MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

100 KVA, 11/ 0.433KV and 22/ 0.433 KV, Star 1 (Level -2) THREE PHASE, OUTDOOR NON SEALED TYPE OIL IMMERSED WITHOUT CSP FEATURE DISTRIBUTION TRANSFORMERS.

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1 Scope:-

1.1 This specification covers design, manufacturing, testing and delivery of **100 kVA, 11/ 0.433 kV & 22/ 0.433 kV, Star 1 (Level-2) three phasedistribution transformers (Non Sealed) without CSP feature oilimmersed, Oil Natural (ONAN)** suitable for 11kV and 22 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 outdoor 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	:	11kV or 22 kV
2.2	Corresponding Highest System Voltage :		12 kV or 24 kV

2.3	Rated Basic Insulation Level	:	75kVp or 125 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.mm
v]	Max. altitude above mean sea level :	1000 trs.
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 markgoverned 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 level 2 (Star 1 of BEE) label approved by BIS (Bureau of Indian Standard) as per IS 1180(Part1):2014

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

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 inparticular, to the following: -

4.4 The applicable standards are as follows:

Sr.No.	IS number	IS name
1.	IS:1180(Part -1) : 2014 Amended up to date	Outdoor type 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/ 1993	New insulating oil - Specification (fourth 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

Sr.No	IS number	IS name
8.	CEA Guidelines August -2008	Manual on transformers
9.	Gazette notification by Ministry of Power dated 16.12.2016	Revised losses of distribution transformer

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

5.0 Specific Technical Requirement

5.1 Standard kVA Ratings: -

The standard ratings for three phase transformer shall be 100 kVA as perIS 1180 (PartI):2014

5.2 Nominal voltage ratings

i] Primary voltage : 11kV OR 22 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 35°C maximum [measured by thermometer in accordance with IS 1180 (Part 1) & IS 2026 (Part2)]

ii] Temperature rise for winding over an ambient temperature of 50° C should be 40° 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 or 22000/433 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 X5 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. Limit of no load current shall be 3% of full load current of respective winding at rated voltage

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 and 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 andgood 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 notbe brittle in case of CRGO material.

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

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 / Varnish.

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 minimum M12 MS Tie rods.

5) Compliance of CRGO Electrical steel as per IS 3024 [as mentioned in Cl.No.9.1(a) of IS 1180(Part1):2014] shall be ensured through test certificate of the supplier.

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.

iv) The purchaser reserves the right to get sample of the core material tested at any Government recognized laboratory.

v) The transformer core shall not be saturated for any value of V/ f ratioto the extent of 112.5% of the rated value of V/ f ratio (i.e. 11000/ 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.

vi) 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.

vii) The No load current at rated voltage shall not exceed the percentage asgiven below.

The no load current of 100 kVA transformer shall not exceed 3% the full load current and will be measured by energizing the transformer at rated voltage and frequency. Increase of 112.5% of rated voltage shall not increase the no load current by 6% of full load current. (As per IS 1180 (Part1):2014)

viii) Number of steps of core shall be minimum of Min. 5 standard steps

6.2 Winding:-

i) Materials: - Aluminum conductor shall be used for HV and LV winding for 100 kVA, 11kV class and Copper conductor shall be used for HV andLV winding for 100 kVA, 22 kV class transformers.

ii) Insulation:- Double paper covered conductor shall be used for HV andLV winding for both 100 kVA, 11 kV & 22 kV transformers.

iii) Current Density: - Current density for HV and LV winding should not be more than 1.3 A/ sq. mm for Aluminum conductor and 2.8 A/ sq. mm for Copper conductor.

iv) L.V. Neutral formation shall be at top.

v) For stack core winding transformers minimum No of HV coils per phase 4for 11 kV class and 6 for 22 kV class and for Wound core typetransformers only one HV coils per phase shall be used.

6.3 Total Losses :

The total losses (no load + load losses at 75 deg. C) at 50% of rated load & total losses at 100% of rated load shall not exceed the maximum total losses values indicated as below:- The indicated losses in the table are for CRGO core only.

Table -1

Maximum Total losses in watts up to 22 kV Class Star 1(Level -2)			
Rating (kVA)	Impedance(%)	50% Load	100% Load
100 kVA, 11/.433 kV	4.5	475	1650
100 kVA, 22/.433 kV	4.5	498	1732

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 biddershould guarantee individual No load losses without any positive tolerance.

The values guaranteed in G.T.P. for flux density, no load current at ratedvoltage, no load current at 100 % & 112.5% of rated voltage and no load loss at rated voltage shall be individually met. The tolerance on Impedance andelectrical 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. The craft paper shall comply to IS 9335 [Cl.No.9.1(d) of IS 1180 (Part 1):2014] and for press board shall comply toIS 1576 [Cl.No.9.1(e) of IS 1180 (Part 1):2014] and Gaskets shall be ensured through test certificate of the supplier.

(ii) 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 40mm 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.

(iii) External Clearances: Minimum external clearances of bushing terminals:

		11 kV	22 kV
HV	Ph to Ph	255 mm	330 mm
	Ph to E	140 mm	230 mm
LV	Ph to Ph	75 mm	75 mm
	Ph to E	40 mm	40 mm

(iv) Thickness of locking spacers between HV coils – 10 mm minimum.

(v) No. of Axial wedges between LV and HV winding equispaced around LV –8 for100 kVA transformers

6.5 Impedance Value –

The percentage impedance at 75 º C. for different ratings shall be as perTable –1 above.

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 Corrugation panel shall be used for cooling. The transformershall be capable of giving continuous rated output without exceeding the specified temperature rise. Bidder shall submit the detailed calculation sheet along with offer. The safe guard angle

frame 50X50X5 mm shall bewelded 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 not be 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: 3.15 mm. (min.)

Top and bottom plate thickness :5 mm. (min)

Tolerance shall be applicable as per IS 1852

a) The permanent deflection of flat plates after pressure / vacuum has been released; shall not exceed the values given below.

Horizontal length of flat Plate	Permanent deflection
Up to and including 750 mm	5.0 mm
751 to 1250 mm	6.5 mm

6.6.4 The tank shall be reinforced by welding the angle of size 50X50X5 MM on allthe outside walls of tank to form two equal compartments

6.6.5 When transformer tank without oil is subjected to air pressure of 80 KPa above atmospheric pressure for 30 min as per IS 1180 (Part 1):2014 , the pressure test shall be performed carefully as per IS 1180 (Part 1):2014 Clause no.21.5. 1 at the time of manufacturing only to confirm the adequacy of reinforcement angle and gauge of the tank

6.6.6 All welding operations t o be carried out by MIG process (Metal Inert Gas Welding)

6.6.7 Lifting lugs:

2 nos. of welded heavy duty lifting lugs of MS plate of 8 mm (minimum) thickness suitably reinforced by vertical supporting flat of same thickness asof lug welded edgewise below the top cover on the side wall shall be provided They shall be so extended that cutting of bend plate is not required. Further 2 nos. of welded heavy duty lifting lugs of MS plate of 8 mm thickness should be on the top plate of transformers

6.6.8 Pulling lugs:

4 nos. of welded heavy duty pulling lugs of MS plate of 8 mm thickness shallbe provided to pull the transformer horizontally

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

a) Size 12 mm or below—stainless steel

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 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.

6.6.10 Vertical clearance

The height of the tank shall be such that minimum vertical clearance up tothe top cover plate of 120 mm is achieved from top yoke

6.6.11 The transformer tank shall be of adequate mechanical strength to withstand positive and negative pressures built up inside the tank whilethe 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 250 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. 1.1

6.6.14 Thermometer pocket if any mu st be located at centre of top cover or high side of tank height for true valve of max top oil temperature

6.6.15 Air release plug if any must be placed at top cover of explosion vent pipe, testing at l kg/ sq.cm carried out on sample at first lot to know correct material used for diaphragm and it must burst before pre-determined pressure

6.6.16 QR code laminated P touch labels shall be fixed on transformer tank body below the name plate depicting various technical details such as Name ofmanufacturer, rating, Serial no, date of manufacturing, A/T No. etc. The technical details are attached as Annexure – P

6.7 Off Load Taps:

No taps are required to be provided for 100 kVA ratingtransformers

7. Efficiency:

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

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

8. Heat Dissipation

a. Heat Dissipation by tank walls excluding top and bottom plates shouldbe 500 Watts/ Sq. meter

b. Heat dissipation calculation should be based on maximum measuredtotal loss i.e (No load at rated excitation + load loss at 100% Loading converted to 75 deg' C reference temperature) shall be supplied duringtemperature rise test

KVA rating	Oil in liters (exclusive of oil absorbed in core & coil assembly)	Permissible oil absorption (in liters)
100KVA, 11/0.433 kV	190	7
100KVA, 22/0.433 kV	200	7

c. Fins type radiators 1.25 mm thick shall be used. The tender shouldsubmit the heat dissipation calculations with the offer

d. 2nos of radiators shall be provided on HV side and should be fixed at right angle to the sides and not diagonally. The size of radiators shall cover at least 50% of the bottom yoke, full core and top yoke

9. 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 whicheveris more.

Note: Transformer shall be supplied complete with first filling of oil up to the mark indicator level of conservator. Detailed calculation of absorption should be submitted with offer.

10. 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 should be 25 to 50 mm and it should be project into the conservator in such way that its end is approximately 20 mm above the bottom of the conservator so as to create a sump for collection of impurities. The minimum oil level (corresponding to (-) 5 deg.) should beabove the sump level. [Refer Cl.no.16.3 of IS 1180 (Part1):2014]

d. There shall be minimum -5 deg, normal 30 deg. and maximum 98 deg.marking on oil gauge indicator of the conservator

e. The pipe of conservator tank shall have slopping flap so that the oil falling from the pipe shall not fall on the active job and shall fall on the side wall only.

f. The conservator tank shall be provided with drain plug and a fillinghole (30 mm) with cover.

11. Breather

a. The material used for Breather shall be only of Poly propylene and jointsshould be screwed type

b. The dehydrating agent shall be Silica gel confirming to IS 3401. The volume of breather shall be suitable for 250 gm up to 100 kVA transformers. 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. (Testing & QC).

12. Terminals:

a. On H.V. side the bimetallic connector to be provided with lug of suitablerating

b. The rating of brass rod & copper rod for H.V. & L.V. terminals shall be as per relevant IS for different capacity of Transformer. [Following (d) and (e)are indicative and shall be confirmed with relevant IS)

c. Brass rods 12 mm. diameter for HT with necessary nuts, check -nutsand plain thick tinned washer

d. Tinned Copper Rods of 12 mm diameter for 100 kVA of LT extension with suitable cable lugs, necessary nuts, check-nuts and plain thick tinned washer

13. Bushings:

(i) The transformers shall be fitted on high voltage and low voltage sides with outdoor type bushings with appropriate voltage and current ratings as per IS 3347 (part IV) . The HV bushings (3nos.) shall be provided with R -Y-B colour coding marking & shall conform to IS 2099. The low voltage bushings (4 nos.) shall conform to IS 7421. Alternatively, the low voltage side may be made suitable for adoption of XLPE cables of suitable size. The dimensions shall conform to IS 1180(Part 1): 2014 clause no. 10.1.5. Lugs suitable forLT XLPE 3.5 Core, 120 sq.mm cable shall be provided

(ii) The LV bushing 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. [Refer Cl.no.10.1.3 of IS 1180(Part1):2014].

(iii) Gaskets shall be made of synthetic rubber or synthetic rubberized cork resistant to hot transformer oil or **Nitrile Rubber**. [Refer Cl.no.10.1.4 of IS 1180 (Part1):2014]

(iv) The dimensions of the bushings of voltage classes shall confirm to Cl. No 10.1.5 of IS 1180 (Part1):2014

(v) For 11kV class transformers 12 kV rating and 22 kV class transformers 24 kV rating Bushings, 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 p er relevant IS:3347 (part IV) amended up to date. HV bushings shall be mounted on the top of the transformer tank & LV bushings shall be mounted on side of the transformer tank.

(vi) HV bushings shall be mounted on curvature shaped embossed plate and not on welded M.S ring. Supporting clamps for LT cable should be provided to avoid the weight of cable on the Bushing.

(vii) The minimum creepage distance for both HV & LV Bushings shall not be less than 25 mm per kV

(viii) Compliance of bushing as per IS 2099 / IS 7421 and relevant part of IS3347 shall be ensured through test certificate from the supplier of transformer manufacturer firm getting the same tested from BIS recognized / group 2 category of laboratory.

(ix) Supporting clamp for cable should be provided to avoid weight of cable on the bushing/ bushing rod.

14. Internal connections:

(i) **H.V. Winding:**

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

ii. Inter coil connection shall be by crimping and brazing

iii. In case of Aluminum / Copper winding Delta joints shall be with crimping and Brazing only

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

(ii) L.V. Winding

i. L.T. Star point shall be formed of Aluminum/ copper flat of sufficient length. Lead from winding shall be connected to the flat by crimping and brazing

ii. 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

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

15. Tank base channel / Mounting Arrangement:

The under-base of the transformer shall be provided as per clause 14.1 of IS1180(Part1):2014

16. Terminal Marking Plates and Rating Plates:

a. All Transformers HV terminals shall be provided with 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 thetransformer which shall conformed to latest 1S -2026 (part- IV)

b. Each Transformer s hall 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 anodize d material sheet in a visible position. The entries of the rating plate shall be indelibly marked (i.e. by etching, engraving or stamping)

e. Marking as `M.S.E.D.C.L' and `Sr. No.' of transformer shall be engravedon 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 firmlywelded to main tank and shall form integral part of the tank

g. The distribution transformer shall be marked with the Standard Mark. The use of Standard Mark is governed by the provisions of the Bureau ofIndian Standards Act, 1986 and the Rules Regulations made there under.

h. In addition to the BIS certification mark license No. (a seven digit number) represented as CM/ L xxxxxxx shall be clearly & indelibly marked on the rating plate as per the norms of BIS. The width to height ratio of ISI symbol shall be 4:3.

i. The copy of valid ISI license shall be submitted in support with the biddingdocument.

j. Each transformer shall be provided with rating plate having marking as per Cl.no.13 of IS 1180 (Part 1): 2014 clearly indicating maximum total losses at 50% rated load in watts and maximum total losses at 100% rated load in watts.

k. Following details shall also be given on the rating plate as per Fig.1 of Cl.no.13.1 of IS 1180(Part 1): 2014 and terminal marking plate with diagram shall be in accordance with Cl.no.13.2 of IS 1180(Part 1): 2014.

   (i) ISI Mark.

   (ii) Energy Efficiency level as approved by BIS

(iii) Order No. – Month & year.

(iv) Sr. No. of transformer.

(v) Date of manufacturing – Month & year.

(vi) Date of expiry of guarantee period – month & year.

(vii) Maximum guaranteed 50% load loss & 100 % load loss figures.

(viii) Name and full address of the manufacturer.

(ix) Capacity.

(x) Rating.

(xi) % Impedance

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

17. Fittings & Fastners:

17.1 The following standard fittings shall be provided

1	Rating and diagram plate	1 no.
2	Earthing terminals with lugs.	2 nos.
3	Lifting lugs	4 nos. (2 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 (20 mm).	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 (only for 22kV transformers)	1 no
11	Silica gel breather 250 gm	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 : Minimum (-) 5 deg.C Normal 30 deg.C Maximum 98 deg.C	1no
14	HV & LV Bushing and terminal connectors	3 nos. of HV bushing and 4 nos. of LV bushing shall be provided with 3 nos. of brass nuts and 2 plain brass washers.
15	Radiators (only fin type)	As per Cl. No. 8 (b)
16	Lightening Arrestors for HV bushings	3 nos.
17	Pulling lugs	4 nos.
18	years guarantee plate	1 no.
19	Filter valve (32 mm dia.)	1 no.
20	Anti-theft stainless steel fasteners with breakaway nut at top cover	4 nos.

17.2 Any other fitting necessary for satisfactory performance
The fittings shall be provided in accordance with Cl no. 20.1 (a to v) & Cl no. 20.2 Optional fittings of IS 1180 (Part1):2014 (if required)

17.3 **Fasteners.**

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

1. Bolts or studs shall not be less than 6 mm in diameter except when used for small wiring terminals.
2. All nuts and pins shall be adequately locked.
3. 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.
4. All ferrous bolts, nuts and washers placed in outdoor 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.
5. 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

6. The length of screwed portion of the bolt s shall be such that no screw thread may form part of a sheer plane between members.
7. Taper washers may be provided where necessary. Protective washers of suitable material shall be provided front and back of the securing screws.
8. LT side should be of Pad type terminal

18. Lightening Arrestors:

The Lightening Arrestors (Disconnector type) of high surge capacity of 9kV , 5kA for 11kv class (8/ 20 micro wave shape) and 18 kVrms, 5 kA (8/ 20 micro wave shape) for 22 kV class transformers conforming to IS: 3070/ 1 993 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 only

19. 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 toIS : 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 passivatoradditives 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 individualcompound.
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 additivesand 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. 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:

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(Part1)].

c) Measurement of short circuit impedance (principal tapping, when applicable) and lo ad 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) Air Pressure test

i) Oil leakage test

All the above routine tests shall be carried out by the Inspecting Officer on the 10% quantity of the lot offered for inspection at the factory premises

20.2. Type Tests:

The following shall constitute the type tests:

a) Lightening impulse test chopped on tail [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.C reference temperature) at 100 percent loading shall be supplied during temperature rise test.

c) Dynamic Short -circuit withstand test [IS 2026 (Part 5)].

d) Air Pressure test.

20.2.1 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

20.2.2 The bidder shall submit the type test report of transformer, Oil & HV/ LV bushings as per relevant IS along with his offer

20.3. The type test reports submitted with the offer shall be got approved from CE(Testing & QC) as per tender terms & conditions

a) Special Tests (to be conducted on one unit): -

The following shall constitute the special tests.

b) Determination of sound levels [IS 2026 (Part 10)].

c) No load current 112.5 % voltage [refer clause 7.9.2 of IS 1180(Part 1): 2014].

d) Paint adhesion tests: The test is performed as per ASTM D 3359(Standard Test Methods for measuring adhesion by Tape Test).

e) BDV and moisture content of oil in the transformer (IS 335).

Note: Tests at (c) and (d) may be carried out on more than one unit

20.4 **Pressure and Oil leakage Test**

20.5.1 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 250 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

The type test shall be submitted by the supplier at the time of offer and shall be got approved from MM Cell as per terms & conditions of tender

20.5.2 **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 thetank for 10 min. There should be no leakage at any point

b) Corrugated tanks:

The corrugated transformer tank shall be t ested for air pressure of 15 kPa above atmospheric pressure maintained inside the tank for 10 min. There should be no leakage at any point.

All the above routine tests shall be carried out by the Inspecting Officer on the sample transformer from the lot of fered for inspection at the factory premises

20.1.3. Oil leakage Test (routine Test) :

The assembled transformer for non -sealed and sealed type with a l l 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.

The above routine test shall be carried out by the Inspecting Officer on the sample transformer from the lot offered for inspection at the factory premises

21. Type Tests report submission:

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

1) If above tests are carried out beyond 5 years.

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

3) 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 bidders have to carry out the type tests at the laboratories accredited by NABL before commencement of supply and get it approved from the CE (Testing & QC). No extension in delivery period shall beentertained on this account.*

21.2 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

22. Drawings, Manual & Calculation sheet:

22.1 A set of following drawings with all dimensions shall be submitted by theBidder along with the offer

(i) General Dimensional drawing.

(ii) Core Assembly drawing.

(iii) Internal Construction Drawing.

(iv) Technical Detail draw ing.

(v) Rating & Diagram Plate Drawing.(As per Cl.no.13.1 Fig.1 of IS:1180(Part1):2014

(vi) HV& LV Bushings Assembly drawing

(vii) Creepage distances distance drawing of HV& LV Bushing

(viii) Operation and Maintenance Manual.

(ix) Silica gel Breather drawing.

(x) BEE star label drawing

(xi) Calculation sheet for flux density

(xii) Heat dissipation calculation

(xiii) Oil absorption calculation

22.2 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

22.3 The bidder should not change design once offered as per A/ T, approved drawings and Type Test Reports

22.4 The successful Bidders shall submit complete set of Drawings (as listed in Cl.No.23.1) of transformer in triplicate indicating dimensions to MM Cell forapproval and get approved it as per terms & conditions of tender

23. Rejection :

23.1 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 not carried out as per clause no. 2 0.2 & 20.3 of the specification.

iv. Drawings 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 not submitted as per clause no.8.0 of the specification.

24. Cleaning and Painting:

24.1 (a) For Thermo setting powder paint: Deleted

(b) For Liquid paint:

Hot oil resistant paint / varnish with one coat inside the tank and Outside of the transformer, one coat of Epoxy primer (minimum 35/ 10 micron) followed by two coats (minimum 25 micron each) of Polyurethane (finish coat). The total dry film thickness as mentioned in Table 12 , Cl.no.15.5 of IS 1180 (Part 1):2014

24.2 The test of measurement of paint thickness shall be carried out cross hatch test, chemical test and other as per IS 13871:1993

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

25 Guaranteed Technical Particulars:

The bidder should fill up all the details in GTP parameter list, the statementsuch 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

26 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

27 Submission of Routine Test Certificate

27.1 The successful bidder shall submit the routine test certificate along with documentary evidence for having paid the relevant taxes for the followingraw materials viz. Oil, Aluminum / copper conductors, insulating materials, core materials, bushings at the time of routine testing of the fully assembled transformer

27.2 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

28 Stage Inspection:

1. After receipt of LoA, Supplier shall give 15 days' advance intimation to the Chief Engineer (MMD) to organize stage inspection.
2. After receipt of intimation from successful bidder, Chief Engineer (MMD) will depute MSEDCL's representative to visit factory of bidder for Stage Inspection.
3. Activities below will be carried out during Stage Inspection:
   (a) Verification of available raw material stock & its quality.
   (b) Verification of assembly of core, windings and other core materials.
   (c) Verification of Raw materials such as core stamping, winding conductor, oil etc. Bidder shall use these materials manufactured/supplied by the standard manufacturers and furnish the manufacturer's test certificates, proof of purchase from those manufacturers, documentary evidence for having paid the excise duty for the information of the department.
   (d) Verification of Performance certificate issued by MSEDCL for earlier transformers supplied by bidder and document of compliance done by manufacturer against failure of supplied transformers in previous tenders of MSEDCL, if any.
   (e) Verification of original type tests reports, Drawings & GTP, if required.
4. After satisfactory inspection, MSEDCL's representative will give clearance to the bidder/manufacturer for further process.
5. MSEDCL's representative may visit factory at any stage of manufacturing process to verify effective use of inspected raw material. The successful bidder shall grant free access to the MSEDCL's representatives at a reasonable time when the work is in progress.

29 Final Inspection

22.1.1 After completion of manufacturing process of all quantity (Lot) as per MSEDCL's clearance letter, Supplier shall give intimation to the Chief Engineer (MMD) to organize final inspection.

22.1.2 After receipt of intimation from successful bidder, Chief Engineer (MMD) will depute MSEDCL's representative to visit factory of bidder for final Inspection.

22.1.3 Activities below will be carried out during final Inspection:

a) Visual inspection of outer side, design, dimensions, color, name plate etc. of all (100%) ready transformers from offered lot.

b) After visual inspection, Inspector will select 10% quantity of transformers at random from offered and visually inspected lot

c) 10 % of the transformers offered will be tested without opening the transformer for all Routine tests as per MSEDCL's technical specifications & related IS. Heat Run Test will have to be carried out on one transformer having maximum total Losses at 100% load

d) Out of balance 90% distribution transformers, one transformer shall be opened and all design technical parameters should be checked as per approved GTP, approved drawings and technical specifications

e) If any technical parameters are found deviating from the approved GTP, approved drawings & technical specifications during final inspection, whole lot shall be reoffered for final inspection after rectification.

22.1.4 After satisfactory final inspection, MSEDCL's representative will give clearance to the bidder/manufacturer for dispatch to allotted store

30. Testing of all Distribution Transformers for total losses at 50% load and 100% load at MSEDCL store

After receipt of transformers at stores centers, all distribution transformers from the lot will be tested for total Losses at 50% load and 100% load at all stores by MSEDCL as well as by a third party NABL lab like ERDA, etc. Supplier has liberty to be present at the time of testing.

31. Random Sample Testing (RST)

1) The bidder should intimate to Chief Engineer (MMD) of completion of dispatches of whole lot of Distribution Transformers to stores against this tender.
2) Chief Engineer (MMD), M.S.E.D.C.L will select the stores for Random Sample Testing (RST) and depute Executive Engineer (Testing) to carry out RST of the lot.
3) Advance intimation of 15 days will be given to supplier for joint inspection.
4) 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.
5) Activities below will be carried out by EE (Testing) during Random Sample Testing:

a) Visual inspection of design, dimensions, color, name plate, radiator, bushings, LAs, Conservator tank, breather etc. of all (100%) transformers from supplied lot.
b) EE (Testing) will select one transformer at random from the lot of transformers already tested for total Losses at 50% load and 100% load which shall be opened and all design technical parameters shall check as per approved GTP, approved drawings and technical specifications.
c) That Selected transformer for random testing shall be tested for all routine testing before opening.
d) If any technical parameters are found deviating from the approved GTP, approved drawings & technical specifications during Random Sample Testing, whole lot shall be rejected

32. **Challenge Testing**:

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

i. Measurement of magnetizing current
ii. No load losses test.
iii. Load losses test (at 50 % loading or as per routine test).
iv. Temperature rise test.

e. The challenge test could be conducted at NABL Laboratory, like ERDA and CPRI.
f. If the values are within the limits, the products gets conformed.
g. No positive tolerances in losses are permitted.
h. If the product is not conformed, the manufacturer would pay the challenge fee and challenger would get the fee refunded. However as a redress 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.
i. If any one of the above sample does not conform 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 be allowed to compete in tenders of the MSEDCL for the period of three years and heavy penalty would be imposed.

33. Inspection & Testing of Transformer Oil:

To ascertain the quality of the transformer oil, the original manufacturer's test report should be submitted at the time of inspection. Also arrangements should be made for testing of transformer oil, after taking out the sample from the manufactured transformers and tested in the presence of purchaser's representative or in an independent laboratory

34. Loading of transformer

The transformer shall be suitable for loading as per IS2026,Part-7. The tenderer should state clearly the percentage overload the transformer can take for a continuous period of one hour

35. Quality Assurance

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

Certificates of following materials

- Aluminium / Copper conductor
- Transformer oil
- Core
- Insulating paper.
- Porcelain Bushings
- Steel Plate used for Tank

35.1 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

35.2 Information and copies of test certificate as in (i) above respect of bought out accessories including terminal connectors

35.3 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

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

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

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

35.7 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

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

36. **Qualifying Requirement**

As per Tender

37. **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

Annexure I

Air Pressure Test

Name of Supplier: OrderNo.:

Capacity & Voltage Ratio of Distribution Transformer : _____kVA,

_____/ 0.433 kV

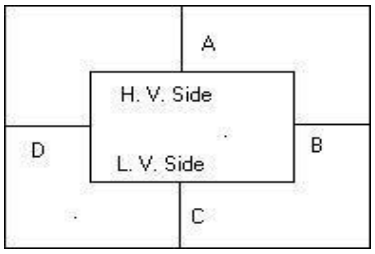
Vector Group Dyn11

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 parallelstring were places around the tank, the distance between st ring 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/ sqcm 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 :

Test witnessed by Tested by

Annexure II

Temperature

Rise Test

Name of

Supplier:

Order No.:

Capacity & Voltage Ratio of Distribution Transformer:_____kVA,

_____/

0.433 kVVector Group Dyn11

Sr. No. of equipment Tested:

Date of Testing:

Reference Standard

	H. V. Winding	L. V. Winding
Rated Line Current inAmp		

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 HV winding is

= Hot Resistance x(235+Cold Ambient Temperature)-(235+Hot Ambient Temperature Cold resistance

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

Guaranteed Technical Particular (GTP)

Sr. No.	GTP Parameter	100 KVA, 11 KV
1	Name of Manufacturer	
2	Reference Standard	IS : 1180 (Part -1) 2014 & 2026/1977 Updated
3	Whether transformer is Oil Natural Air Natural cooled type (Yes/No)	Yes
4	Whether transformer is suitable for Indoor /Outdoor installation	Outdoor
5	Rating of Transformers in KVA	100
6	Primary Voltage in KV	11
7	Secondary Voltage in KV	0.433
8	Whether neutral is solidly earthed (Yes/No)	Yes
9	Colour of transformer	Aircraft Blue Colour (Shade No. 108)
10	Vector Group	Dyn11
11	Approximate overall length of transformer in mm	1080
12	Approximate overall breadth of transformer inmm	770
13	Approximate overall height of transformer in mm	1400
14	Approximate length of transformer tank in mm	915
15	Approximate breadth of transformer tank in mm	350
16	Approximate height of transformer tank in mm	905
17	Thickness of the side of transformer Tank platein mm	3.15
18	Thickness of the bottom of transformer tank plate in mm	5.0
19	Thickness of the top of transformer tank platein mm	5.0
20	Weight of Tank & fittings in kgs	147
21	Total Weight of Transformer in kgs	705
22	Type of Tank (corrugated/conventional)	Conventional
23	Degree of slope to the top plate of transformer	5° to 10° towards HV Side
24	In case of Corrugated tank, Thickness of corrugated sheet (in mm)	N.A.
25	Name plate details are as per the requirement specified in tender. (Yes/No)	Yes

Sr. No.	GTP Parameter	100 KVA, 11 KV
26	No of radiators provided and location with arrangement	02 Nos on HV Side
27	Thickness of the radiator of transformer in mm	1.25 mm
28	No of radiator fins	10
29	Total radiating Surface of Tank & radiators in Sq.Mtrs.	5.5296
30	Core material used & its grade	CRGO, M4
31	Type of core	Stacked
32	Weight of Core in kgs	227.0
33	No. of steps of core for CRGO core	11
34	Diameter of core in mm	119.9
35	Effective core area.(sq.cm)	104.4738
36	Flux density in Tesla	1.69 Tesla Maximum
37	Thickness of core lamination in mm	0.27
38	The temperature shall in no case reach a value that will damage the core itself, other parts or adjacent materials (Yes/No)	Yes
39	Type of connection for H.V. Winding (Delta) (Yes/No)	Delta
40	Type of connection for L.V. Winding (Star) (Yes/No)	Star
41	Material of H.V winding	Aluminium
42	Material of L.V.Winding	Aluminium
43	Insulation provided to H.V winding.	Double Paper Covering
44	Insulation provided to L.V. winding.	Double Paper Covering
45	Current density of H.V. winding (in Ampere/ sq.mm)	1.3 A/sq. mm (MAX)

46	No. of HV Winding Turns	3168
Sr. No.	GTP Parameter	100 KVA, 11 KV
47	Current density of L.V. winding (in Ampere/ sq.mm)	1.3 A/sq. mm (MAX)
48	No. of LV Winding Turns	72
49	Resistance of LV winding per phase at 20 oC in Ohms	0.0078
50	Resistance of HV winding per phase at 20 oC in Ohms	19.10
51	Clearance between Core & L.V. winding in mm	3.5
52	Clearances between L.V. & H.V. winding in mm	11.0
53	Clearances between HV Phase to Phase in mm	10.0
54	Clearances between end insulation to Earth in mm	25.0
55	Clearances between winding to tank in mm (min 30 mm)(Yes/No)	Yes-30 mm
56	Weight of Aluminium (Winding) in kgs	109.5
57	Inter layer insulation provided in H.V winding to design for Top & bottom layer	Electrical Grade insulating Kraft Paper
58	Inter layer insulation provided in L.V winding to design for Top & bottom layer	Electrical Grade insulating Kraft Paper
59	Inter layer insulation provided in between all layer in H.V winding	Electrical Grade insulating Kraft Paper
60	Inter layer insulation provided in between all layer in L.V winding	Electrical Grade insulating Kraft Paper
61	Details of end insulation	Press Board, Blocks & Sheet
62	Whether wedges are Provided at 50% turns of the Coil (Yes/No)	No
63	Insulation materials provided for core	Hot Oil Proof Insulation Carlite
64	Length of coil used for HV winding in meter.	2347
65	Cross Section area of coil used in HV winding in sq mm	3.462
66	Length of coil used for LV winding in meter.	34.025

67	Size of strip used for LV winding in mm	12.6 x 5.2
Sr. No.	GTP Parameter	100 KVA, 11 KV
68	No. of conductors in parallel for LV winding	2
69	Total cross section area of LV conductor in sq. mm	129.32
70	No. of H.V coils /phase	4
71	Thickness of locking spacers between H.V. coils (in mm)	10
72	Weight of Oil in kgs	156
73	Volume of Oil in Ltrs (A)	190
74	Quantity of total oil absorption (in liters) in first filling	7
75	Total oil volume including Total Oil absorbtion in Ltrs.	197
76	Grade of Oil used.	Mineral oil confirming to IS - 335 amended upto date
77	Name of Oil manufactures to be supplied.	Like Apar / Savita / Columbia / Raj Petro / Panama / Gandhar / Hindustan Petolium / Indian Oil / Transol / Servo / Power Oil
78	Breakdown Values of Oil at the time of first filling (kV/mm) considering 2.5 mm gap	60 kV for Filtered & 30 kV for Unfiltered Oil
79	Conservator Tank to the Transformers with oil level indicator (Showing three levels) and drainplug is provided (Yes / No)	Yes
80	Drain Valve (32 mm) provided to the transformer tank (Yes/No)	32
81	Earthing terminals with lugs is provided (Yes/No)	Yes
82	Lifting lugs provided (Yes/No)	Yes
83	Oil Filling hole with cap (on conservator) is provided (Yes / No)	Yes
84	Thermometer pocket is provided (Yes/No)	Yes
85	Quantity of Silica gel filled in breather (in gm)	250 gms

Sr. No.	GTP Parameter	100 KVA, 11 KV
86	Material of HV and LV Bushings and makes thereof	Porcelain, Make like - Bikaner / Jaipuria Brothers / Teckmek / RR Ind / Rajeev Ind / Rama Pottery / Tayal / Shine / CJI / Udyog Centre / Sampat / BiharCeramics / Patna Ceramics / Earthen / Radiant
87	Reference standard of Bushings	IS : 3347 Updated
88	Rating of LV Bushing	1 kV / 250 Amp.
89	Minimum Creepage Distance of HV Bushing in mm (min.25 mm per kV)	300 mm
90	Minimum Creepage Distance of LV Bushing in mm (min.25 mm per kV)	50 mm
91	Rating of H.V. Bushings (in kV, Amp)	12 kV / 250 Amp.
92	Rating of L.V. Bushing (in kV, Amp)	1.0 kV / 0.250 KA
93	Min. External clearances of H.V. bushing terminals between ph. to ph (255 mm)	255
94	Min. External clearances of H.V. bushing terminals between ph. to earth (140 mm)	140
95	Min. External clearances of L.V. bushing terminals between ph. to ph (75 mm)	75
96	Min. External clearances of L.V. bushing terminals between ph. to earth (40 mm)	40
97	Rating of Lightning Arrestor and make thereof	9 kVrms, 5kA ,Make like - Oblum / Lamco / Orange / New Aquariya / Engineers Enterprises / Elektrolites Power / Radiant / Movester / Shreem
98	Reference standard of Lightning Arrestor	IS : 3070 / 1974 Updated
99	Maximum winding temperature rise in °C overan Ambient temp. of 50°C by Resistance Method	40 Degree C
Sr. No.	GTP Parameter	100 KVA, 11 KV
100	Maximum temperature rise of Oil in °C over an Ambient temp. of 50°C by thermometer.	35 Degree C

101	Magnetising current (No load) in Amps and its % of full load current at rated voltage referredto LV Side	3% of Full Load Current, 4.00 Amps
102	Magnetizing current (No load) in Amps and its % of full load current at maximum voltage (112.5% of rated voltage)referred to LV side	6% of Full Load Current, 8.00 Amps
103	Maximum Core (No Load) Losses at ratedvoltage & rated frequency	230
104	Maximum Total Losses (No Load + Load Losses at 75°C) at 50% loading (Watts)	475
105	Maximum Total Losses (No Load + Load Lossesat 75°C) at 100% loading (Watts)	1650
106	Efficiency at 75 °C at unity P.F. at 125% load	98.56
107	Efficiency at 75 °C at unity P.F. at 100% load	98.77
108	Efficiency at 75 °C at unity P.F. at 75 % load	98.95
109	Efficiency at 75 °C at unity P.F. at 50% load	99.05
110	Efficiency at 75 °C at unity P.F. at 25% load	98.87
111	Efficiency at 75 °C at 0.8 P.F. lag at 125% load	98.21
112	Efficiency at 75 °C at 0.8 P.F. lag at 100 % load	98.47
113	Efficiency at 75 °C at 0.8 P.F. lag at 75 % load	98.69
114	Efficiency at 75 °C at 0.8 P.F. lag at 50 % load	98.62
115	Efficiency at 75 °C at 0.8 P.F .lag at 25% load	98.44
116	Efficiency at 75 °C at 0.8 P.F. leading at 125% load	98.21
117	Efficiency at 75 °C at 0.8 P.F. leading at 100% load	98.47
118	Efficiency at 75 °C at 0.8 P.F. leading at 75%load	98.69
119	Efficiency at 75 °C at 0.8 P.F. leading at 50%load	98.62
Sr. No.	GTP Parameter	100 KVA, 11 KV
120	Efficiency at 75°C at 0.8 P.F. leading at 25 %load	98.44

121	Regulation at Unity P.F (in %)	1.066
122	Regulation at 0.8 P.F. lag. (in %)	3.41
123	Regulation at 0.8 P.F. leading. (in %)	3.41
124	% Impedance value at 75°C	4.5% Tolerance +/-10%
125	Separate source power frequency withstand test for HV for 1 minute in kv(min)	28 kVrms
126	Separate source power frequency withstand test for LV for 1 minute in kv(min)	3 kVrms
127	Induced over voltage withstand test for 1 min. specify voltage frequency, time for test.	866 Volt , 100 Hz. For one minute
128	Impulse test value (in kVp) .	75 kVp, 1.2/50 micro-second
129	Test certificate of Aluminium /Copper conductor,Core,Insulating paper porcelain bushing,steel plate used for enclosure of offertransformer is enclosed along with the offer in soft copy (Yes/No)	Yes
130	All type test report type test carried out ontransformer at NABL laboratory shall be submitted along with the offer in soft copy (Yes/No)	Yes
131	Air pressure test and temperature rise test shall be conducted as per format enclosed with the technical specification along the offer (Yes/No)	Yes
132	All Drawings shall be furnished with eachoffered item seperately along with the offer(Yes/No)	Yes
133	Oil absorbtion Calculation sheet shall be furnished with for each offered item seperately along with the offer(Yes/No)	Yes
134	Heat Dissipation Calculation sheet shall be furnished with for each offered item seperately along with the offer(Yes/No)	Yes
135	Flux Density calculation sheet shall be furnished with for each offered item seperatelyalong with the offer(Yes/No)	Yes
Sr. No.	GTP Parameter	100 KVA, 11 KV
136	Calculation sheet for 112.5% of rated v/f ratio(Over fluxing calculation sheet) offered shall be furnished with for each item seperatelyalong with	Yes

	the offer(Yes/No)	
137	Required documents, plant & machinery list oforder executed/ under execution sheet shall be furnished for each offered item seperately along with the offer(Yes/No)	Yes
138	The information required under quality assurance shall be submitted with the offer in physical format & soft copy (Yes/No)	Yes
139	The cost data in the prescribed format shall besubmitted with the offer in physical format & soft copy (Yes/No)	Yes
140	The performance guarantee of thetransformers in years	24 Months from theDate of Receipt of Material
141	Power frequency withstand voltage dry & wet in KV (rms) for HV Bushing	28 kVrms for one minute
142	Dry lightning impulse withstand voltage in KV(peak) stating the waveform adopted for hvbushing	75 kVP, 1.2/50 micro-second

Guaranteed Technical Particular (GTP)

S. No.	GTP Parameter	100 KVA, 22 KV
1	Name of Manufacturer	
2	Reference Standard	IS : 1180 (Part -1) 2014 & 2026/1977 Updated
3	Whether transformer is Oil Natural Air Naturalcooled type (Yes/No)	Yes
4	Whether transformer is suitable for Indoor /Outdoor installation	Outdoor
5	Rating of Transformers in KVA	100
6	Primary Voltage in KV	22
7	Secondary Voltage in KV	0.433
8	Rated Primary Current in Amp	2.62
9	Whether neutral is solidly earthed (Yes/No)	Yes
10	Rated Secondary Current in Amp	133.34
11	Colour of transformer	Aircraft Blue Colour (Shade No. 108)
12	Vector Group	Dyn11
13	Approximate overall length of transformer in mm	1150
14	Approximate overall breadth of transformer in mm	870
15	Approximate overall height of transformer in mm	1460
16	Approximate length of transformer tank in mm	940
17	Approximate breadth of transformer tank inmm	360
18	Approximate height of transformer tank in mm	780
19	Thickness of the side of transformer Tank plate in mm	3.15
20	Thickness of the bottom of transformer tank plate in mm	5.0
21	Thickness of the top of transformer tank plate in mm	5.0
22	Weight of Tank & fittings in kgs	171
23	Total Weight of Transformer in kgs	745
24	Type of Tank (corrugated/conventional)	Conventional
25	Degree of slope to the top plate of transformer	5 ° to 10 ° towards HVSide

Sr. No.	GTP Parameter	100 KVA, 22 KV
26	In case of Corrugated tank, Thickness ofcorrugated sheet (in mm)	N.A.
27	Name plate details are as per the requirement specified in tender. (Yes/No)	Yes
28	No of radiators provided and location with arrangement	02 Nos on HV Side
29	Thickness of the radiator of transformer in mm	1.25
30	No of radiator fins	12
31	Total radiating Surface of Tank & radiators in Sq.Mtrs.	2.028
32	Core material used & its grade	CRGO, M4
33	Type of core	Stacked
34	Weight of Core in kgs	233.44
35	No. of steps of core for CRGO core	10
36	Diameter of core in mm	128
37	Effective core area.(sq.cm)	117.3894
38	Flux density in Tesla	1.69 Tesla Maximum
39	Thickness of core lamination in mm	0.27
40	The temperature shall in no case reach a value that will damage the core itself, other parts oradjacent materials (Yes/No)	Yes
41	Type of connection for H.V. Winding (Delta) (Yes/No)	Delta
42	Type of connection for L.V. Winding (Star)(Yes/No)	Star
43	Material of H.V winding	Copper
44	Material of L.V.Winding	Copper
45	Insulation provided to H.V winding.	Double Paper Covering
46	Insulation provided to L.V. winding.	Double Paper Covering
47	Current density of H.V. winding (in Ampere/ sq.mm)	2.8 A/sq. mm (MAX)
48	No. of HV Winding Turns	5454
49	Current density of L.V. winding (in Ampere/sq.mm)	2.8 A/sq. mm (MAX)
50	No. of LV Winding Turns	62
51	Resistance of LV winding per phase at 20 oC inOhms	0.0068
52	Resistance of HV winding per phase at 20 oC in Ohms	75.01
53	Clearance between Core & L.V. winding in mm	4.0
54	Clearances between L.V. & H.V. winding in mm	14.0
55	Clearances between HV Phase to Phase in mm	15.0

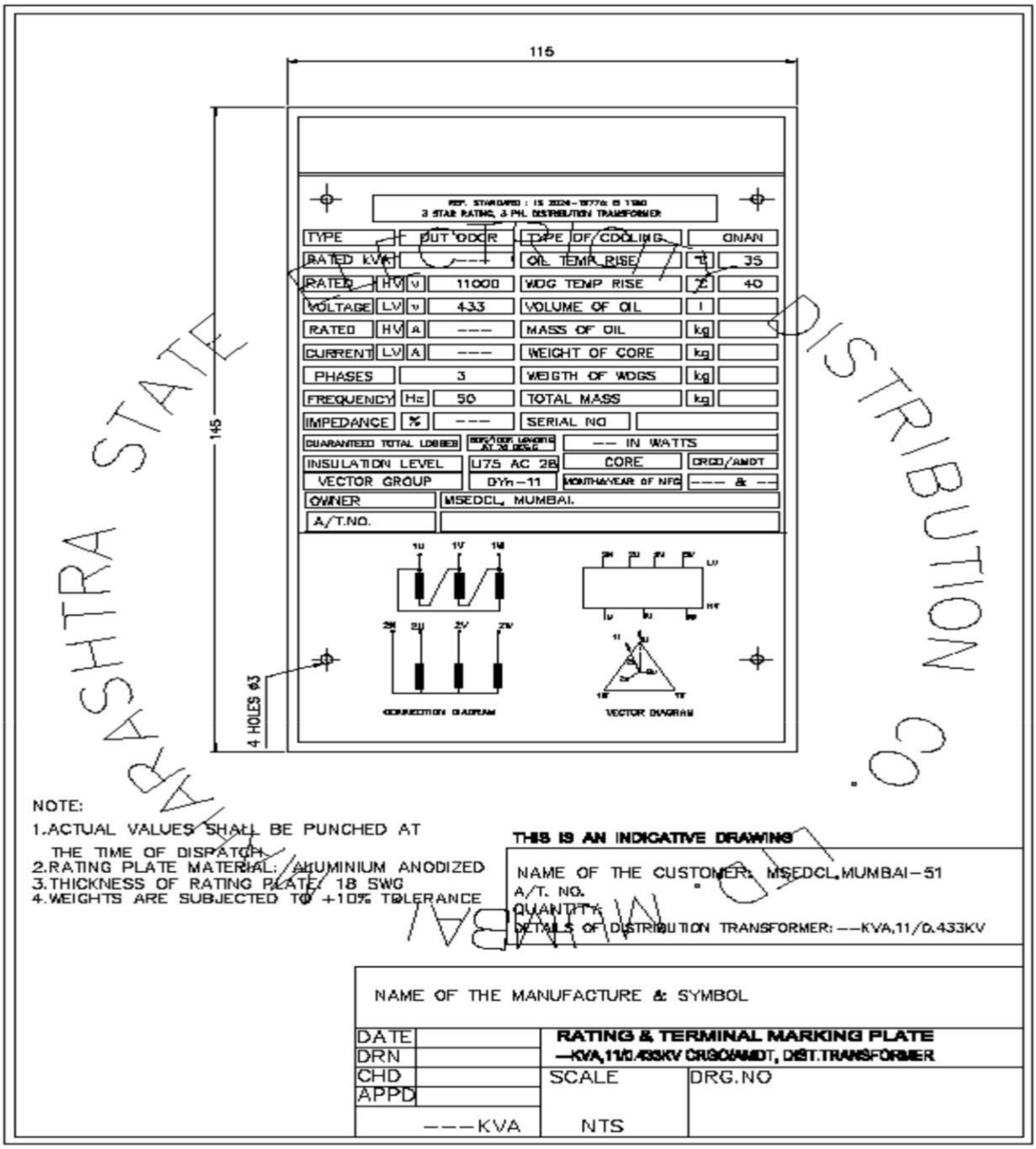
Sr. No.	GTP Parameter	100 KVA, 22 KV
56	Clearances between end insulation to Earth in mm	40.0
57	Clearances between winding to tank in mm (min 40 mm)(Yes/No)	Yes-40 mm
58	Weight of Aluminium (Winding) in kgs	166.5
59	Inter layer insulation provided in H.V winding to design for Top & bottom layer	Electrical Grade Insulating Kraft Paper
60	Inter layer insulation provided in L.V winding to design for Top & bottom layer	Electrical Grade Insulating Kraft Paper
61	Inter layer insulation provided in between all layer in H.V winding	Electrical Grade Insulating Kraft Paper
62	Inter layer insulation provided in between all layer in L.V winding	Electrical Grade Insulating Kraft Paper
63	Details of end insulation	Press Board, Blocks & Sheet
64	Whether wedges are Provided at 50% turns of the Coil (Yes/No)	No
65	Insulation materials provided for core	Hot Oil Proof Insulation Carlite
66	Length of coil used for HV winding in meter.	4015.944
67	Cross Section area of coil used in HV winding in sq mm	0.98
68	Length of coil used for LV winding in meter.	29.29934
69	Size of strip used for LV winding in mm	11.3 x 3.10
70	No. of conductors in parallel for LV winding	2
71	Total cross section area of LV conductor in sq. mm	70.06
72	No. of H.V coils /phase	6
73	Thickness of locking spacers between H.V. coils (in mm)	10
74	Weight of Oil in kgs	164
75	Volume of Oil in Ltrs (A)	200
76	Quantity of total oil absorption (in liters) in first filling	7
77	Total oil volume including Total Oil absorbtion in Ltrs.	207
78	Grade of Oil used.	Mineral oil confirming to IS - 335 amended upto date
79	Name of Oil manufactures to be supplied.	Like Apar / Savita / Columbia / Raj Petro / Panama / Gandhar / Hindustan Petrolium / Indian Oil / Transol / Servo / Power Oil

Sr. No.	GTP Parameter	100 KVA, 22 KV
80	Breakdown Values of Oil at the time of firstfilling (kV/mm) considering 2.5 mm gap	60 kV for Filtered & 30kV for Unfiltered Oil
81	Conservator Tank to the Transformers with oil level indicator (Showing three levels) and drainplug is provided (Yes / No)	Yes
82	Drain Valve (32 mm) provided to the transformer tank (Yes/No)	32
83	Earthing terminals with lugs is provided(Yes/No)	Yes
84	Lifting lugs provided (Yes/No)	Yes
85	Oil Filling hole with cap (on conservator) is provided (Yes / No)	Yes
86	Thermometer pocket is provided (Yes/No)	Yes
87	Quantity of Silica gel filled in breather (in gm)	250 gms
88	Material of HV and LV Bushings and makesthereof	Porcelain, Make like - Bikaner / Jaipuria Brothers / Teckmek / RR Ind / Rajeev Ind / Rama Pottery / Tayal / Shine / CJI / Udyog Centre / Sampat / Bihar Ceramics / Patna Ceramics / Earthen / Radiant
89	Reference standard of Bushings	IS : 3347 Updated
90	Rating of LV Bushing	1 kV / 250 Amp.
91	Minimum Creepage Distance of HV Bushing in mm (min.25 mm per kV)	550 mm
92	Minimum Creepage Distance of LV Bushing in mm (min.25 mm per kV)	50 mm
93	Rating of H.V. Bushings (in kV, Amp)	24 kV / 250 Amp.
94	Rating of L.V. Bushing (in kV, Amp)	1.0 kV / 250 Amp.
95	Min. External clearances of H.V. bushing terminals between ph. to ph (330 mm)	330
96	Min. External clearances of H.V. bushing terminals between ph. to earth (230 mm)	230
97	Min. External clearances of L.V. bushing terminals between ph. to ph (75 mm)	75
98	Min. External clearances of L.V. bushingterminals between ph. to earth (40 mm)	40

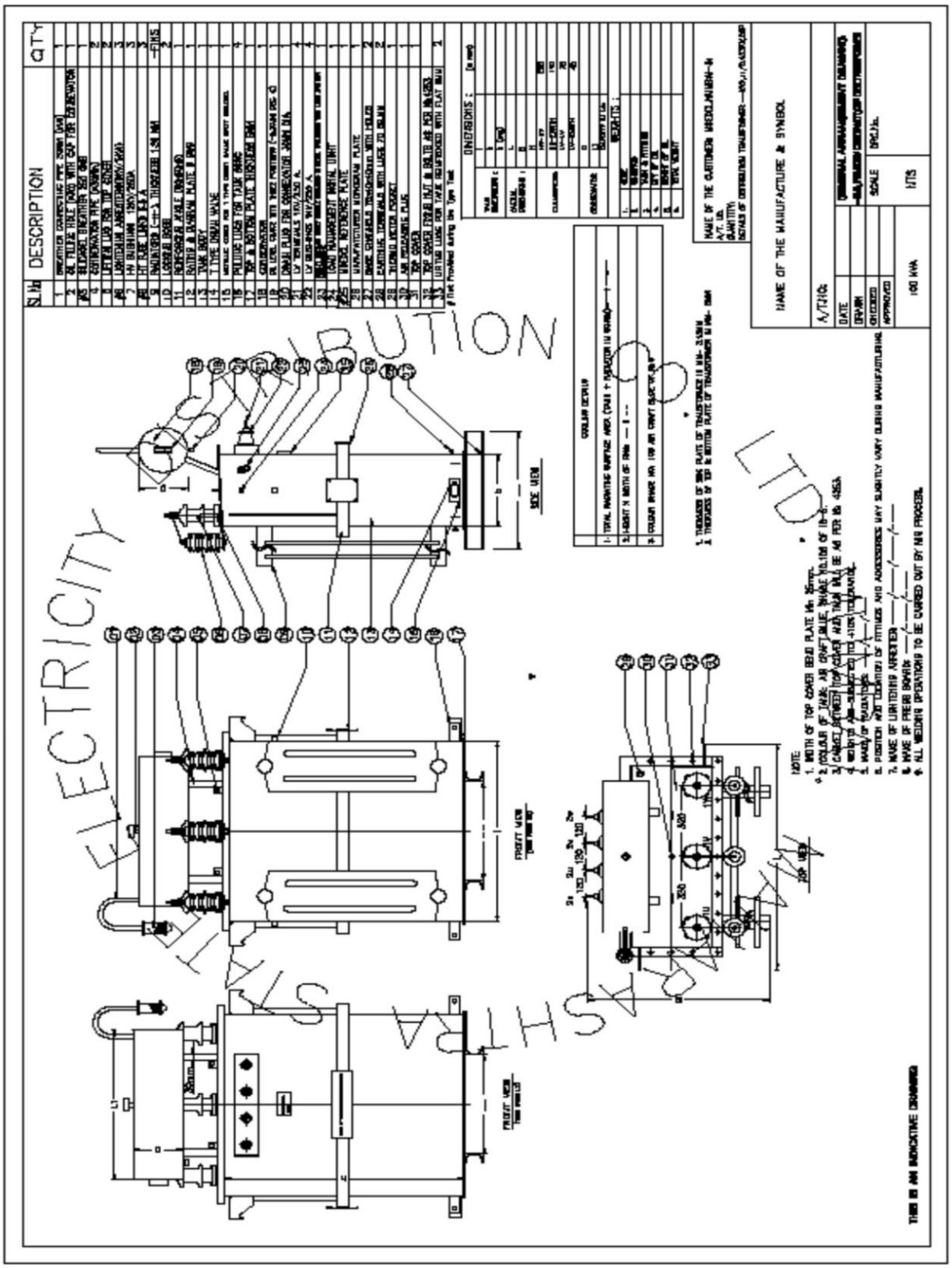
Sr. No.	GTP Parameter	100 KVA, 22 KV
99	Rating of Lightning Arrestor and make thereof	18 kVrms, 5kA , Make like - Oblum / Lamco /Orange / New Aquariya / Engineers Enterprises / Elektrolites Power / Radiant / Movester / Shreem
100	Reference standard of Lightning Arrestor	IS : 3070 / 1974 Updated
101	Maximum winding temperature rise in °C over an Ambient temp. of 40°C by ResistanceMethod	40 Degree C
102	Maximum temperature rise of Oil in °C over anAmbient temp. of 40°C by thermometer.	35 Degree C
103	Magnetising current (No load) in Amps and its % of full load current at rated voltage referredto LV Side	3% of Full Load Current, 4.0 Amps
104	Magnetizing current (No load) in Amps and its % of full load current at maximum voltage (112.5% of rated voltage)referred to LV side	6% of Full Load Current, 8.0 Amps
105	Maximum Core (No Load) Losses at rated voltage & rated frequency	276
106	Maximum Total Losses (No Load + Load Lossesat 75°C) at 50% loading (Watts)	498
107	Maximum Total Losses (No Load + Load Losses at 75°C) at 100% loading (Watts)	1732
108	Efficiency at 75 °C at unity P.F. at 125% load	98.60
109	Efficiency at 75 °C at unity P.F. at 100% load	98.65
110	Efficiency at 75 °C at unity P.F. at 75 % load	98.35
111	Efficiency at 75 °C at unity P.F. at 50% load	98.65
112	Efficiency at 75 °C at unity P.F. at 25% load	98.35
113	Efficiency at 75 °C at 0.8 P.F. lag at 125% load	98.54
114	Efficiency at 75 °C at 0.8 P.F. lag at 100 % load	98.65
115	Efficiency at 75 °C at 0.8 P.F. lag at 75 % load	98.35
116	Efficiency at 75 °C at 0.8 P.F. lag at 50 % load	98.65
117	Efficiency at 75 °C at 0.8 P.F .lag at 25% load	98.35
118	Efficiency at 75 °C at 0.8 P.F. leading at 125% load	98.54
119	Efficiency at 75 °C at 0.8 P.F. leading at 100% load	98.65

120	Efficiency at 75 °C at 0.8 P.F. leading at 75% load	98.35
Sr. No.	GTP Parameter	100 KVA, 22 KV
120	Efficiency at 75 °C at 0.8 P.F. leading at 75% load	98.35
121	Efficiency at 75 °C at 0.8 P.F. leading at 50%load	98.41
122	Efficiency at 75°C at 0.8 P.F. leading at 25 % load	98.48
123	Regulation at Unity P.F (in %)	1.047
124	Regulation at 0.8 P.F. lag. (in %)	3.45
125	Regulation at 0.8 P.F. leading. (in %)	3.45
126	% Impedance value at 75°C	4.5% Tolerance +/-10%
127	Separate source power frequency withstand test for HV for 1 minute in kv(min)	50 kVrms
128	Separate source power frequency withstand test for LV for 1 minute in kv(min)	3 kVrms
129	Induced over voltage withstand test for 1 min. specify voltage frequency, time for test.	866 Volt , 100 Hz. For one minute
130	Impulse test value (in kVp) .	125 kVp, 1.2/50 micro-second
131	Test certificate of Aluminium /Copper conductor,Core,Insulating paper porcelain bushing,steel plate used for enclosure of offer transformer is enclosed along with the offer in soft copy (Yes/No)	Yes
132	All type test report type test carried out on transformer at NABL laboratory shall be submitted along with the offer in soft copy (Yes/No)	Yes
133	Air pressure test and temperature rise test shall be conducted as per format enclosed with the technical specification along the offer (Yes/No)	Yes
134	All Drawings shall be furnished with each offered item seperately along with the offer(Yes/No)	Yes
135	Oil absorbtion Calculation sheet shall be furnished with for each offered item seperately along with the offer(Yes/No)	Yes

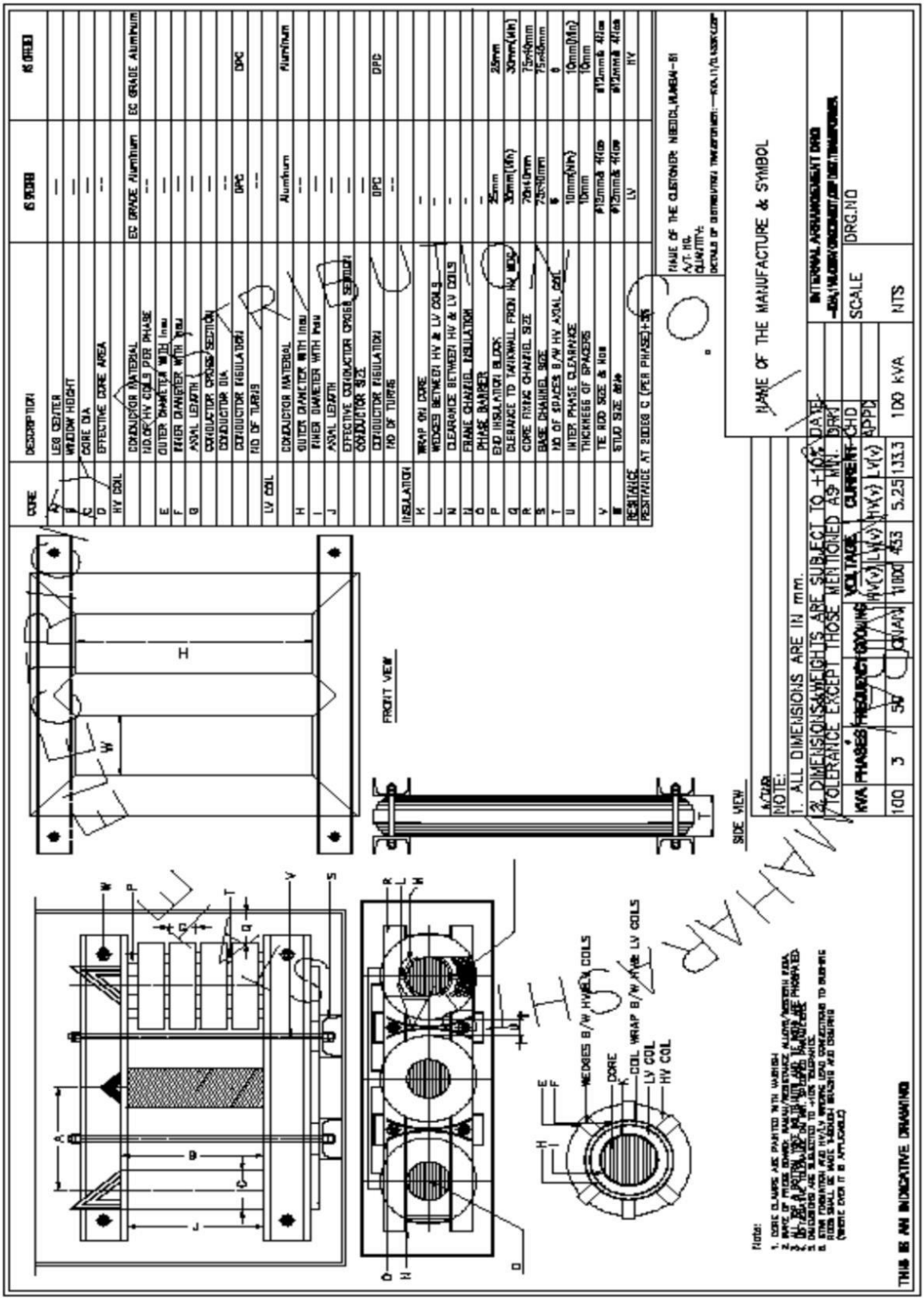
Sr. No.	GTP Parameter	100 KVA, 22 KV
136	Heat Dissipation Calculation sheet shall be furnished with for each offered item seperately along with the offer(Yes/No)	Yes
137	Flux Density calculation sheet shall be furnished with for each offered item seperately along with the offer(Yes/No)	Yes
138	Calculation sheet for 112.5% of rated v/f ratio (Over fluxing calculation sheet) offered shall befurnished with for each item seperately along with the offer(Yes/No)	Yes
139	Required documents, plant & machinery list oforder executed/ under execution sheet shall be furnished for each offered item seperately along with the offer(Yes/No)	Yes
140	The information required under quality assurance shall be submittede with the offer inphysical format & soft copy (Yes/No)	Yes
141	The cost data in the prescribed format shall be submitted with the offer in physical format &soft copy (Yes/No)	Yes
142	The performance guarantee of the transformersin years	24 Months from theDate of Receipt of Material
143	Power frequency withstand voltage dry & wet inKV (rms) for HV Bushing	50 kVrms for one minute
144	Dry lightning impulse withstand voltage in KV(peak) stating the waveform adopted for hvbushing	125 kVP, 1.2/50 micro-second


115
145
4 HOLES ϕ3
REF. STANDARD : IS 2026-1977& IS 1180
3 STAR RATING, 3 PH. DISTRIBUTION TRANSFORMER
TYPE OUT DOOR TYPE OF COOLING ONAN
RATED kVA --- OIL TEMP. RISE °C 35
RATED VOLTAGE HV V 11000 WDG TEMP RISE °C 40
LV V 433 VOLUME OF OIL l
RATED CURRENT HV A --- MASS OF OIL kg
LV A --- WEIGHT OF CORE kg
PHASES 3 WEIGTH OF WDGS kg
FREQUENCY Hz 50 TOTAL MASS kg
IMPEDANCE % --- SERIAL NO
GUARANTEED TOTAL LOSSES -- IN WATTS
INSULATION LEVEL LI75 AC 28 CORE CRGO/AMDT
VECTOR GROUP DYn-11 MONTH&YEAR OF MFG --- & --
OWNER MSEDCL, MUMBAI.
A/T.NO.
CONNECTION DIAGRAM
VECTOR DIAGRAM
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
DRN
CHD
APPD
---KVA
RATING & TERMINAL MARKING PLATE
--KVA,11/0.433KV CRGO/AMDT, DIST.TRANSFORMER
SCALE
NTS
DRG.NO

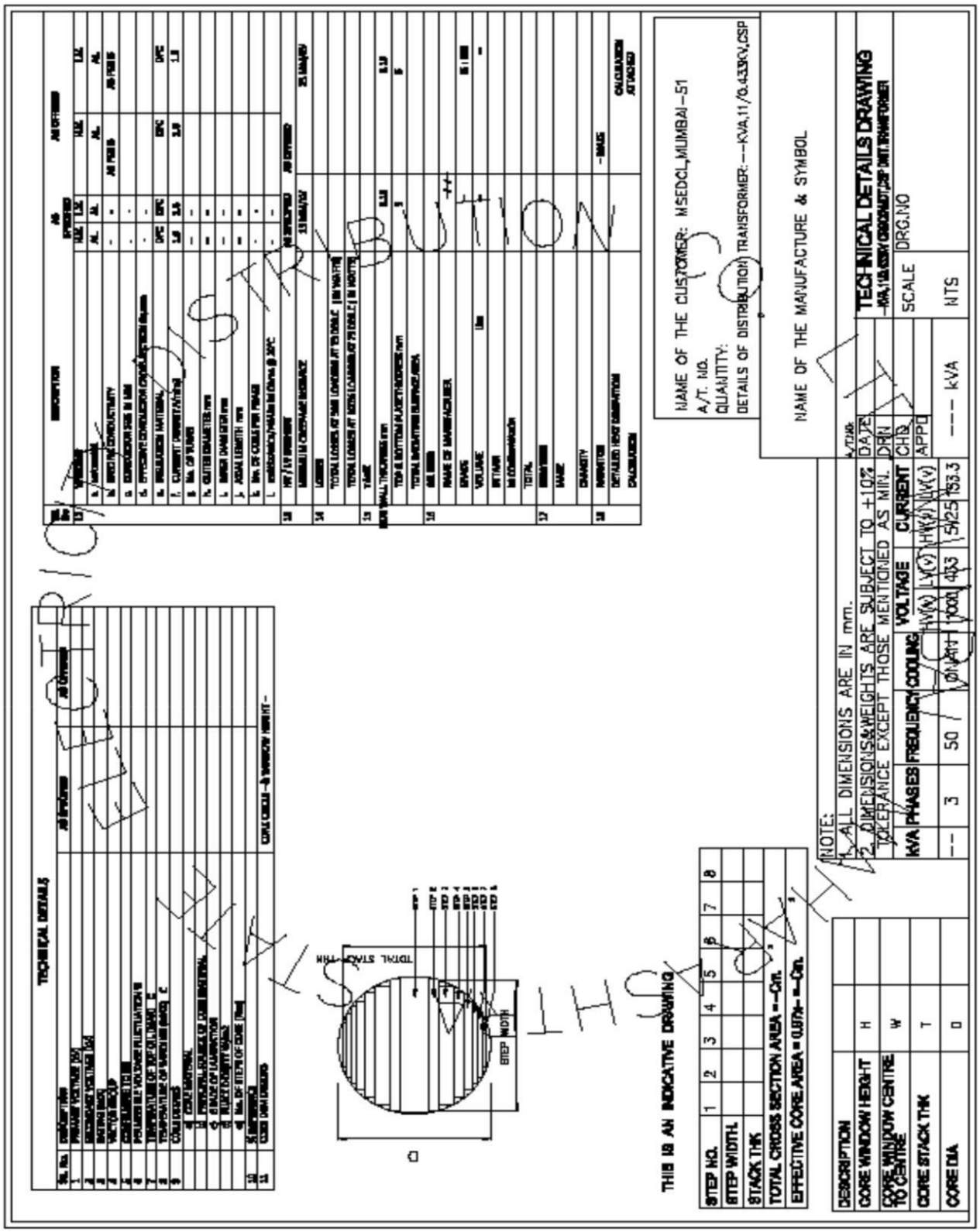
100 KVA, 11/ 0.433KV and 22/ 0.433 KV, Star 1 (Level -2) THREE PHASE, OUTDOOR NON SEALED TYPE OIL IMMERSED WITHOUT CSP FEATURE DISTRIBUTION TRANSFORMERS.

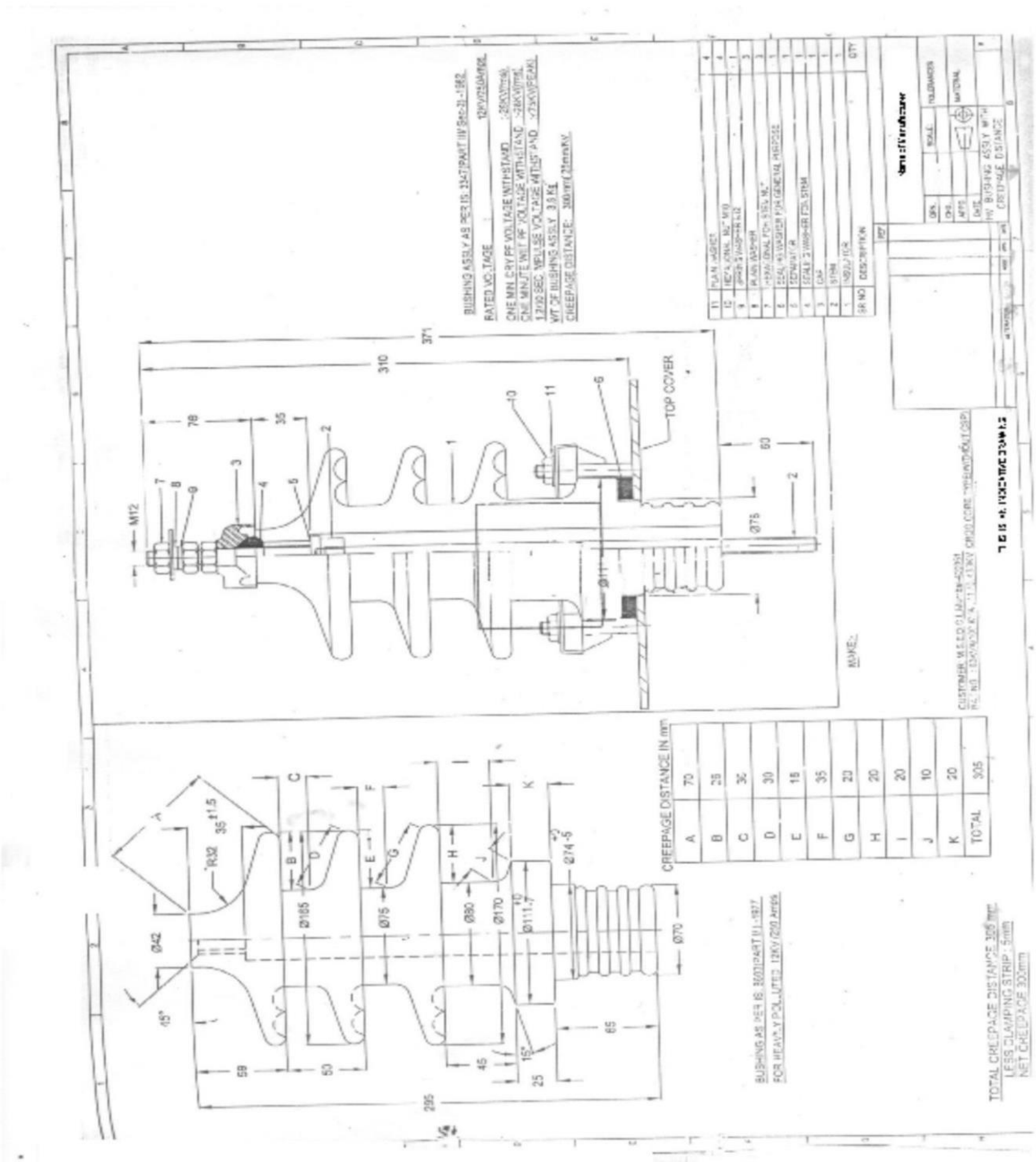


100 KVA, 11/ 0.433KV and 22/ 0.433 KV, Star 1 (Level -2) THREE PHASE, OUTDOOR NON SEALED TYPE OIL IMMERSED WITHOUT CSP FEATURE DISTRIBUTION TRANSFORMERS.



100 KVA, 11/ 0.433KV and 22/ 0.433 KV, Star 1 (Level -2) THREE PHASE, OUTDOOR NON SEALED TYPE OIL IMMERSED WITHOUT CSP FEATURE DISTRIBUTION TRANSFORMERS.




TOP COVER
MAKE:
CREEPAGE DISTANCE IN mm
A 70
B 28
C 36
D 30
E 18
F 35
G 23
H 20
I 20
J 10
K 20
TOTAL 305

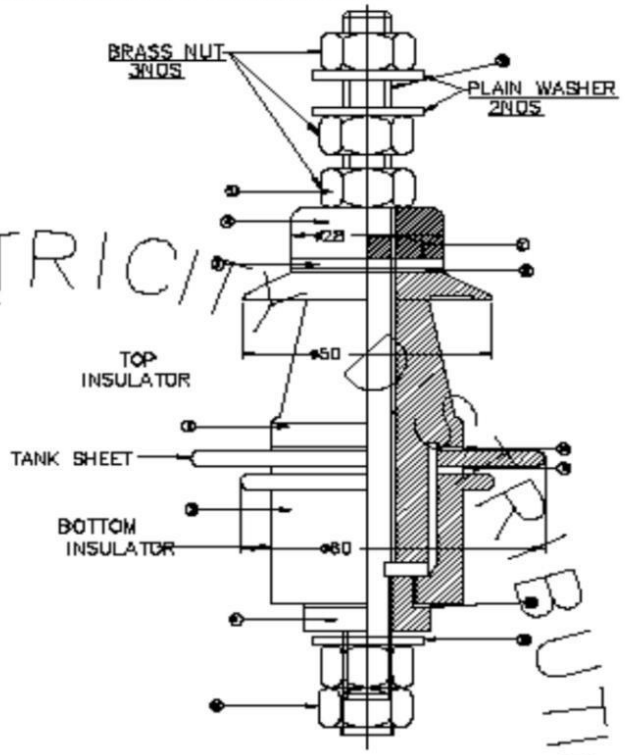
TRANSFORMER BUSHING AS PER IS:3347

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	STUD-M12	1
4	TOP END WASHER	1
5	STEM WASHER	1
6	BOTTOM NUT-	1
7	SEALING WASHER (TYPE-M)	1
8	SEALING WASHER (TYPE-M)	1
9	SEALING WASHER (TYPE-M)	1
10	SEALING GASKET	1
11	NUT-M-12	1
12	NUT-M-12	1
13	LOCK NUT-M-12	1
14	PLAIN WASHER-M-12	1
15	SEALING WASHER (TYPE-M)	1

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:

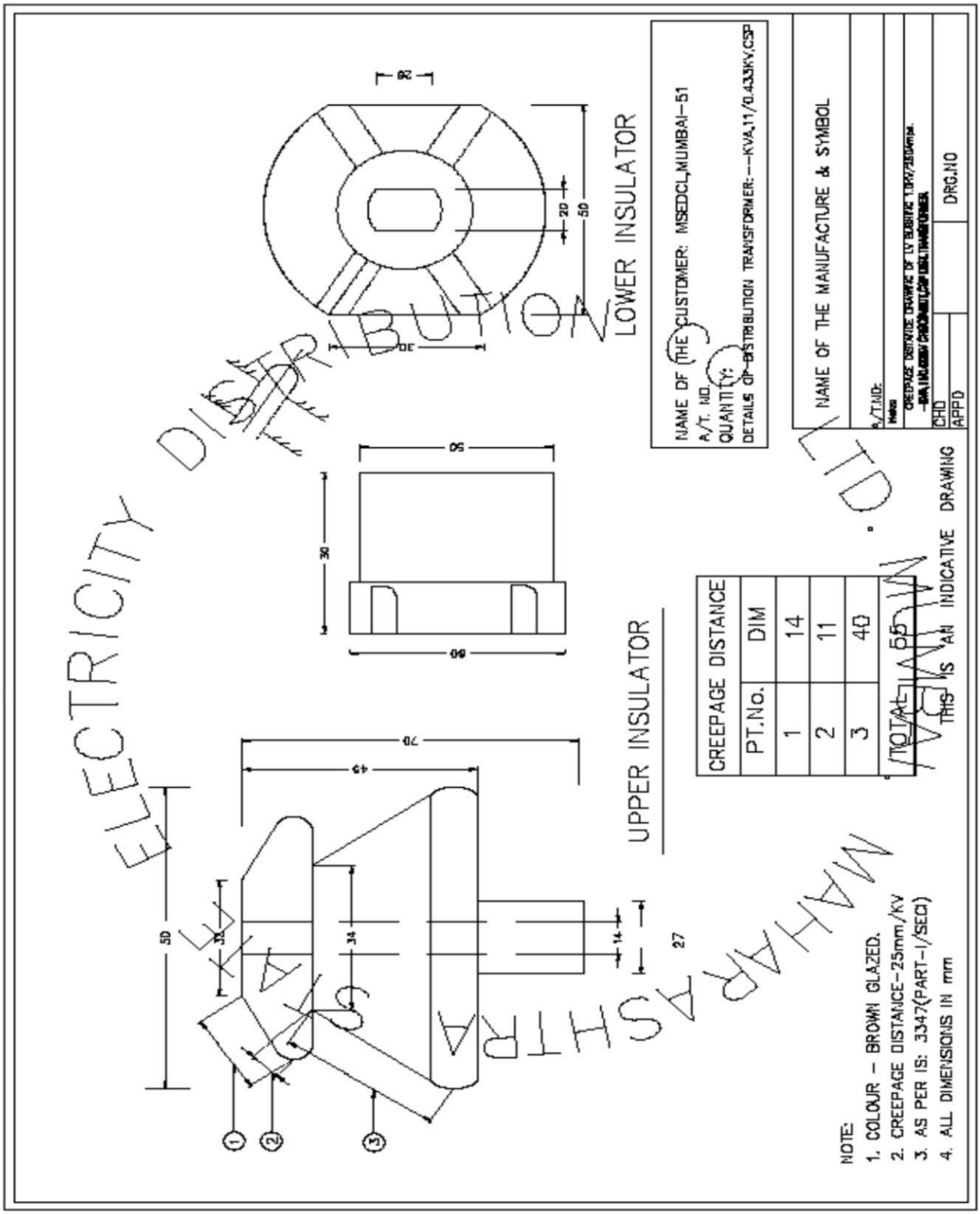
Note:

LV BUSHING ASSEMBLY DRAWING
100KVA,11/0.433KV CRGD,CSP DIST.TRANSFORMER

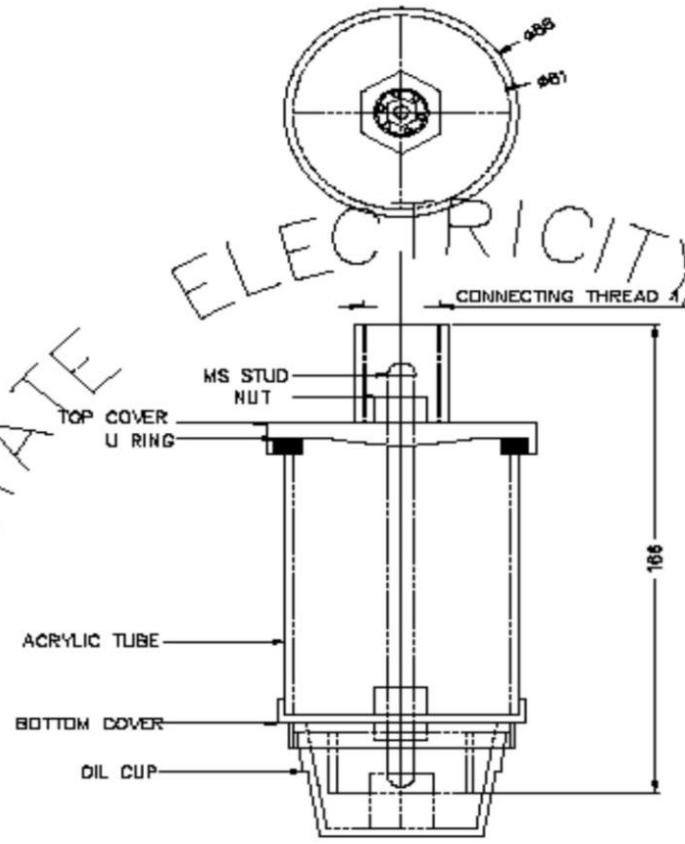
CHD
APPD

DRG.NO

THIS IS AN INDICATIVE DRAWING


ELECTRICITY DISTRIBUTION
LOWER INSULATOR
UPPER 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
P/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-1/SEC)
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		

Note:- The drawings given below are indicative drawings, however for providing and affixing label for respective capacity kVA, should be followedas per guidelines of BEE.

Label design, manner of display:

Fig.1. Detailed label specifications (size, colour scheme, font size, security features, if any, etc.), content of the label (parameters displayed on the label) isprovided below:

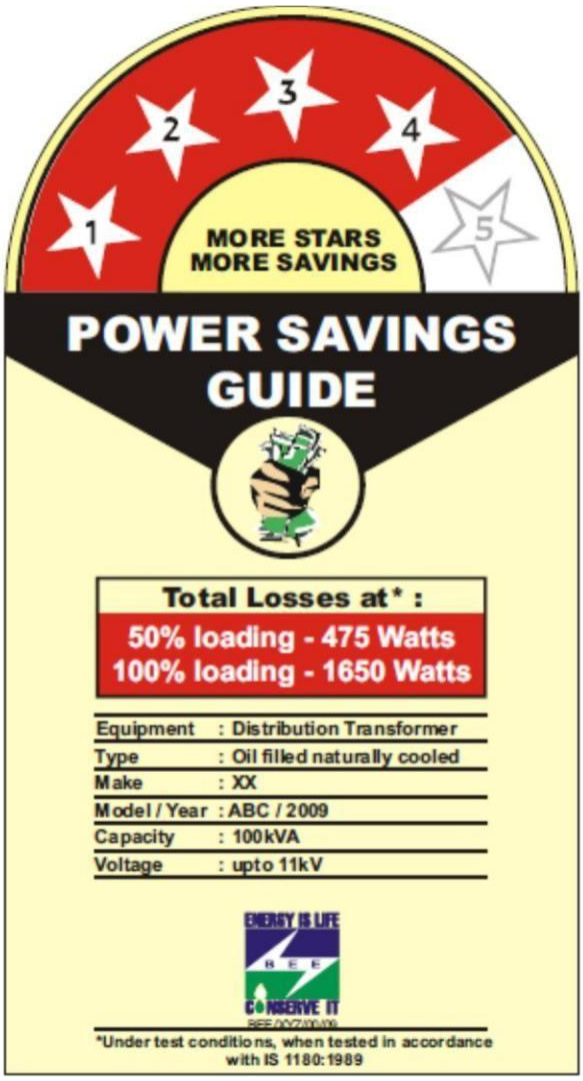
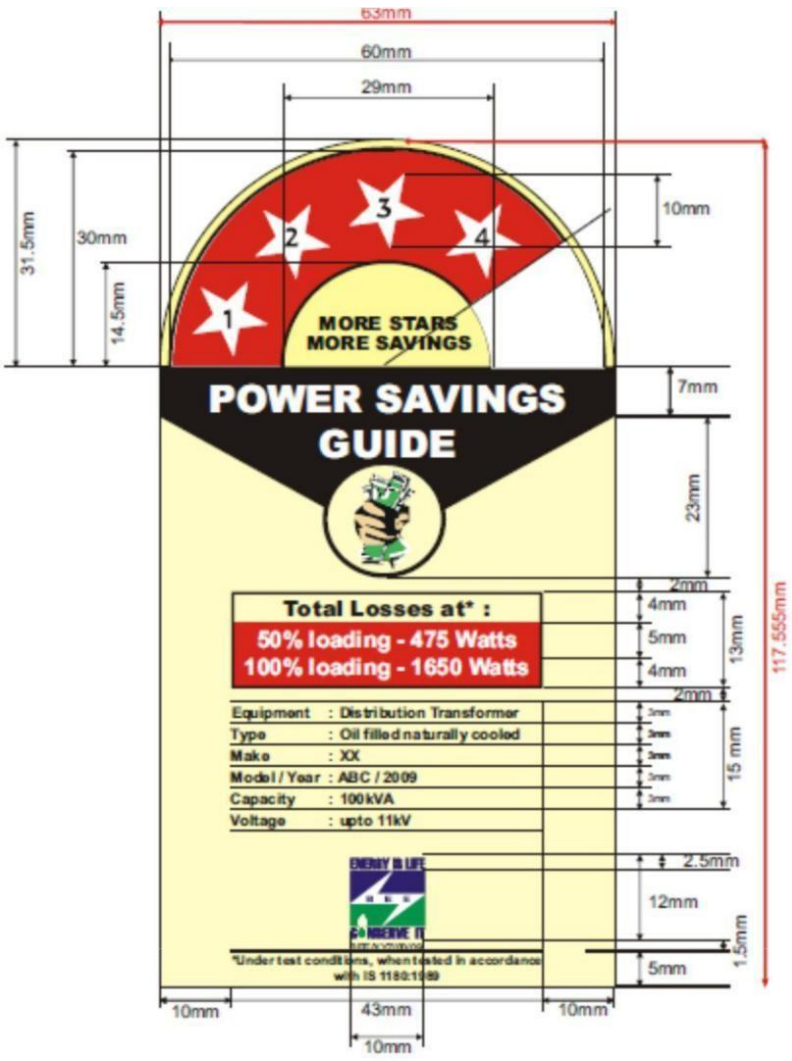
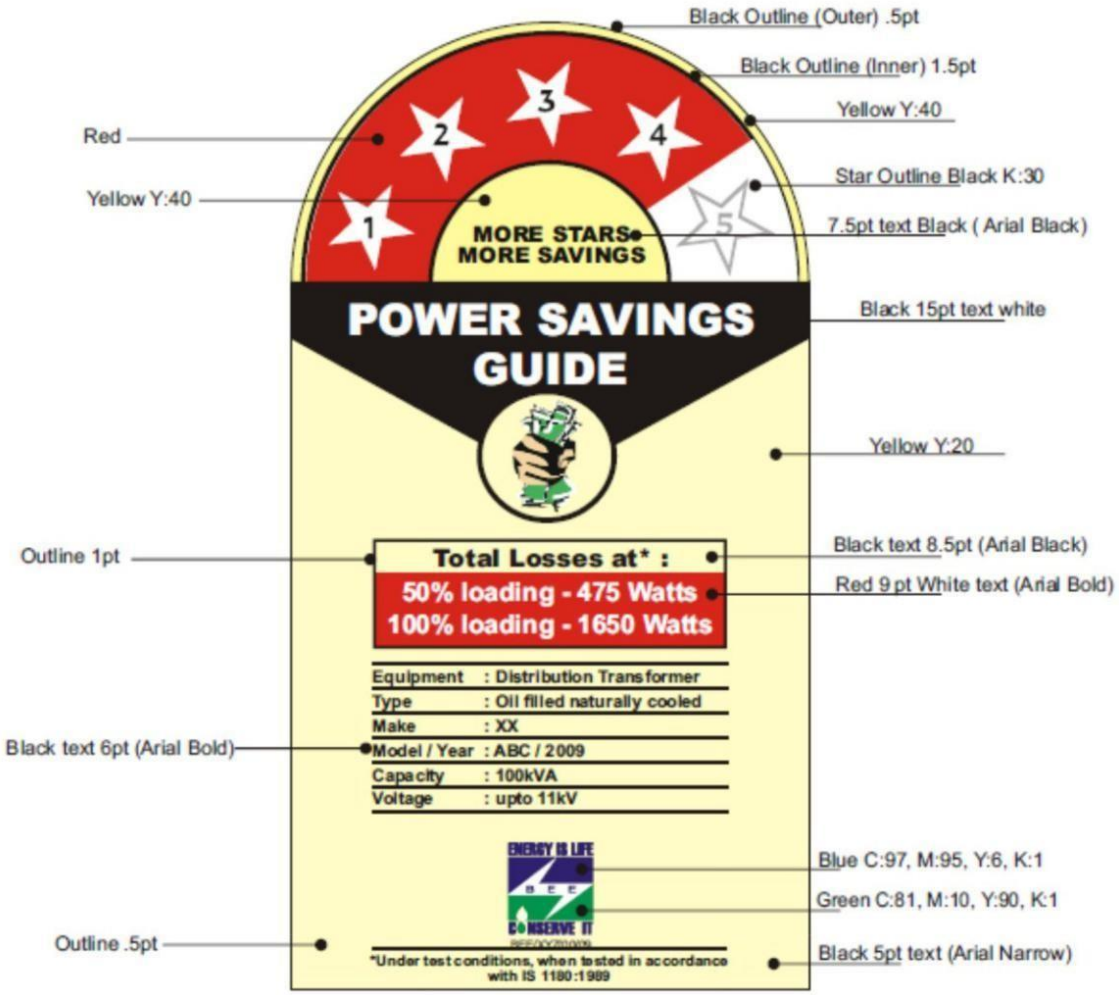
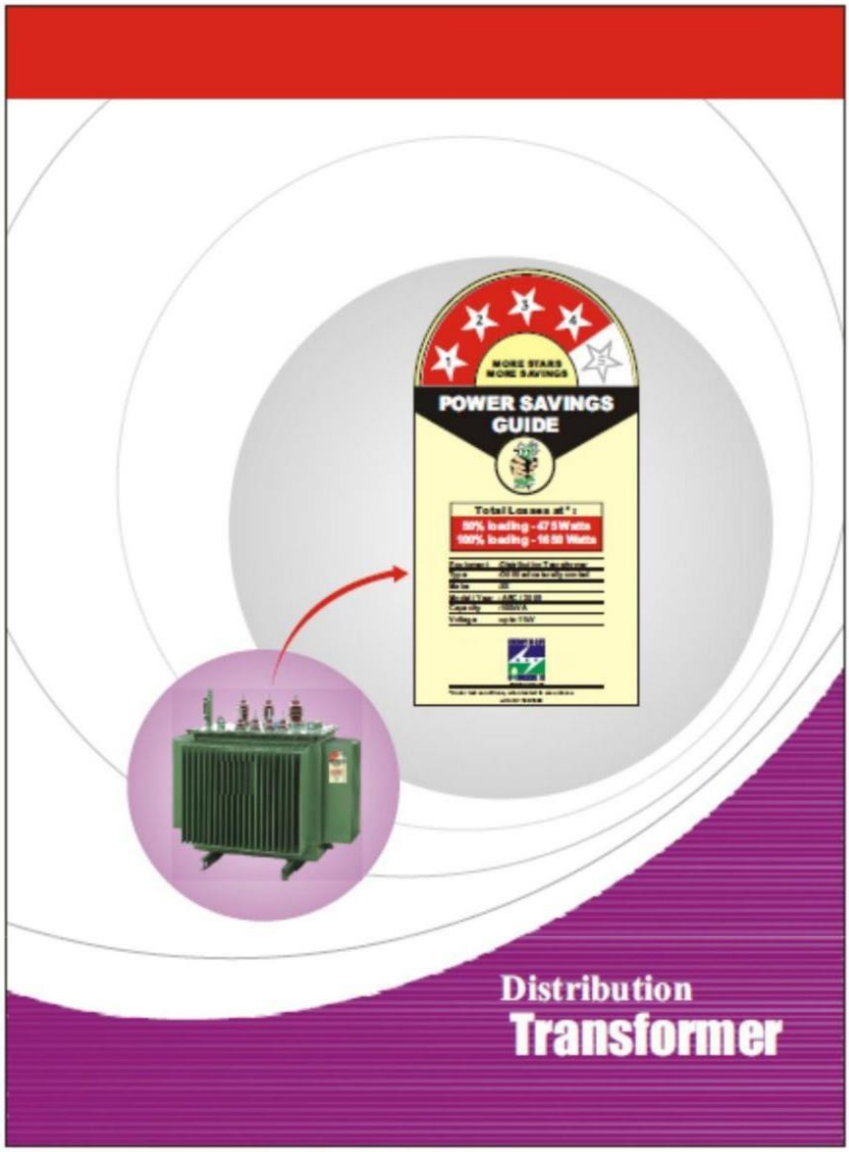


Fig. 2. Manner of display of label:

The label shall be applied on the front base of the equipment near the name plate,so as to be prominently visible on the equipment




Black Outline (Outer) .5pt
Black Outline (Inner) 1.5pt
Yellow Y:40
Red
Star Outline Black K:30
Yellow Y:40
7.5pt text Black (Arial Black)
MORE STARS
MORE SAVINGS
Black 15pt text white
POWER SAVINGS
GUIDE
Yellow Y:20
Outline 1pt
Black text 8.5pt (Arial Black)
Total Losses at* :
Red 9 pt White text (Arial Bold)
50% loading - 475 Watts
100% loading - 1650 Watts
Equipment : Distribution Transformer
Type : Oil filled naturally cooled
Make : XX
Black text 6pt (Arial Bold)
Model / Year : ABC / 2009
Capacity : 100kVA
Voltage : upto 11kV
ENERGY IS LIFE
CONSERVE IT
Blue C:97, M:95, Y:6, K:1
Green C:81, M:10, Y:90, K:1
Outline .5pt
*Under test conditions, when tested in accordance with IS 1180:1989
Black 5pt text (Arial Narrow)


MORE STARS
MORE SAVINGS
POWER SAVINGS
GUIDE
Distribution
Transformer

ANNEXURE-III

Technical Specification for QR code generation

1. SCOPE:

The QR Code Generation for Distribution Transformer Identification should be easy to create, compact in size and friendly user. Being compact in size the QR Code requires less space.

2. SERVICE CONDITIONS:

The QR Code laminated P-Touch labels shall be suitable for satisfactory operationunder the following tropical conditions.

2.1	Maximum ambient temperature (Degree C)	50
2.2	Maximum temperature in shade (Degree C)	45
2.3	Minimum Temperature (Degree C)	3.5
2.4	Relative Humidity (percent)	10 to 95
2.5	Maximum Annual rain fall (mm)	1450
2.6	Maximum wind pressure (kg/sq.m)	150
2.7	Maximum altitude above mean sea level (Meter)	1000
2.8	Isoceranic level (days per year)	50
2.9	Siesmic level (Horizontal Acceleration)	0.3 g

Moderately hot and humid tropical climate conductive to rust and fungusgrowth ….

3. GENERAL TECHNICAL REQUIREMENT:

The QR Code shall be laminated P-Touch labels. The QR Code shall be 2D square barcode which can be store data in encoded format. This saves space and giving specified information to users. This QR Code, if scanned with mobile shall be convert encoded data readable text without error.

4. TECHNICAL DETAILS :

The QR Code laminated P-Touch labels shall be temperature resistant, fade resistant, water resistant, chemical resistant, scratch (abrasion) proof and strong adhesion.

5. TECHNICAL DATA :

The QR Code laminated P-Touch labels with following data shall be provided on transformer.

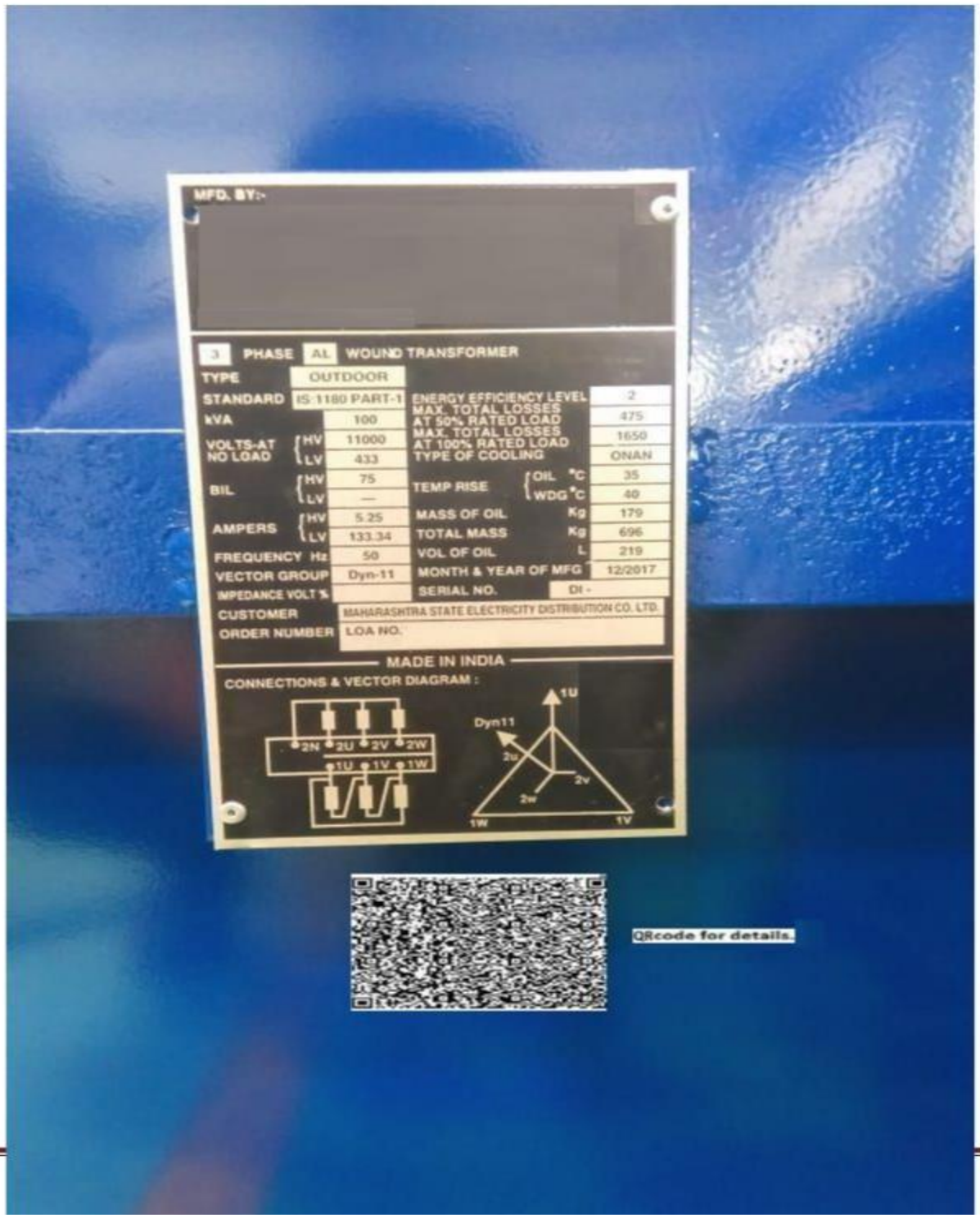
1) Name of Manufacture :
2) Rating :
3) Sr. No. :
4) Date of Manufacturing :

5) A/T No. :

6. LOCATION OF QR CODE :

The QR Code laminated P-Touch labels shall be located below the Name Plate on transformer body. It should be clearly visible.

The QR Code laminated P-Touch labels location as below :


MFD. BY:-
3 PHASE AL WOUND TRANSFORMER
TYPE OUTDOOR
STANDARD IS 1180 PART-1
kVA 100
VOLTS-AT NO LOAD HV 11000 LV 433
BIL HV 75 LV —
AMPERS HV 5.25 LV 133.34
FREQUENCY Hz 50
VECTOR GROUP Dyn-11
IMPEDANCE VOLT %
ENERGY EFFICIENCY LEVEL 2
MAX. TOTAL LOSSES AT 50% RATED LOAD 475
MAX. TOTAL LOSSES AT 100% RATED LOAD 1650
TYPE OF COOLING ONAN
TEMP RISE OIL °C 35 WDG °C 40
MASS OF OIL Kg 179
TOTAL MASS Kg 696
VOL OF OIL L 219
MONTH & YEAR OF MFG 12/2017
SERIAL NO. DI -
CUSTOMER MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.
ORDER NUMBER LOA NO.
MADE IN INDIA
CONNECTIONS & VECTOR DIAGRAM :
2N 2U 2V 2W
1U 1V 1W
Dyn11
1U
2u
2v
2w
1W
1V
QRcode for details.