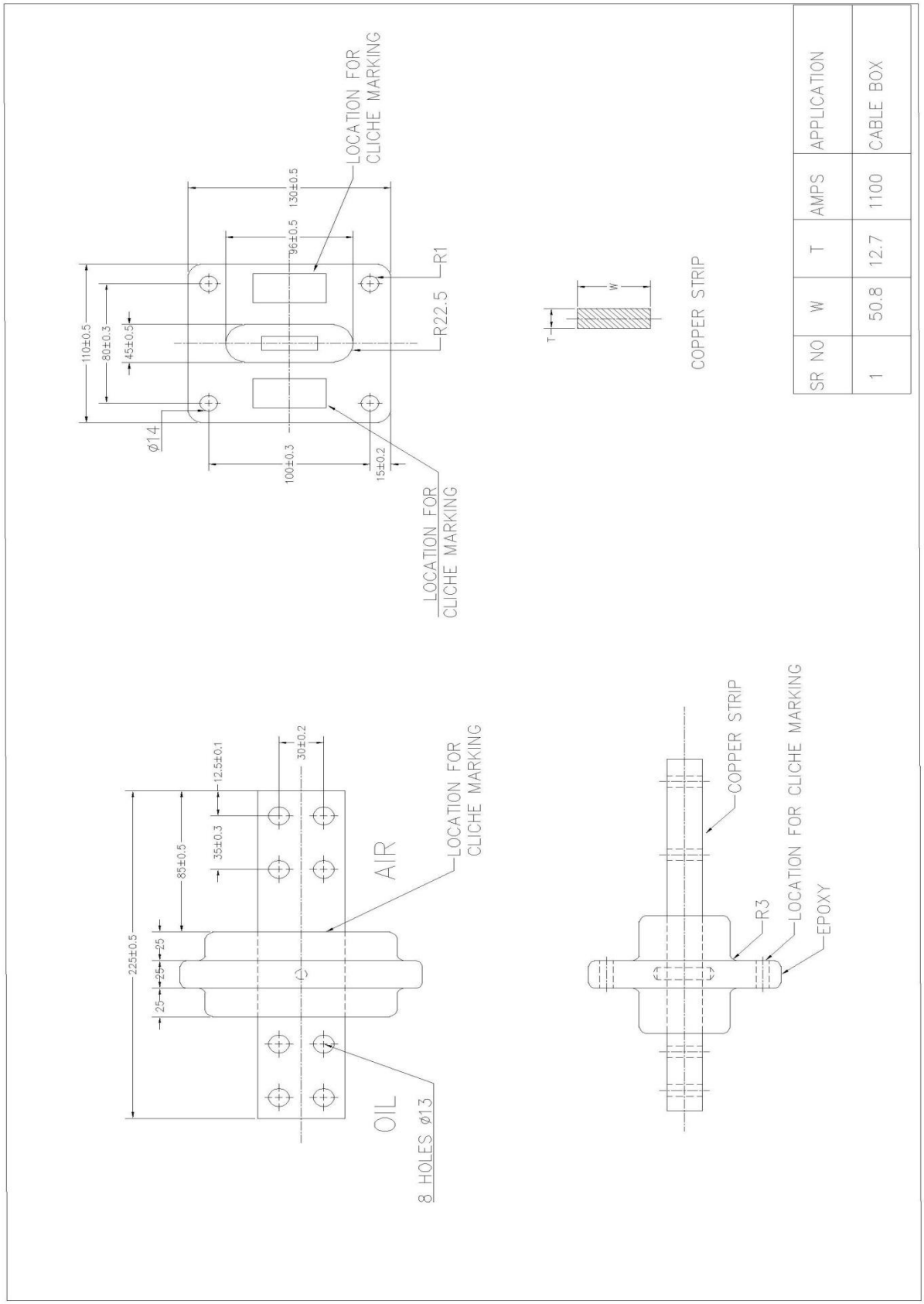
SILICA GEL BREATHER, 250gms

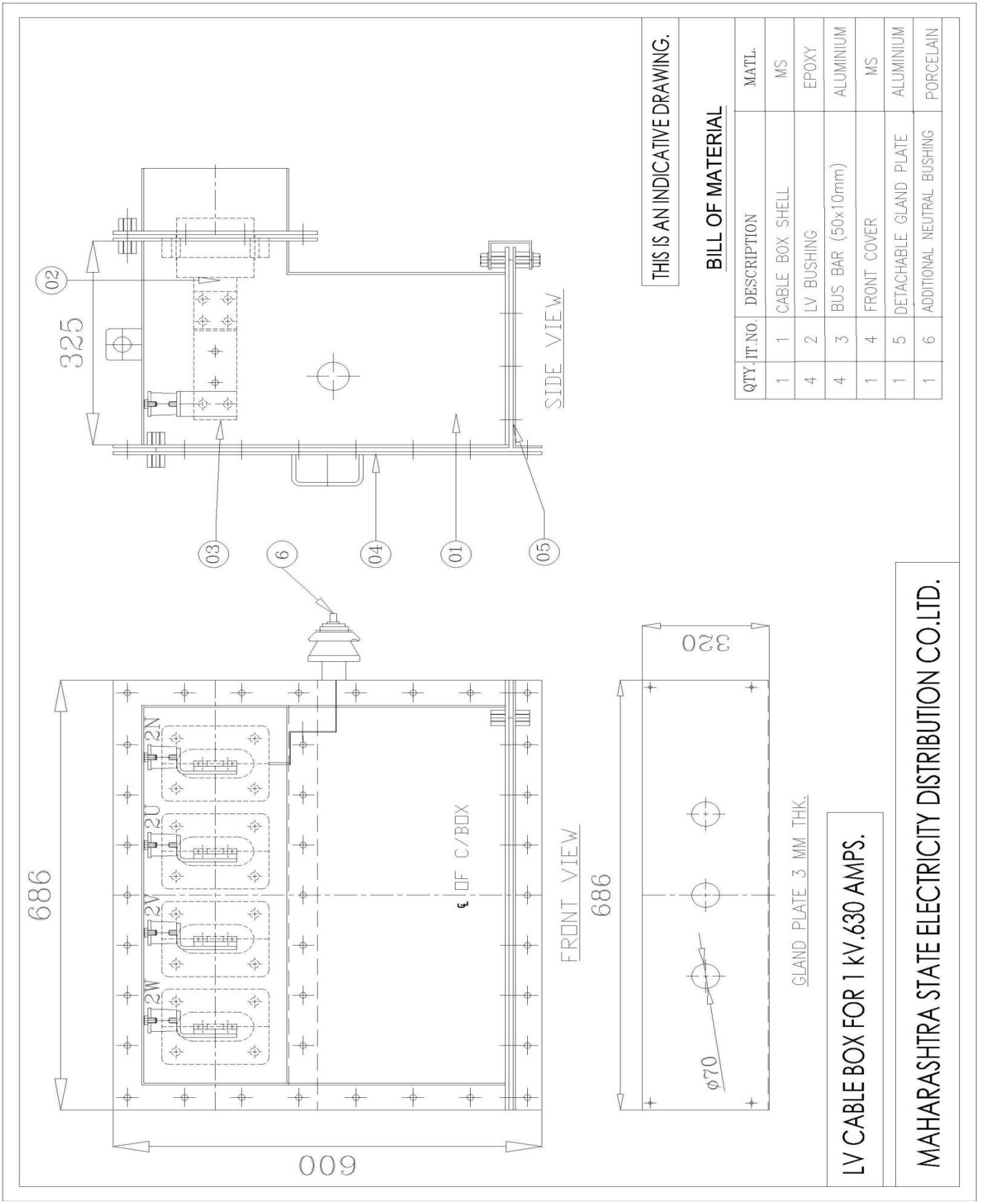
THIS IS AN INDICATIVE DRAWING

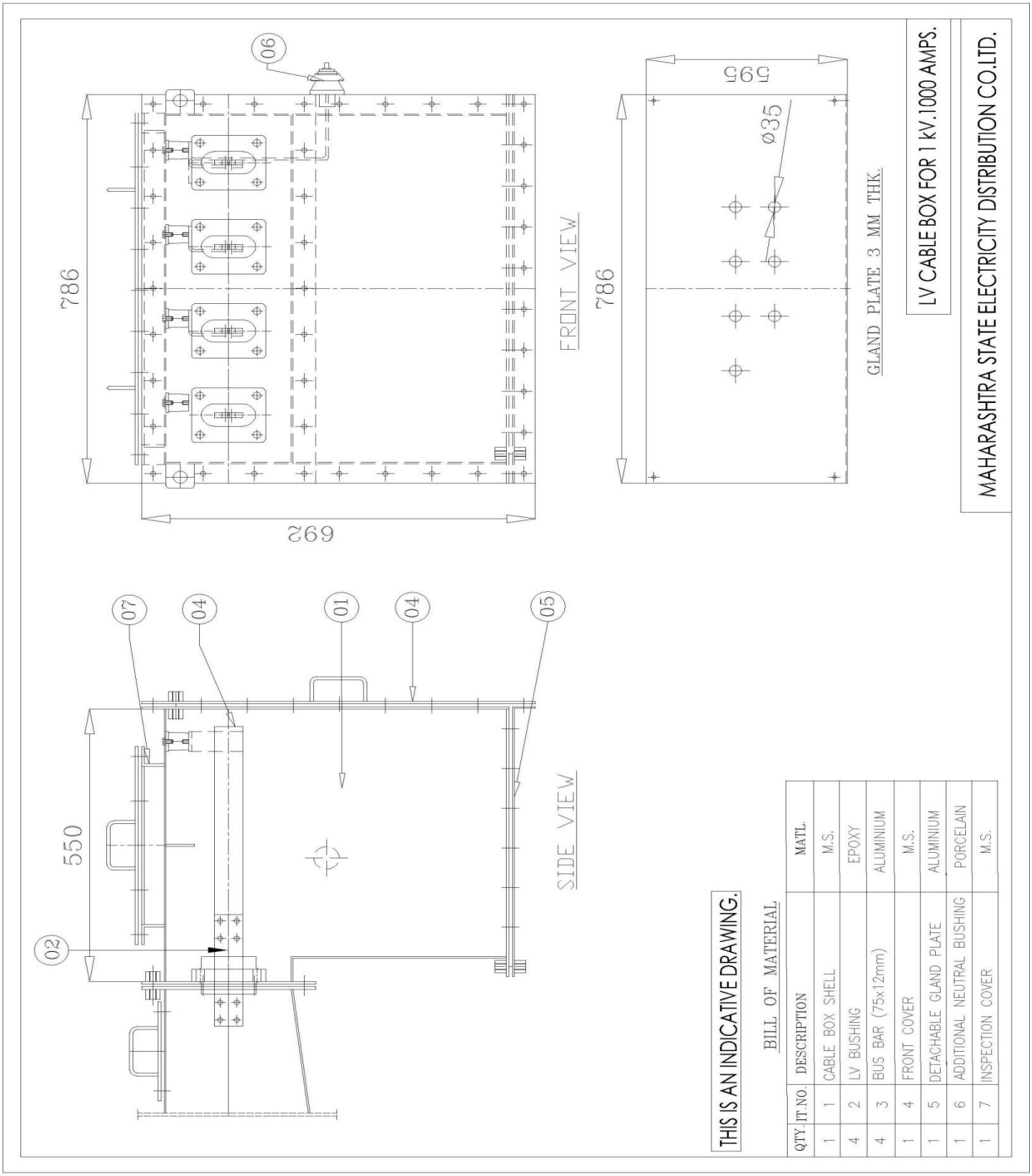
CHD		DRG.NO
APPD		

MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.

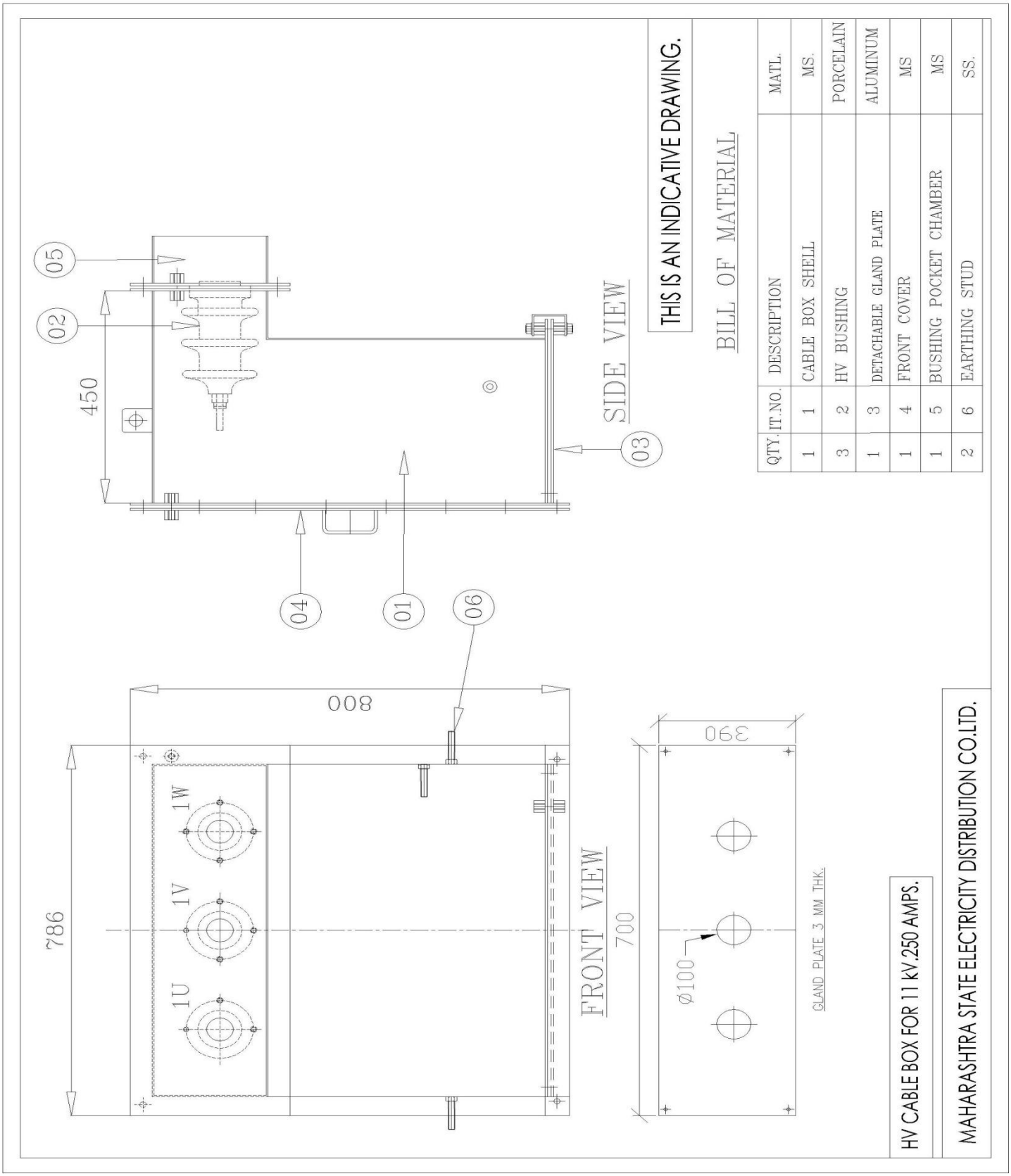

LOCATION FOR CLICHE MARKING
4 HOLES ø14
R22.5
R1
ø14
110±0.5
80±0.3
45±0.5
96±0.5
130±0.5
100±0.3
15±0.2
LOCATION FOR CLICHE MARKING
VARIANTS
SR NO
W
T
AMPS
1 63.5 12.7 1400
2 63.5 19.0 2150
3 76.0 25.4 3300
T
W
COPPER STRIP
10 HOLES ø13±0.1
LOCATION FOR CLICHE MARKING
AIR
OIL
315±0.5
155±0.5
50±0.3
25±0.2
35±0.2
45±0.3
25
COPPER STRIP
R3
LOCATION FOR CLICHE MARKING
EPOXY


LOCATION FOR CLICHE MARKING
130±0.5
96±0.5
R1
R22.5
110±0.5
80±0.3
45±0.5
Ø14
100±0.3
15±0.2
LOCATION FOR CLICHE MARKING
T
W
COPPER STRIP
SR NO | W | T | AMPS | APPLICATION
1 | 50.8 | 12.7 | 1100 | CABLE BOX
12.5±0.1
30±0.2
35±0.3
85±0.5
225±0.5
25
25
25
AIR
LOCATION FOR CLICHE MARKING
OIL
8 HOLES Ø13
COPPER STRIP
R3
LOCATION FOR CLICHE MARKING
EPOXY


THIS IS AN INDICATIVE DRAWING.
BILL OF MATERIAL
QTY. | IT.NO. | DESCRIPTION | MATL.
1 | 1 | CABLE BOX SHELL | MS
4 | 2 | LV BUSHING | EPOXY
4 | 3 | BUS BAR (50x10mm) | ALUMINIUM
1 | 4 | FRONT COVER | MS
1 | 5 | DETACHABLE GLAND PLATE | ALUMINIUM
1 | 6 | ADDITIONAL NEUTRAL BUSHING | PORCELAIN
SIDE VIEW
325
02
03
6
04
01
05
FRONT VIEW
686
600
2N
2U
2V
2W
℄ OF C/BOX
320
686
ø70
GLAND PLATE 3 MM THK.
LV CABLE BOX FOR 1 kV.630 AMPS.
MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.LTD.



QTY	IT.NO	DESCRIPTION	MATL.
1	1	CABLE BOX SHELL	M.S.
4	2	LV BUSHING	EPOXY
4	3	BUS BAR (75x12mm)	ALUMINIUM
1	4	FRONT COVER	M.S.
1	5	DETACHABLE GLAND PLATE	ALUMINIUM
1	6	ADDITIONAL NEUTRAL BUSHING	PORCELAIN
1	7	INSPECTION COVER	M.S.


THIS IS AN INDICATIVE DRAWING.
BILL OF MATERIAL
QTY. | IT.NO. | DESCRIPTION | MATL.
1 | 1 | CABLE BOX SHELL | MS.
3 | 2 | HV BUSHING | PORCELAIN
1 | 3 | DETACHABLE GLAND PLATE | ALUMINUM
1 | 4 | FRONT COVER | MS
1 | 5 | BUSHING POCKET CHAMBER | MS
2 | 6 | EARTHING STUD | SS.
SIDE VIEW
450
05
02
03
04
01
06
FRONT VIEW
800
786
700
1W
1V
1U
390
ø100
GLAND PLATE 3 MM THK.
HV CABLE BOX FOR 11 kV,250 AMPS.
MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.LTD.