MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

FOR

TECHNICAL SPECIFICATION OF 63kVA, 11/0.433 kV, 22/0.433 kV, (Star 1) THREE PHASE, DISTRIBUTION TRANSFORMERS OUTDOOR TYPE OIL IMMERSED WITHOUT CSP FEATUREFOR AGRICULTURAL (INDIVIDUAL OR GROUP) CONNECTIONS IN MSEDCL.

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1 Scope:-

1.1 This specification covers design, manufacturing, testing and delivery of **63kVA, 11/0.433 , 22/ 0.433 kV, Star 1, three phase distribution transformers without CSP feature oil immersed, Oil Natural (ONAN)** suitable for 11 kV & 22 kV, 50 Hz, Distributionsystem.

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 ornot.

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 andprices.

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 SystemParticulars:-

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	NominalSystemVoltage	:	11 kV or 22 kV
2.2	Corresponding HighestSystemVoltage	:	12 kV or 24 kV
2.3	Rated BasicInsulationLevel	:	75 KVp or 125 KVp
2.4	Neutralearthing	:	Solidlyearthed
2.5	Frequency	:	50 Hz with ±3 %tolerance
2.6	NumberofPhases	:	3

3 SERVICECONDITIONS:

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

i	Max. ambientairtemperature	:	50 Deg. C
ii	Max. relative humidity	:	100 %
iii	Max.annualrainfall	:	1450 mm
iv	Max.wind pressure	:	150 kg/sq.m.
v	Max. altitude above meansealevel	:	1000 mtrs.
vi	Isoceraunicllevel	:	50
vii	Seismic level(Horizontalacceleration)	:	0.3 g.
viii	ClimaticCondition		Moderately hot and humid tropical climate conducive to rust and fungusgrowth.
ix	Reference Ambient Temperaturefor temperaturerise	:	50 DegC

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 underthese conditions.

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

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

3.5 The Distribution Transformer shall bear star 1 or 2 or 3 or 4 or 5 ratinglabel approved by BEE (Bureau of EnergyEfficiency).

3.6 The Distribution Transformer shall bear level 2 (star 1of BEE) ratings 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 offeredproduct.

3.8 The Bidder/ Manufacturer shall possess the BEE certification for offeredproduct.

4 APPLICABLESTANDARDS:-

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 1180latest.

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 thefollowing:-

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
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 this specification shouldprevail.

5 Specific Technicalrequirement:

5.1 Standard kVARatings:-

The standard ratings for three phase transformer shall be 63 kVA as per IS 1180 (Part-I):2014

5.2 Nominal voltage ratings

i Primaryvoltage : 11 kV/ 22 kV

ii Secondaryvoltage : 0.433 kV

5.2.1 Windingconnections:-

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 TemperatureRise:

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 voltageratio:-

The no load voltage ratio shall be 11000/433 Volts &22000/433 Volts Design & construction

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

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 1.55 Tesla at rated voltage and frequency.

d. Limit of no load current shall be 3% of full load current of respective winding at ratedvoltage.

5.5 Core

i The core shall be stacked/ woundtype.

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 steelclamped.
2. M.S. core clamps shall be painted with oil-resistantpaint.
3. Suitable provision shall be made in the bottom core clamp / bottom plate of the transformer to arrest movement of the activepart.
4. Core shall be clamped by minimum 12 mm diameter MS Tierods.
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 thesupplier.

ii The grade of core laminations shall be M4 orbetter.

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 Corematerials.
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 or 33000/50) (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 thissituation.

v Fluxdensity:-

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 1.55 Tesla at rated voltage and frequency.

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

The no load current of 63 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 12.5 percent of rated voltage shall not increase the no load current by 6% of full load current.(As per IS 1180(Part1):2014)

Number of steps of core shall be minimum of

Sr. No.	Rating (kVA)	Number of steps
1	63	Min. 5 standard steps

5.6 Winding:-

The material for winding shall be Aluminium/Copper.

i Materials:- Double paper covered Aluminum conductor shall be used for HV and LV winding for 11 kV.

ii Double paper covered Copper conductor shall be used for HV and LV winding for 22 kV with respectiveclass.

ii Current Density:- Current density for HV and LV winding should not be more than 2.8 A/sq. mm for Copper and 1.6 A/sq. mm forAluminum.

iii L.V. Neutral formation shall be attop.

5.7 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:- for 11kV class transformers. *The indicated losses in the table are for CRGO coreonly.*

Maximum Total losses in watts up to 11 kV Class			
		Star 1 (Level-2)	
Rating (kVA)	Impedance (Percent)	50% Load	100% Load
63	4.50	340	1140

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 6.8.1.2 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 positivetolerance.

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).

5.8 Insulation material &clearances:

i Materials - Makes of Electrical grade insulating Kraft 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 .Compliance to Kraft paper IS 9335 [Cl.No.9.1(d) of IS 1180 (Part 1):2014] and for press board IS 1576 [Cl.No.9.1(e) of IS 1180 (Part 1):2014] and gasket shall be ensured through test certificate of thesupplier.

ii 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 30 mm and 40 mm for 11 kV and 22 kV classrespectively.

iii Thickness of locking spacers and thickness of comb teeth between HV coils and HV Disc – Minimum 3 mm. to 200 kVA and Minimum clearance for cross over coil shall be 10 mm upto 200 kVA .

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

5.9 Impedance Value-

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

5.10 Tank

5.10.1 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 transformerwhenfilledwithoilmaybeliftedbodilybymeansoftheliftinglugs

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 atcorners.

5.10.2 The transformer tank of corrugation is also acceptable, however shape of tank shall be rectangular only. The corrugation sheets thickness shall be of minimum 1.6mm. 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 thetank.

5.10.3 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 bereleased.

Sidewallthickness	:	3.15 mm. (min.)
Top and bottomplatethickness	:	5 mm. (min)

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

(All figures in mm)

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

5.10.4 Reinforced by welded angle 50X50X5 MM on all the outside walls on the edge of tank to form two equalcompartments.

5.10.5 When transformer tank without oil is subject to air pressure of 80 KPa above atmospheric pressure for 30 min as per IS 1180 (Part 1):2014. Pressure test shall be performed carefully as per IS 1180 (Part 1):2014 Clause no.21.5.1 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).

5.10.6 All welding operations to be carried out by MIG process.(Metal Inert GasWelding)

5.10.7 Lifting lugs: 2 nos. for 63 kVA welded heavy duty lifting lugs of MS plate of 8 mm (minimum) thickness suitably reinforced by vertical supporting flat of same thickness as of lug welded edgewise below the top cover on the side wall. They shall be so extended that cutting of bend plate is not required. 2 nos. of welded heavy duty lifting lugs of MS plate of 8 mm thickness should be on the top plate oftransformers.

5.10.8 Pulling lugs: 4 nos. of welded heavy duty pulling lugs of MS plate of 8mm thickness shall be provided to pull the transformerhorizontally.

5.10.9 All bolts / nuts / washers exposed to atmosphere shall be as follows:[Clause no.15.3 of IS 1180 (Part1):2014]

a) Size 12mm or below—stainlesssteel.

b) Above 12mm--- steel with suitable finish like electro galvanized with passivation or hot dipgalvanized.

5.10.10 Top cover fixing bolts: GI nut bolts of 1/2‖ diameter (min) with one plain washer shall be used for top cover fixing, 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 coverplate.

5.10.11 Vertical clearance: - The height of the tank shall be such that minimum vertical clearance up to the top cover plate of 120 mm is achieved from topyoke.

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

5.10.13 The tank design shall be such that the core and windings can be liftedfreely.

5.10.14 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.

5.10.15 Thermometer pocket if any must be located at centre of top cover or high side of tank height for true valve of max top oiltemperature

5.10.16 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-determinedpressure.

5.10.17 QR code laminated P touch labels shall be fixed on transformer tank body belowthe nameplatedepictingvarioustechnicaldetailssuchasNameofmanufacturer,rating, Serialno,dateofmanufacturing,A/TNo.etc

6.7 Off Load Taps:

6.7.1 No taps are normally required to be provided up to 63 kVA rating, unless specified by the user.

7.0 Efficiency:

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

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

The minimum Percentage Efficiency of distribution transformer shall be 98.25 %.

Total loss comprise of No-load loss and Loadloss.

8.0 HeatDissipation:

a) Heat dissipation calculation should be based on minimum measured total loss i.e. (No load at rated excitation + load loss at 100 %loading) converted to 75 deg' C reference temperature) shall be supplied during temperature risetest.

b) The heat dissipation by tank wall should be increase to appropriatevalue considering the climatic temperaturerise.

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
1	63	155	165

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.

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 color shall not beaccepted.

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 approximately20 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 be above the sump level. [Refer Cl.no.16.3 of IS 1180 (Part1):2014]

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

11.0 Breather:

a) The material used for breather shall be only of Polypropylene

b) The dehydrating agent shall be silica gel. The volume of breather shall be suitable for250gmupto63kVA,silicagelconfirmingtoIS3401
.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).

12.0 Terminals:

a. The Palm type terminal connector of adequate capacity shall be connected to L.V side suitable to connect it to the Busextension.

b. On H.V. side the bimetallic connector to be provided with bimetallic lug of suitable rating.

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

d. Brass rods 12 mm. diameter for HT with necessary nuts, check-nuts and plain thick tinnedwasher.

e. Tinned Copper Rods of 12 mm diameter upto 63 kVA distribution transformers for LT extension with suitable cable lugs, necessary nuts, check-nuts and plain thick tinnedwasher.

13.0. Bushings &Connections:

13.1 The transformers shall be fitted on high voltage and low voltage sideswith outdoor type bushings of appropriate voltage and current ratings. The high voltage 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.

13.2 The 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 IS3347 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]

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

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

13.5 For 11 kV class 12 kV bushing, for 22 kV class 24 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 shall be mounted on the top of the transformer tank & LV bushings shall be mounted on side of the transformertank.

13.6 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 theBushing.

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

13.8 Compliance of bushing as per IS 2099 / IS 7421 and relevant part of IS 3347 shall be ensured through test certificate from the supplier of transformer manufacturer firm getting the same tested from BIS recognized / group 2 category oflaboratory.

13.9 Supporting clamp for cable should be provided to avoid weight of cable on the

bushing/bushingrod

(i) HT side – Tinned brass (ii) LT side – TinnedCopper

14.0 Internalconnections:

14.1 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 andbrazing.

iii. In case of Aluminium/Copper Winding Delta joints shall be with Brazingonly.

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

14.2 L.V. Winding:

i. For Copper windings crimping & silver brazing alloy shall beused.

ii. 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 andbrazing.

iii. FirmconnectionsofL.T.windingtobushingshallbemadeofadequatesizeof `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 andwashers.

15.0 Tank base channel / Mounting Arrangement :

The under-base of the transformer shall be provided as per clause 14.1 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 inwatts

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 act1986.

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 orstamping).

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 thetank.

g) The distribution transformer shall 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 madethereunder.

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 be4:3.

i) The copy of valid ISI licence shall be submitted in support with the bidding document.

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.

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) ISIMark.
(ii) Energy Efficiency level as approved byBIS
(iii) Order No. – Month &year.
(iv) Sr. No. oftransformer.
(v) Date of manufacturing – Month &year.
(vi) Date of expiry of guarantee period – month &year.
(vii) Maximum guaranteed 50% load loss & 100 % load lossfigures.
(viii) Name and full address of themanufacturer.
(ix) Capacity.
(x) 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 nosfortop 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 250/500 g	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 3 nos. of brass nuts and 2 plain brass washers.
15	Radiators	As per Cl. No. 8 (b)
16	Lightening Arrestors for HT bushings	3 nos
17	Pulling lugs	4 nos
18	Five year 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.

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)

17.2 Fasteners.

1. 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.
2. Bolts or studs shall not be less than 6 mm in diameter except when used for small wiringterminals.
3. All nuts and pins shall be adequatelylocked.
4. 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 inposition.
5. 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 dissimilarmaterials.
6. 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.

7. The length of screwed portion of the bolts shall be such that no screw thread may form part of a sheer plane betweenmembers.
8. Taper washers may be provided where necessary. Protective washers of suitable material shall be provided front and back of the securingscrews.
9. LT side should be of Pad typeterminal.

18.0 LightningArrestors:

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 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 groundedseparately.

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

19.0 TransformerOil

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 mm²/s, Max.
2.	Viscosity at 0°C	IS : 1448 (Part 25)	1800 mm²/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 inClause 21.2 to 21.4 of IS 1180 (Part 1):2014 shall be performed as per relevant partsof 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 routinetests:

a) Measurement of winding resistance [IS 2026 (Part 1)].
b) Measurement of voltage ratio and check of phase displacement[IS2026(Part1)].
c) Measurement of short circuit impedance (principal tapping, when applicable) and load loss at 50 percent and 100 percent load [IS 2026 (Part1)].
d) Measurement of no load loss and current [IS2026 (Part1)].
e) Measurement of insulation resistance [IS 2026 (Part 1)].

f) Induced over-voltage withstand test [IS2026 (Part3)].
g) Separate-source voltage withstand test [IS2026 (Part3)].
h) Pressuretest
i) Oil leakagetest

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

a) Lightening impulse test [IS2026 (Part3)].
b) Temperature-rise test [IS 2026 (Part2)].
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)]. (upto 200kVA)
d) Pressuretest.
In addition to that the successful bidder shall submit the type test report of transformer Oil & HV/LV bushings as per relevant IS with offer.

20.3 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 ofoffer.

20.4 The type test reports should be submitted and got approved from the Chief Engineer (MMC) before commencement ofsupply.

20.5Special Tests (to be conducted on one unit):- The following shall constitute the specialtests.

a) Determination of sound levels [IS2026 (Part10)].
b) No load current 112.5 percent voltage [refer clause 7.9.2 of IS 1180(Part 1): 2014].
c) Paint adhesion tests: The test is performed as per ASTM D 3359 (Standard Test Methods for measuring adhesion by TapeTest).
d) BDV and moisture content of oil in the transformer (IS 335).
Note:Tests at (c) and (d) may be carried out on more than oneunit.

20.6 Pressure and Oil leakage Test:-

20.6.1 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

20.6.2. 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.

20.6.3 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 anypoint.

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 magnetizingcurrent.
2. No load lossestest.
3. Load losses test (at 50 % loading or as per routinetest).
4. Temperature risetest.

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 positivetolerancesinlossesispermitted.Iftheproductisnotconfirmedthe

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 theutility.

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 compete in tenders of the MSEDCL for the period of three years and heavy penalty would be imposed.

22.0 Offer Qualification for TypeTest:-

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

i) If above tests are carried out beyond 5years
ii) Impulse Voltage Withstand test ,Dynamic Short Circuit test, Temperature rise Test & Pressure Test carried out not from NABL approvedLaboratory.
iii) If there is any change in the design/ type of old type tested transformers to be offered against thisspecification.

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.*

22.2 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 theoffer.

23.0 Drawings & Calculationsheet:-

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

i. General Dimensionaldrawing.
ii. Core Assemblydrawing.
iii. Internal ConstructionDrawing
iv. Rating & Diagram Plate Drawing.(As per Cl.no.13.1 Fig.1 ofIS 1180(Part1):2014
v. HV& LV Bushings Assemblydrawing
vi. Creepage distances distance drawing of HV& LVBushing
vii. Silica gel Breatherdrawing.
viii. Technical Detaildrawing.
ix. Calculation sheet for flux density
x. Heatdissipation
xi. Oilabsorption

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 TestReports.

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 (MMC) for approval and get approved it before offering Ist stageinspection.

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 followingreasons.

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

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

iii Type test are not carried out as per clause no. 20.2 & 20.3 of the specification.

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

v. GTP not submitted as per clause no. 26.0 of thespecification.

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

25.0 Cleaning andPainting.

i. The external surfaces shall be painted with one coat of thermo setting paint or one coat of epoxy primer followed by two coats of polyurethane(finish coat) for (outside) and hot oil resistant paint/ varnish with one coat (inside) with dry film thickness as mentioned in Table 12 , Cl.no.15.5 of IS 1180(Part 1):2014.

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

iii. 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 theground.

26.0 Guaranteed & TechnicalParticulars:

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 thetender.

28.0 Submission Routine TestCertificate

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 assembledtransformer

b. Instruction and operationManual

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 Supplier shall give 15 days advance intimation to the Chief Engineer (MM

Cell.) 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 his representative 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.

29.7 Testing of all Distribution Transformers for no load and full load losses.

29.8 After inspection of new transformers at factory for acceptance of the lot, all distribution transformers from the lot will be tested for no load and full load losses at 50 % & 100 % loading at all stores. Tenderer has liberty to be present at the time of testing.

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. S.E. (MMC.), M.S.E.D.C.L 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 No load & full load losses.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 TransformerOil:

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 thelot.

33.0 QualityAssurance

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

33.2 Certificates of following materials shall be submitted as per relevant standards indicated in Clause No.9.1 of IS 1180(Part1):2014.

i. Copper / Aluminumconductor
ii. Transformer oil
iii.C.R.G.O.Core
iv. Insulating / Kraftpaper.
v. PorcelainBushings
vi Steel Plate used for Tank, press board.

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 befurnished.

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

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 withhim.

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

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

33.8 Special features provided in the equipments to make it maintenancefree

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. These limitations shall be very clearly brought out in schedule of deviations from specified testrequirements.

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 assembledtransformer.

34.0 Qualifying Requirement: As perTender

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. Out of balance 90% distribution transformers, one transformer shall be opened and all design technical parameters should be checked as per E-GTP, approved drawings and technical specifications. If any technical parameters are found deviating from the E-GTP, approved drawings & technical specifications, the final inspection of the whole lot shall be reoffered for final inspection after rectification.

C.E. (MM Cell) will depute his representative at the time of final inspection along with "Executive Engineer (Testing)"Leakage test on sample transformer shall be carried out during final inspection as per relevantIS.

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.

Annexure I

Air Pressure Test

Name of Supplier:

Order No.:

Capacity & Voltage Ratio of DistributionTransformer :_____kVA,_____/0.433 kV

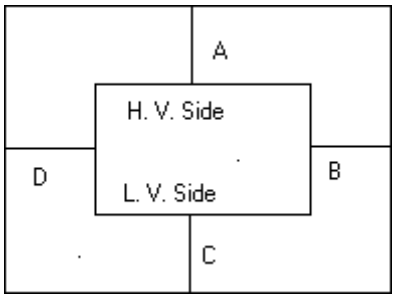
Vector GroupDyn11

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.



TankThickness:Side_____mm. Top& Bottom_____mm

TestPressure:_____kg/cm^2 applied for 30Minutes.

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

Permanent Deflection:_____mm

Permissible Limit of Permanent Deflection as perSpecification:_____mm

Test witnessed by Tested by

Annexure II

Temperature Rise Test

Name of Supplier:
Order No.:
Capacity & Voltage Ratio of DistributionTransformer :_____kVA,____/0.433 kV
Vector GroupDyn11
Sr. No. of equipment Tested:
Date of Testing:
Reference Standard

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

Guaranteed NoLoadLosses _____watt
LoadLosses _____watt
TotalLosses _____watt

P. T.Ratio : _____/____ =
C. T. Ratio : _____/_____ =
WattmeterConstant =
Total MultiplyingFactor(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 toRated 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 LVWinding=_____°C

HV Winding Resistance across1U1V at_____°C =_____ohm

Measurement of Hot Resistance of HV Winding after ShutDown.

Time	Resistance

Hot winding Resistance at AmbientTemperature_____°C (fromgraph)= _____ 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 inOil = _____°C

2) Temperature Rise in LV Winding = _____°C

3) Temperature Rise in HVWinding = _____°C

4) Oil leakagetest:

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 shouldoccur.

Test witnessed by Tested by

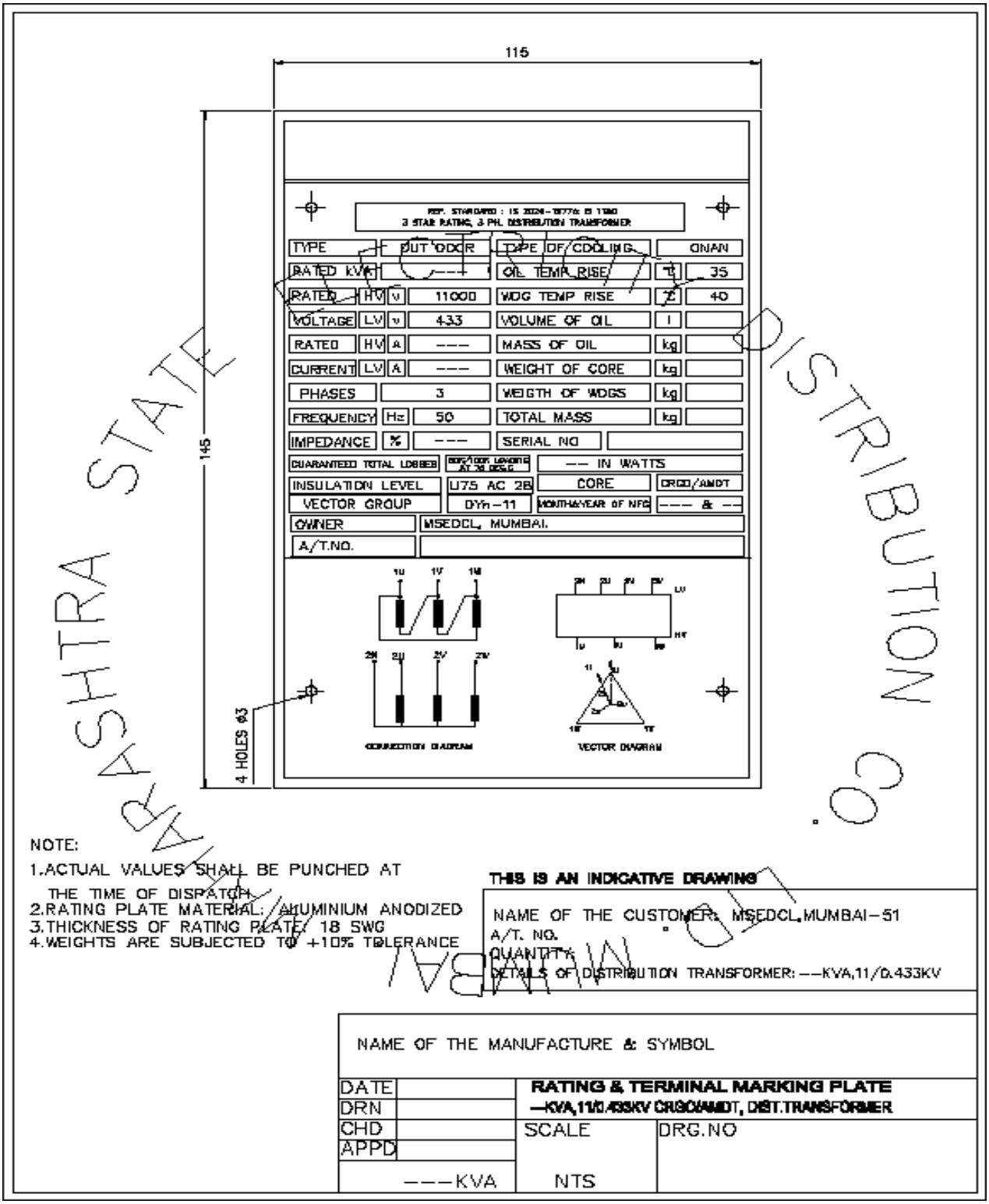
Three phase, 63, kVA, 11/0.433 kV & 22/0.433 kV Distribution Transformer Star 1 (Level2) without CSP feature		
Sr. No.	GTP Parameter	
1	Name of Manufacturer .	T
2	Reference Standard	T
3	Whether transformer is Oil Natural Air Natural cooled type (Yes/ No)	B
4	Whether transformer is suitable for Indoor /Outdoor installation	T
5	Rating of transformer in KVA	N
6	Primary Voltage in kV	N
7	Secondary Voltage in kV	T
8	Whether neutral is solidly earthed (Yes/ No)	B
9	Colour of transformer	T
10	Vector Group	T
11	Approximate overall length of transformer in mm	N
12	Approximate overall breadth of transformer in mm	N
13	Approximate overall height of transformer in mm	N
14	Approximate length of transformer tank in mm	N
15	Approximate breadth of transformer tank in mm	N
16	Approximate height of transformer tank in mm	N
17	Thickness of the side of transformer Tank plate in mm	N
18	Thickness of the bottom of transformer tank plate in mm	N
19	Thickness of the top of transformer tank plate in mm	N
20	Weight of Tank & fittings in kgs	N
21	Total Weight of Transformer in kgs	N
22	Type of Tank (corrugated/conventional)	T
23	Degree of slope to the top plate of Transformer.	T
24	In case of Corrugated tank, Thickness of corrugated sheet (in mm)	T
32	Name plate details are as per the requirement specified in tender. (Yes/ No)	B
33	No of radiators provided and location with arrangement	T
34	Thickness of the radiator of transformer in mm	N
35	No of radiator fins .	T
36	Total radiating surface of transformer tank in Sq. mtrs.	N
37	Core material used & its grade	T
38	Type of core	T
39	Weight of Core in kgs	N
40	No. of steps of core for CRGO core	N
41	Diameter of core in mm	N
42	Effective core area.(sq.cm)	N
43	Flux density in Tesla	N
44	Thickness of core lamination in mm	N
45	The temperature shall in no case reach a value that will damage the core itself, other parts or adjacent materials (Yes/No)	B
46	Type of connection for H.V. Winding (Delta) (Yes/ No)	B
47	Type of connection for L.V. Winding (Star) (Yes/ No)	B
48	Material of H.V. winding	T
49	Material of L.V. Winding	T
50	Insulation provided to H.V winding.	T
51	Insulation provided to L.V. winding.	T
52	Current density of H.V. winding (in Ampere/ sq.mm)	N
53	No of LV winding turns	N
54	No of HV winding turns	N
55	Resistance of LV winding per phase at 20 deg C in ohms	T
56	Resistance of HV winding per phase at 20 deg C in ohms	T

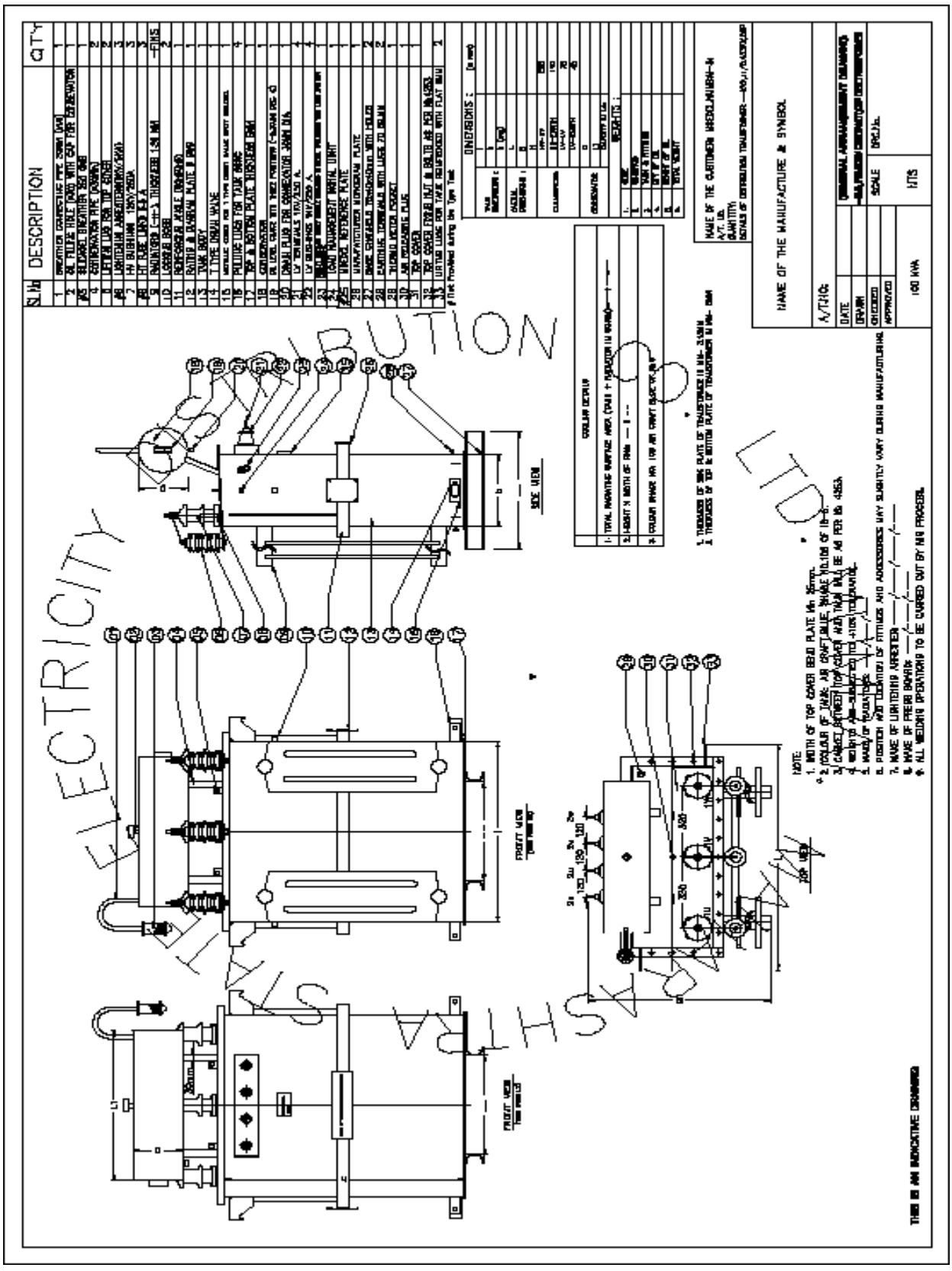
57	Current density of L.V. winding (in Ampere/sq. mm.)	N
58	Clearance between Core & L.V. winding in mm	N
59	Clearances between L.V. & H.V. winding in mm	N
60	Clearances between HV Phase to Phase in mm	N
61	Clearances between end insulation to Earth in mm	N
62	Clearances between winding to tank in mm (min 30 mm)Yes/No	B
63	Weight of Aluminum/Copper in kgs	N
64	Inter layer insulation provided in H.V winding to design for Top & bottom layer	T
65	Inter layer insulation provided in L.V winding to design for Top & bottom layer	T
66	Inter layer insulation provided in between all layer in H.V winding	T
67	Inter layer insulation provided in between all layer in L.V winding	T
68	Details of end insulation	T
69	Whether wedges are Provided at 50% turns of the Coil (Yes/ No)	B
70	Insulation materials provided for core	T
71	Length of coil used for HV winding in meter.	N
72	Cross section area of the coil used for HV winding (sq.mm)	T
73	Length of coil used for LV winding in meter.	N
74	Size of strip used for LV winding in mm	T
75	No. of conductors in parallel for LV winding	N
76	Total cross section area of LV conductor in sq. mm	N
77	No. of H.V coils /phase	N
78	Thickness of locking spacers between H.V. coils (in mm)	N
79	Weight of Oil in kgs	N
80	Volume of Oil in Ltrs	N
81	Quantity of total oil absorption (in liters) in first filling	N
82	Total oil Volume including Total Oil absorption in liters	N
83	Grade of Oil used.	T
84	Name of Oil manufacturers to be supplied.	T
85	Breakdown Values of Oil at the time of first filling (kV/mm) considering 2.5 mm gap	T
86	Conservator tank to the transformer with oil level indicator (showing three levels) and drain plug is provided (Yes/ No)	B
87	Drain Valve (20 mm) provided to the transformer tank (Yes/No)	B
88	Earthing terminals with lugs is provided (Yes/No)	B
89	Lifting lugs provided (Yes/No)	B
90	Oil filling hole with cap (on conservator) is provided (Yes/No)	B
91	Thermometer pocket is provided (Yes/No)	B
92	Quantity of Silica-Gel filled in breather (in gm)	N
93	Material of HV and LV Bushings and makes thereof	T
94	Reference standard of Bushings	T
95	Rating of L.V. Bushing	T
96	Minimum Creepage Distance of HV Bushing in mm (min.25 mm per kV)	N
97	Minimum Creepage Distance of LV Bushing in mm (min.25 mm per kV)	N
98	Rating of H.V. Bushings (in kV)	N
99	Rating of L.V. Bushing (in kV, kA)	T
100	Min. External clearances of H.V. bushing terminals between ph. to ph (255 mm)	B
101	Min. External clearances of H.V. bushing terminals between ph. to earth (140 mm)	B
102	Min. External clearances of L.V. bushing terminals between ph. to ph (75 mm)	B
103	Min. External clearances of L.V. bushing terminals between ph. to earth (40 mm)	B
104	Rating of Lightening Arrestors and Make thereof	T
105	Reference Standard of Lightening Arrestors.	T
106	Maximum winding temperature rise in °C over an Ambient temp. of 50°C by Resistance Method	N
107	Maximum temperature rise of Oil in °C over an Ambient temp. of 50°C by thermometer.	N
108	Magnetizing current (No load) in Amps and its % of full load current at rated voltage	T

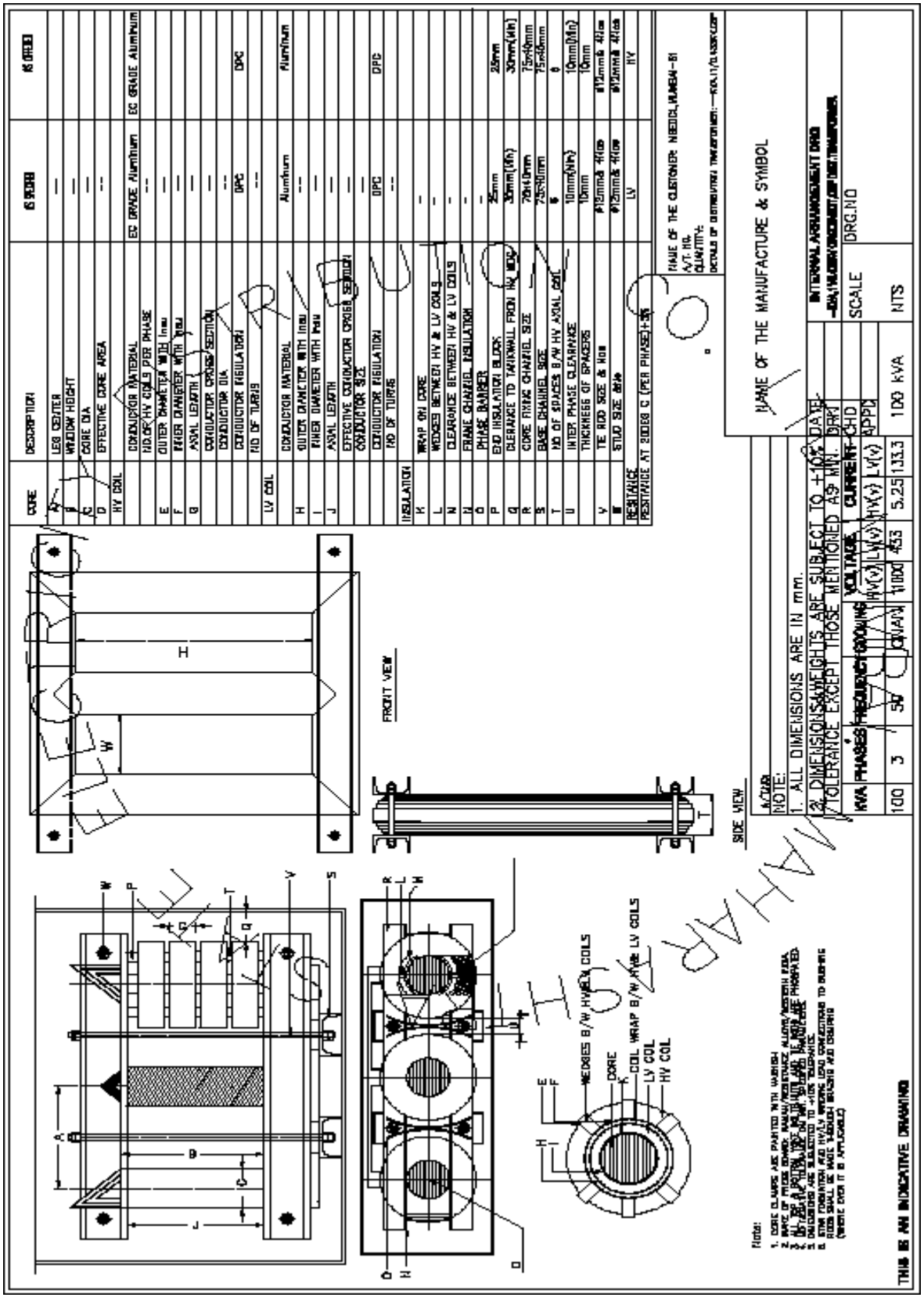
	referred to L.V. side.	
109	Magnetizing current (No load) in Amps and its % of full load current at maximum voltage (112.5% of rated voltage) referred to L.V. side.	T
110	Max. core (No load) losses at rated voltage and rated frequency (Watts) .	N
111	Max. Total losses (No Load + Load Losses at 75 °C) at 50% loading in Watts	N
112	Max. Total losses (No Load + Load Losses at 75 °C) at 100% loading in Watts	N
113	Efficiency at 75 °C at unity P.F. at 125% load	N
114	Efficiency at 75 °C at unity P.F. at 100% load	N
115	Efficiency at 75 °C at unity P.F. at 75 % load	N
116	Efficiency at 75 °C at unity P.F. at 50% load	N
117	Efficiency at 75 °C at unity P.F. at 25% load	N
118	Efficiency at 75 °C at 0.8 P.F. lag at 125% load	N
119	Efficiency at 75 °C at 0.8 P.F. lag at 100 % load	N
120	Efficiency at 75 °C at 0.8 P.F. lag at 75 % load	N
121	Efficiency at 75 °C at 0.8 P.F. lag at 50 % load	N
122	Efficiency at 75 °C at 0.8 P.F .lag at 25% load	N
123	Efficiency at 75 °C at 0.8 P.F. leading at 125% load	N
124	Efficiency at 75 °C at 0.8 P.F. leading at 100% load	N
125	Efficiency at 75 °C at 0.8 P.F. leading at 75% load	N
126	Efficiency at 75 °C at 0.8 P.F. leading at 50%load	N
127	Efficiency at 75°C at 0.8 P.F. leading at 25 % load	N
128	Regulation at Unity P.F (in %)	N
129	Regulation at 0.8 P.F. lag. (in %)	N
130	Regulation at 0.8 P.F. leading. (in %)	N
131	% Impedance value at 75°C	N
132	Separate source power frequency withstand test for HV for 1 minute in kv(min)	T
133	Separate source power frequency withstand test for LV for 1 minute in kv(min)	T
134	Induced over voltage withstand test for 1 min. specify voltage frequency, time for test.	T
135	Impulse test value (in kVp) .	T
137	The test certificates of Aluminium/copper conductor, core , insulating paper, porcelain bushings, steel plate used for enclosure of offer transformer is enclosed along with the offer in soft copy.(Yes/ No)	B
138	All type test report of type tests 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)	B
139	Air pressure test and temperature rise test shall be conducted as per format enclosed with the technical specification along with the offer (Yes/ No)	B
140	All drawings shall be furnished for each offered item separately along with this offer (Yes/ No)	B
141	Oil absorption calculation sheet shall be furnished for each offered item separately along with this offer (Yes/ No)	B
142	Heat dissipation calculation shall be furnished for each offered item separately along with this offer (Yes/ No)	B
143	Flux density calculation sheet with no. of Primary & Secondary turns shall be furnished for each offered item separately along with this offer (Yes/ No)	B
144	Calculation sheet for 112.5% of Rated V/f ratio (over fluxing calculation sheet) shall be furnished for each offered item separately along with this offer (Yes/ No)	B
145	Required documents, plant and machinery, list of order executed/under execution shall be furnished for each offered item separately along with this offer (Yes/ No)	B
146	The information required under Quality Assurance shall be submitted with the offer in physical format & soft copy(Yes/ No)	B
147	The cost data in the prescribed format shall be submitted with offer in physical format & soft copy (Yes/ No)	B
148	The performance Guarantee of the transformers in years	N

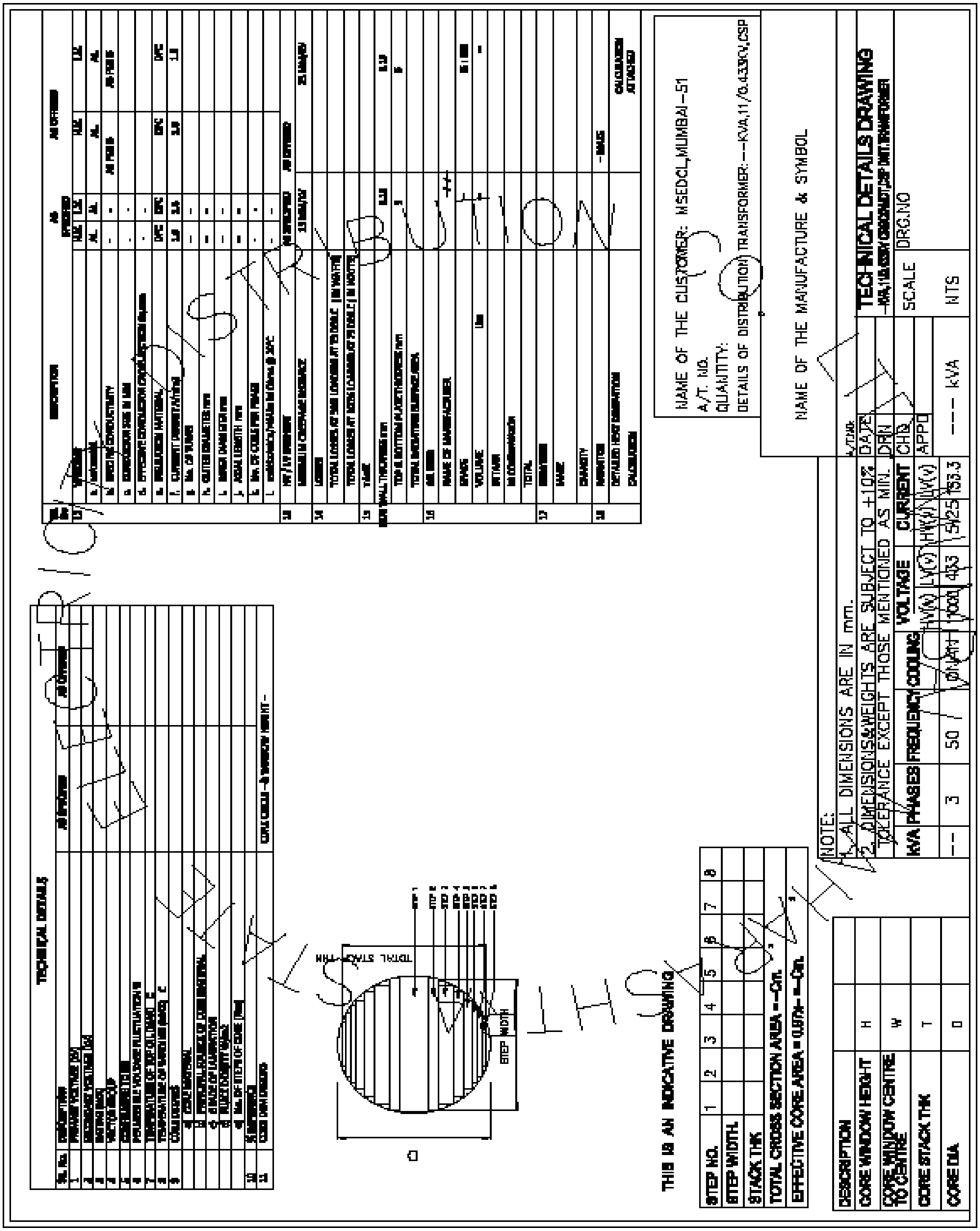
149	Power frequency withstand voltage dry & wet in kV(rms) for H.V Bushing	T
150	Dry lightning Impulse withstand voltage test in kV (peak) Stating the wave form adopted for H.V. bushing	T

This is an indicative drawing .Bidder shall submit name plate drawing as per Clause No. 15.1 Fig.1 of IS 1180(Part-1):2014 and as per Clause No.16 of this technical specification.

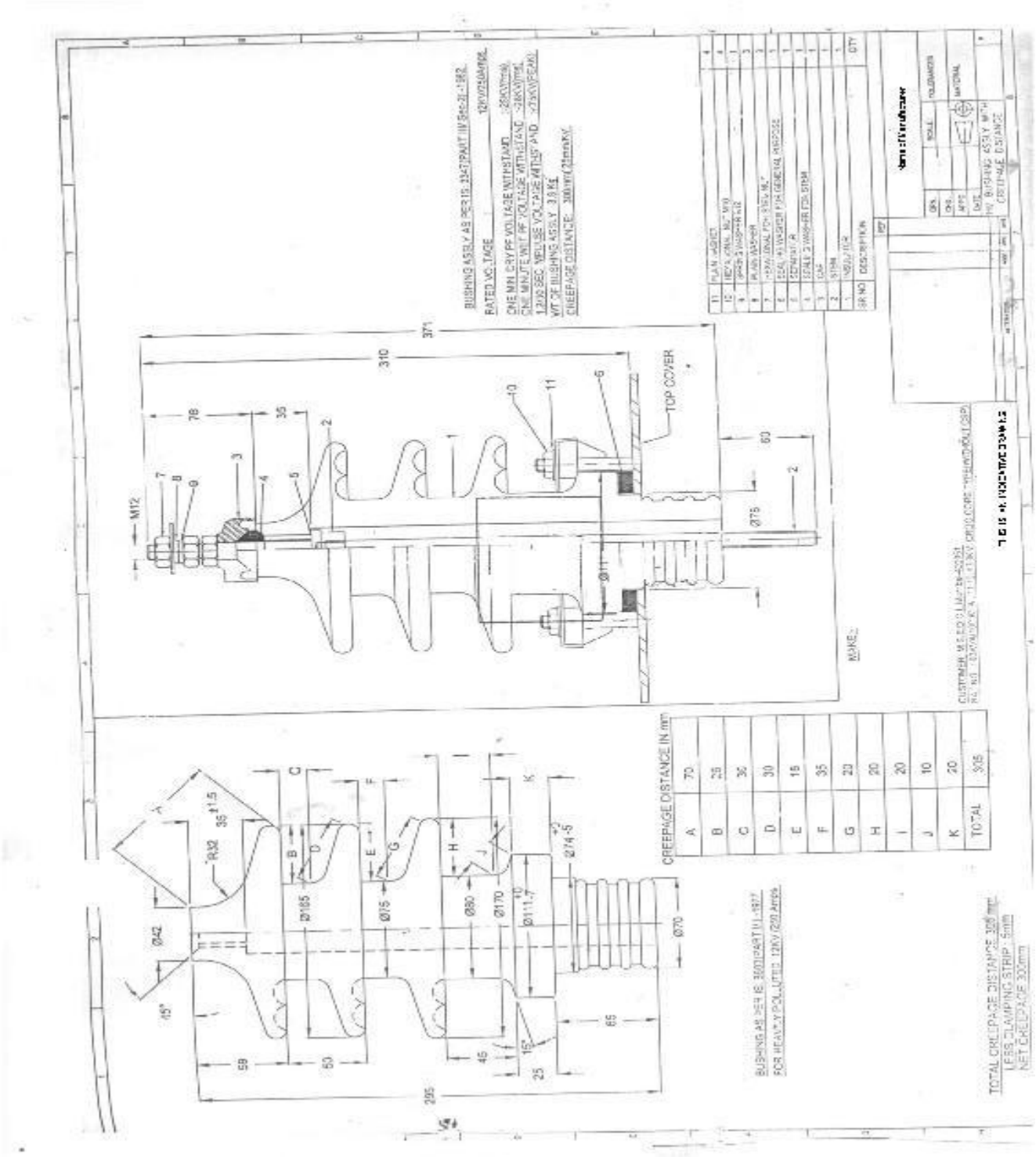



DESCRIPTION
QTY
NAME OF THE MANUFACTURE & SYMBOL
160 KVA
11/0.433
SIDE VIEW
FRONT VIEW
NOTE:


CORE
DESCRIPTION
IS GRADE
LEG CENTER
WINDOW HEIGHT
CORE DIA
EFFECTIVE CORE AREA
HV COIL
CONDUCTOR MATERIAL
EC GRADE Aluminium
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
Aluminium
DPC
INSULATION
WRAP ON CORE
WEDGES BETWEEN HV & LV COILS
CLEARANCE BETWEEN HV & LV COILS
FRAME CHANNEL INSULATION
PHASE BARRIER
END INSULATION BLOCK
25mm
CLEARANCE TO TANKWALL FROM HV SIDE
30mm(Min)
CORE FRAME CHANNEL SIZE
75x40mm
BASE CHANNEL SIZE
NO OF SPACES B/W HV AXIAL COIL
6
INTER PHASE CLEARANCE
10mm(Min)
THICKNESS OF SPACERS
10mm
TIE ROD SIZE & Nos
TERMINAL ARRANGEMENT
STUD SIZE &No
LV
HV
RESISTANCE
NAME OF THE MANUFACTURE & SYMBOL
NOTE:
1. ALL DIMENSIONS ARE IN mm.
2. DIMENSIONS & WEIGHTS ARE SUBJECT TO +10% /TOLERANCE EXCEPT THOSE MENTIONED AS MIN.
DATE
DRWG
CHD
APPD
SCALE
DRG.NO
NTS
100 KVA
FRONT VIEW
SIDE VIEW
WEDGES B/W HV&LV COILS
CORE
COIL WRAP B/W HV&LV COILS
LV COIL
HV COIL
THIS IS AN INDICATIVE DRAWING


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
NTS
DRG.NO
DATE
DRN
CHD
APPD
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
HV(V)
LV(V)
HV(A)
LV(A)

3
50
ONAN
11000
433
---- kVA
THIS IS AN INDICATIVE DRAWING
STEP NO.
STEP WIDTH
STACK THK
TOTAL CROSS SECTION AREA
EFFECTIVE CORE AREA
1
2
3
4
5
6
7
8
DESCRIPTION
CORE WINDOW HEIGHT
CORE WINDOW CENTRE TO CENTRE
CORE STACK THK
CORE DIA
H
W
T
D
TOTAL STACK THK
STEP WIDTH
TECHNICAL DETAILS


TOP COVER
M12
MAKE:-
CREEPAGE DISTANCE IN mm
TOTAL
BUSHING AS PER IS 3347(PART IV)-1979
FOR HEAVY POLLUTED 12KV/ 200 Amps
TOTAL CREEPAGE DISTANCE 305 mm
LESS CLAMPING STRIP 5mm
NET CREEPAGE 300mm

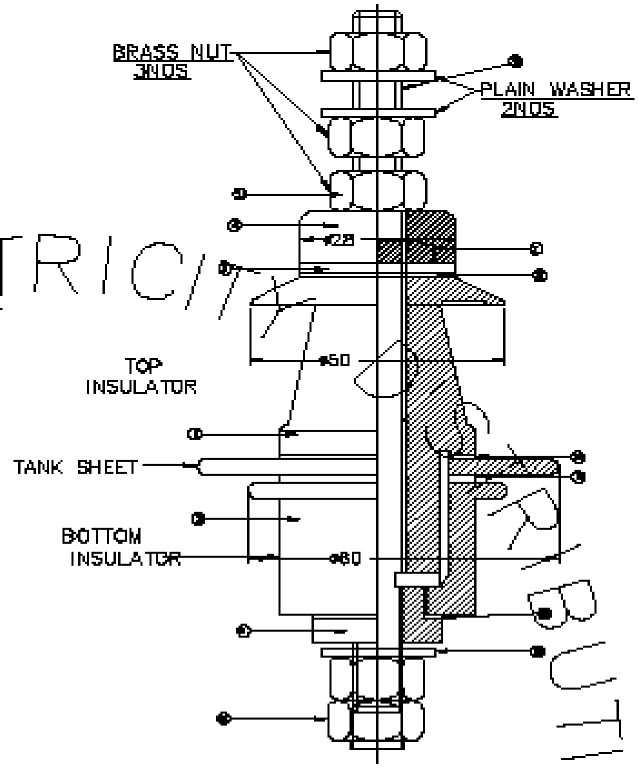
TRANSFORMER BUSHING AS PER IS:3347

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: ---/---/---/---

SL. 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 (STEM)	1
8	SEALING WASHER (TYPE-M)	1
9	SEALING WASHER (TYPE-M)	1
10	SEALING GASKET	1
11	HEX NUT-M-12	[illegible]
12	HEX LOCK NUT-M-12	2
13	PLAIN WASHER-M-12	[illegible]
14	SEALING WASHER (TYPE N)	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:

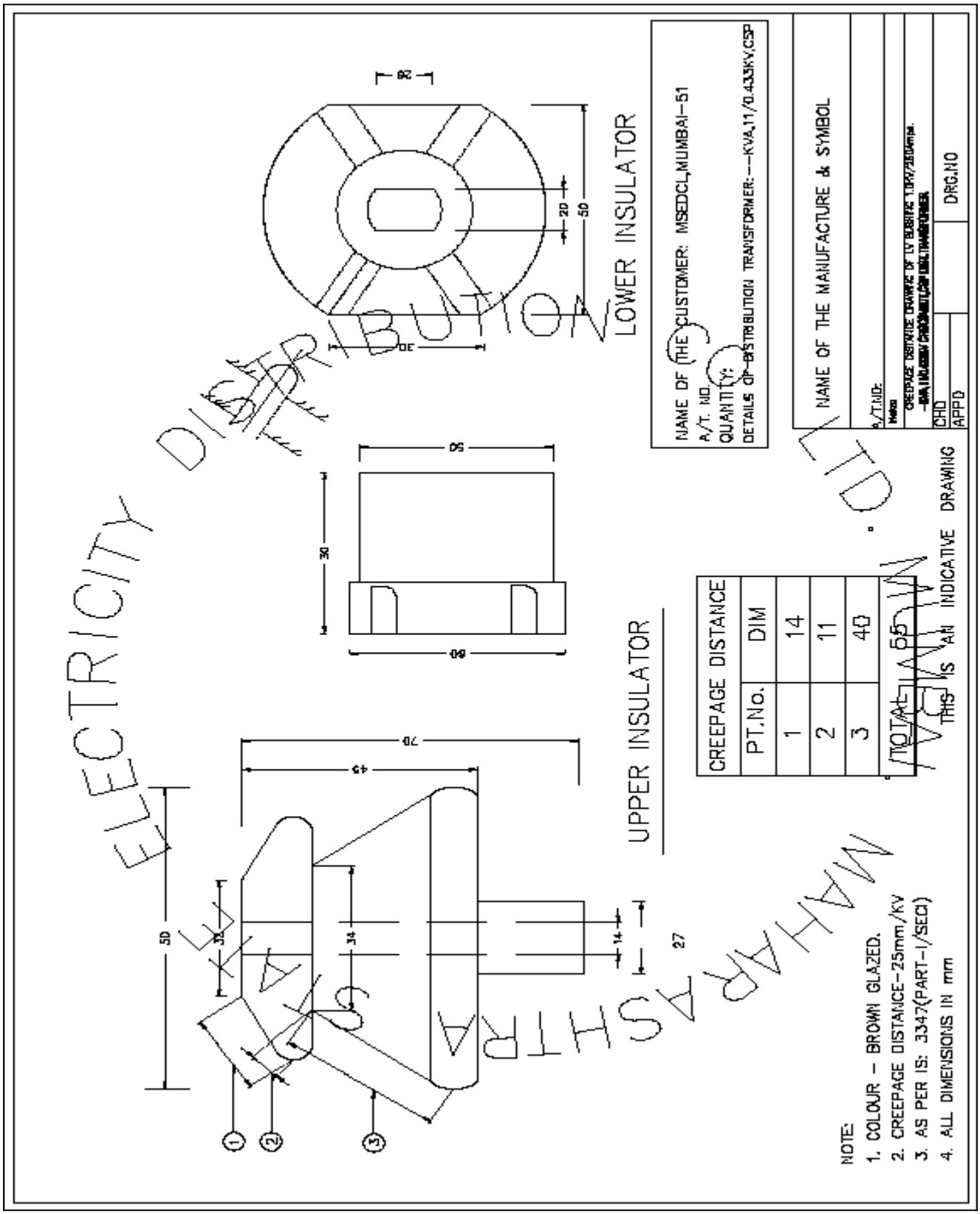
Note

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

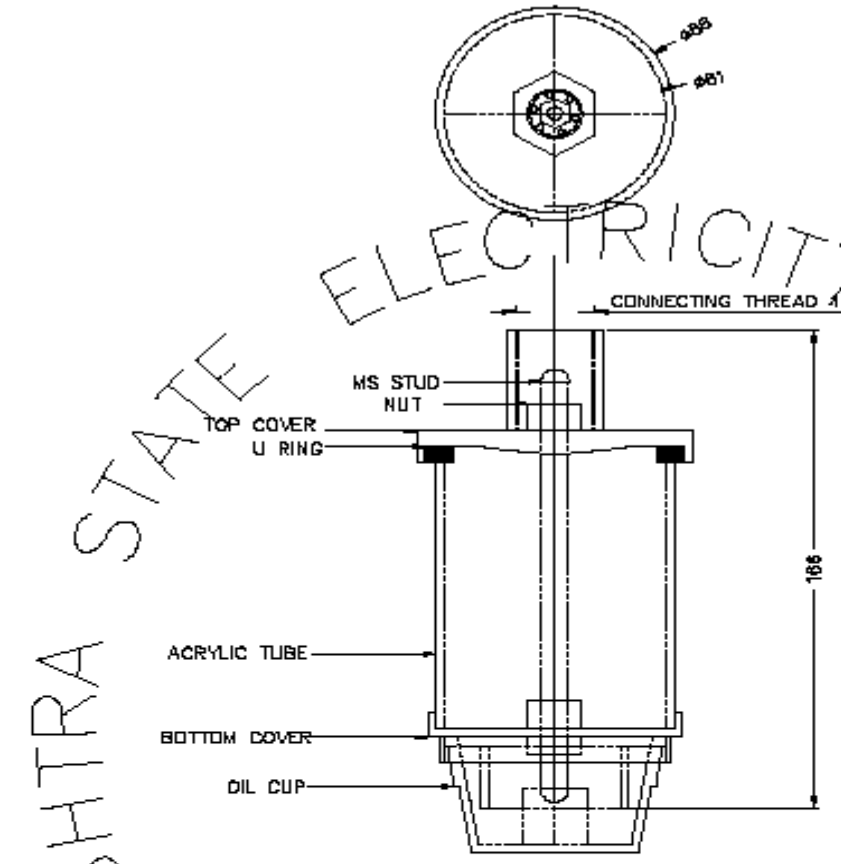
CHD
APPD

DRG.NO

THIS IS AN INDICATIVE DRAWING


ELECTRICITY DISTRIBUTION
MAHARASHTRA STATE
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
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
CHD
APPD
DRG.NO

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 followed as per guidelines ofBEE.

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) is provided below:

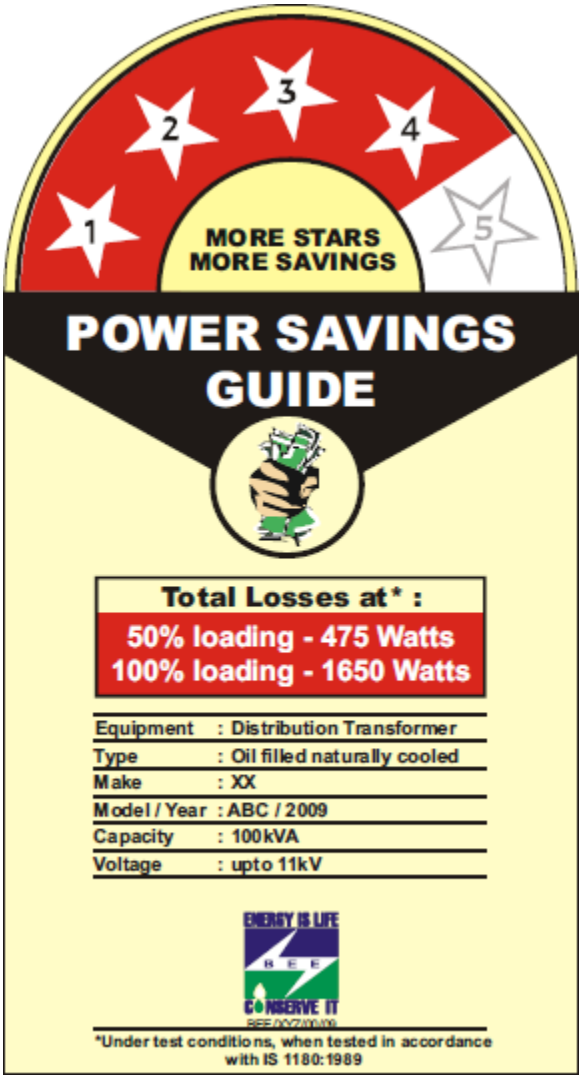


Fig. 2. Manner of display of label:

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.

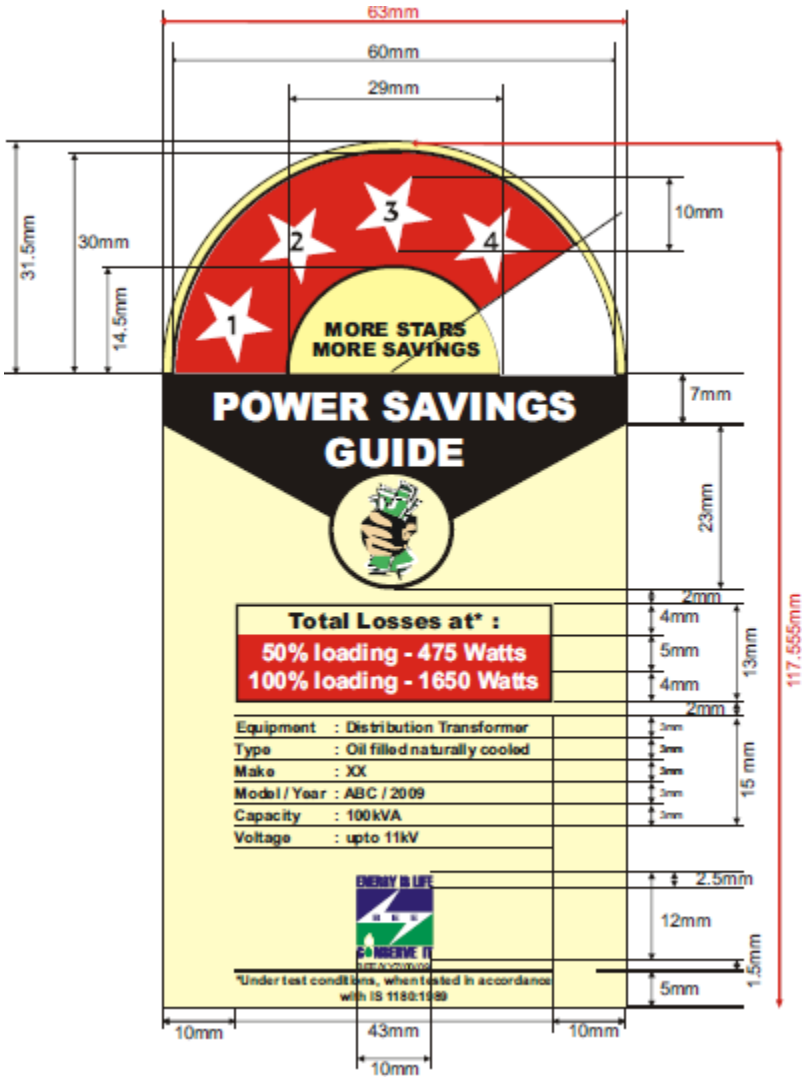
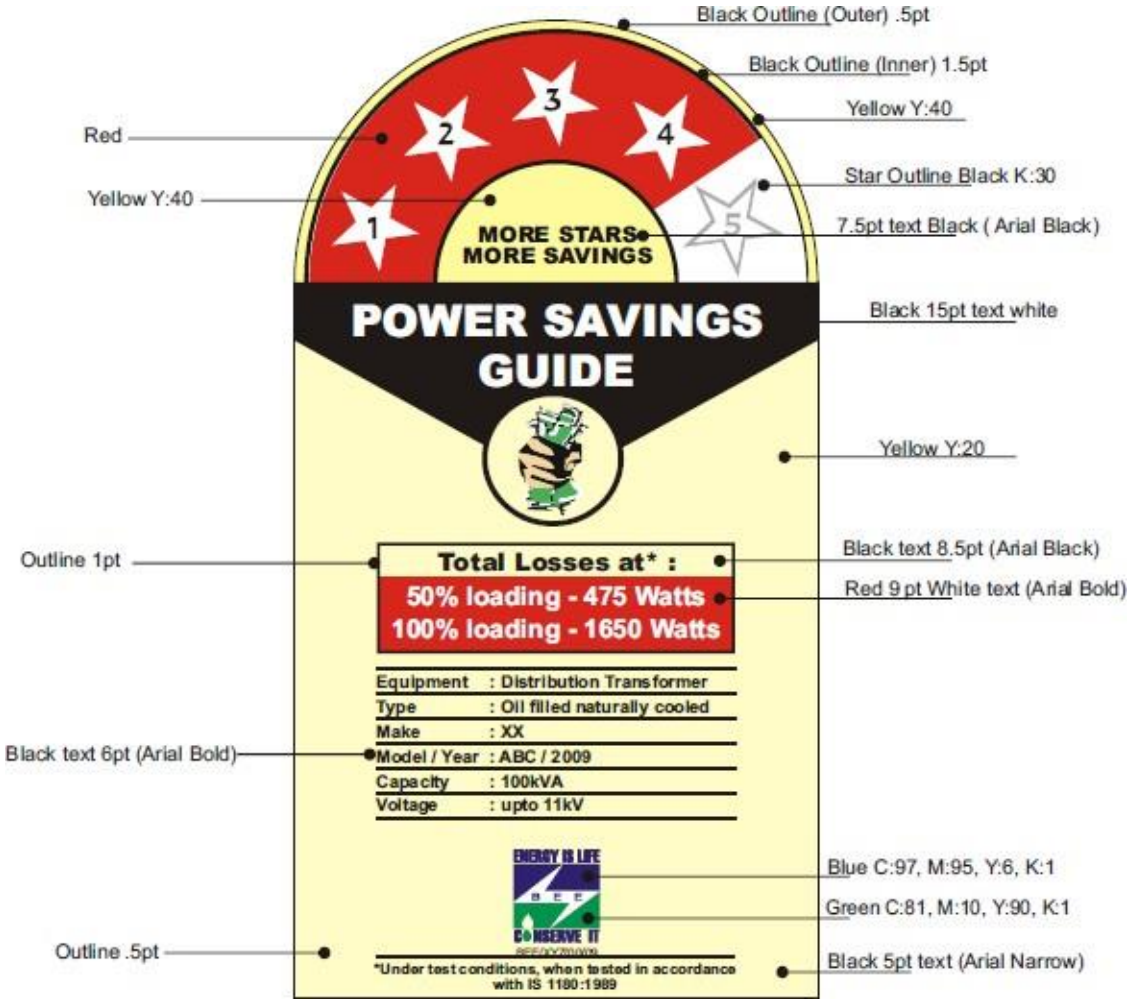
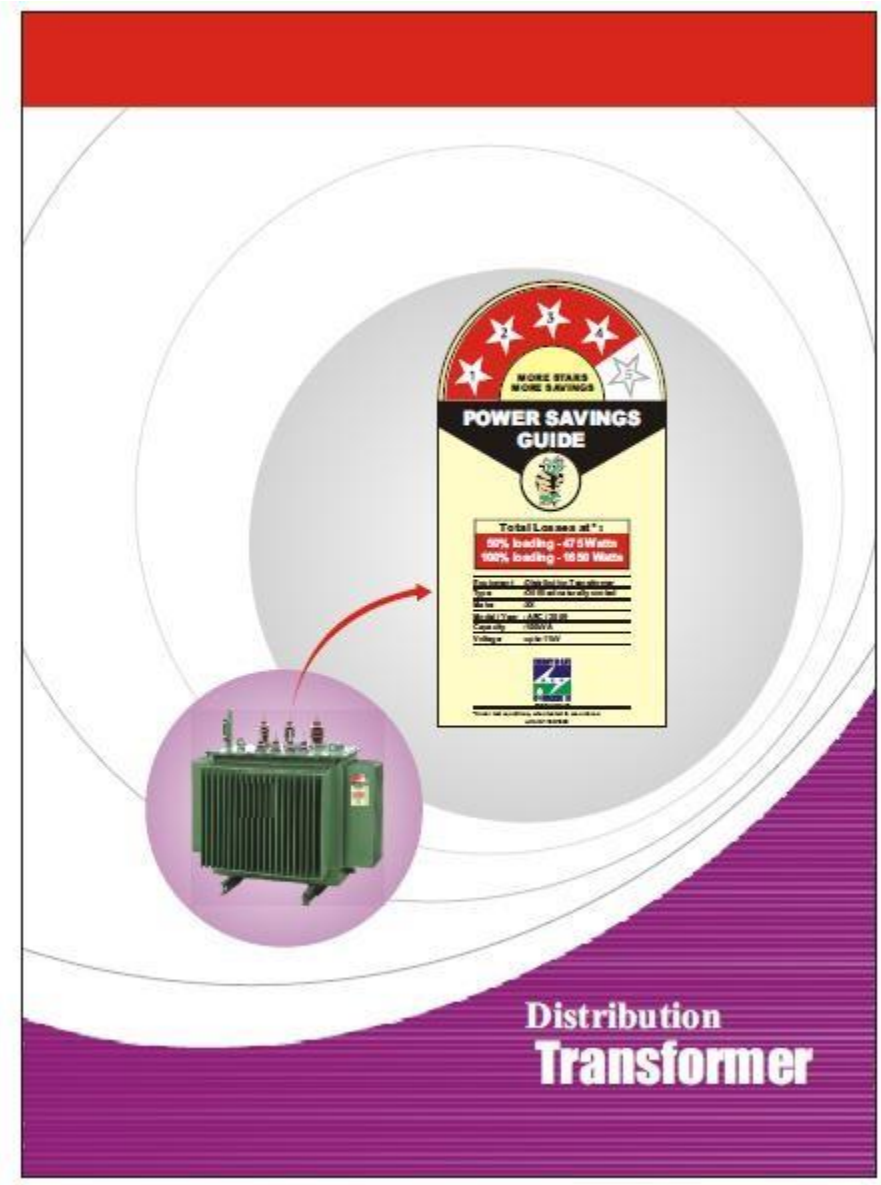


Fig. 3. Colour Scheme:



Sample Picture of manner of affixing of Label:



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 operation under 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	Isoceraniclevel (days per year)	50
2.9	Siesmic level (Horizontal Acceleration)	0.3 g

Moderately hot and humid tropical climate conductive to rust and fungus growth ….

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 :

TECHNICAL SPECIFICATION OF 63KVA, 11/0.433 kV, 22/0.433kV, (Star 1)Level-2 THREE PHASE, DISTRIBUTION TRANSFORMERS OUTDOOR TYPE OIL IMMERSED WITHOUTCSP FEATURE FOR AGRICULTURAL (INDIVIDUAL OR GROUP) CONNECTIONS IN MSEDCL