

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS.**

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MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

200 kVA, 11/ 0.433 kV and 22/ 0.433 kV, Star 1 (Level-2) THREE  
PHASE, NON SEALED, OIL IMMERSED OUTDOOR TYPE  
DISTRIBUTION TRANSFORMERS

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**1 Scope:-**

- 1.1 This specification covers design, manufacturing, testing and delivery of **200 kVA, 11/ 0.433 kV & 22/ 0.433 kV, Star 1 (Level -2) oil immersed, Oil Natural (ONAN) , (Non Sealed) Three phase distribution transformers** 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 notwithstanding any anomalies, discrepancies, omissions, incompleteness, 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

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2.3	Rated Basic Insulation Level	: 75kVp or 125kVp
2.4	Neutral earthing	: Solidly earthed
2.5	Frequency	: 50 Hz with $\pm 3$ % tolerance
2.6	Number of Phases	: 3

**3 SERVICE CONDITIONS:**

- 3.1 Equipment supplied against the specification shall be suitable for satisfactory operation under the following tropical conditions: -
- i] Max. ambient air temperature : 50 Deg.
  - C ii] Max. relative humidity : 100 %
  - iii] Max. annual rainfall : 1450 mm
  - iv] Max. wind pressure : 150 kg/  
sq.m. v] Max. altitude  
above mean sea level : 1000 mtrs.
  - vi] Isoceraunic level : 50
  - vii] Seismic level (Horizontal acceleration) : 0.3 g.
  - viii] Climatic Condition : Moderately hot and humid tropical  
climate conducive to rust and  
fungus growth.
  - ix] Reference Ambient Temperature for temperature rise: 50 Deg C
- 3.2 The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.
- 3.3 The equipment shall be for use in moderately hot and humid tropical climate conducive to rust and fungus growth.
- 3.4 The Distribution Transformer shall be mark with standard mark governed by BIS as per clause 13.4 of IS 1180(Part 1):2014] .
- 3.5 The Distribution Transformer shall bear star 1 rating label approved by BEE (Bureau of Energy Efficiency).
- 3.6 The Distribution Transformer shall bear 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.
- 3.8 The Bidder/ Manufacturer shall possess the BEE certification for offered product.
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**4 APPLICABLE STANDARDS:-**

- 4.1 The design, manufacture and performance of the equipment shall comply with all currently applicable statutes, regulations and safety codes. Nothing in this specification shall be construed to relieve the bidder off his responsibilities.
- 4.2 The Distribution Transformers shall conform to IS: 1180 (Part 1) : 2014 amended up to date or other International Standards for equal or better performance. Unless otherwise modified in this specification the Distribution Transformers shall comply with the Indian Standard Specification IS 1180 latest.
- 4.3 Unless otherwise specified, the equipment offered shall conform to amended up to date Indian, IEC, British or U.S.A. Standards and in particular, to the following: -
- 4.4 The applicable standards are as follows:

Sr.No.	IS number	IS name
1.	IS:1180(Part -1) : 2014	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 to V / Sec-2)-1979, IS:3347 (Part -I to V /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

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9.	Gazette notification by Ministry of Power dated 16.12.2016	Revised losses of distribution transformer
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4.5 In case of conflict arising out due to variations between the applicable standard and the standards specified herein the provisions of this specification should prevail.

**5 Specific Technical requirement:**

5.1 Standard kVA Ratings: -

The standard ratings for three phase transformer shall be 200 kVA as per IS 1180 (Part - I):2014

5.2 Nominal voltage ratings

- a) Primary voltage : 11kV OR 22 kV
- b) Secondary voltage : 0.433 kV

5.2.1 Winding connections: -

- i. H.V. Winding : Delta ( $\Delta$ )
- 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 (Part 2)]
- 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 X 5 mm MS Channel with proper bolting **applicable for stack core only**. The core assembly shall be fixed by four locking bolts.

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- 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**

- ij] The core shall be stacked/ wound type.

a) **For Stack core :-**

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

b) **For Wound core :-**

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

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

1. Core clamping shall be with top and bottom U - shaped core clamps made of sheet steel clamped.
2. M.S. core clamps shall be painted with oil-resistant paint / **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 **M12** mm MS Tie rods.
5. Compliance of CRGO Electrical steel as per IS 302 4 [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

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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 ratio to 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 as given below.

The no load current of 200 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% maximum 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 200kVA, 11kV class and Copper conductor shall be used for HV and LV winding for 200kVA,22 kV class transformers.
- ii] Insulation:- Double paper covered conductor shall be used for HV and LV winding for both 200 kVA, 11kV & 22kV transformers.
- iii] Current Density: - Current density for HV and LV winding should not be more than 1.6 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 4 for 11kV class and 6 for 22 kV class and for Wound core type transformers only one HV coils per phase shall be used.

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**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
200kVA, 11/.433 kV	4.5	780	2300
200kVA, 22/.433 kV	4.5	820	2415

**Tolerances:**

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

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

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

**6.4 Insulation material & clearances:**

(i) Materials –

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

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

(iii) External Clearances:

Minimum external clearances of bushing terminals: -

		11kV	22 kV
HV	Ph to Ph	255 mm	330mm
	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 – 10mm minimum.
- (v) No. of Axial wedges between LV and HV winding equispaced around LV – 8 for 200 kVA transformers.

**6.5 Impedance Value –**

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

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**6.6 Tank**

- 6.6.1 The transformer tank shall be made up of prime quality M.S. sheets of rectangular shape. No other shape will be accepted. The transformer tank shall be of robust construction. All joints of tank and fittings should be oil tight and no bulging shall occur during service. The tank design shall be such that the core and windings can be lifted freely. The tank plates shall be of such strength that the complete transformer when filled with oil may be lifted bodily by means of the lifting lugs provided. Tank inside shall be painted by varnish or oil resistant paint. Top cover plate shall be slightly sloping; approximately 5 to 10 deg. towards HV bushing and edges of cover plate should be bent downwards so as to avoid entry of water through the cover plate gasket. The width of bend plate shall be 25 mm min. The top cover shall have no cut at point of lifting lug. The rectangular tank shall be fabricated by welding at corners.
- 6.6.2 The transformer tank of corrugation is also acceptable, however shape of tank shall be rectangular only. The corrugation sheets thickness shall be of minimum **1.25** mm. Corrugation panel shall be used for cooling. The transformer shall be capable of giving continuous rated output without exceeding the specified temperature rise. Bidder shall submit the detailed calculation sheet along with offer. The safe guard angle frame 50X50X5 mm shall be welded for corrugated side to the tank.
- 6.6.3 In rectangular shape tanks, horizontal or vertical joints in tank side walls and its bottom or top cover will 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)

- 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 all

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the 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 to be carried out by MIG process (Metal Inert Gas Welding).
- 6.6.7 Lifting lugs:  
4 nos. of 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 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 8mmthickness shall be provided to pull the transformer horizontally.
- 6.6.9 The under base shall be provided with two 75mmX40mm channels 460 mm long to make suitable for fixing to a platform or plinth.
- 6.6.10 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 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 while the transformer is in operation.
- 6.6.12 The tank design shall be such that the core and windings can be lifted freely.
- 6.6.13 Plain tank shall be capable of withstanding a pressure of 80kPa for 30 minutes and a vacuum of 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 must be located at centre of top cover or high side of tank height for true value of max top oil temperature
- 6.6.15 QR code laminated P touch labels shall be fixed on transformer tank body below the name plate depicting various technical details such as Name of manufacturer, rating, Serial no, date of manufacturing, A/ T No. etc.

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**6.7 Off Load Taps:**

No taps are required to be provided for 200 kVA rating transformers.

**7 Efficiency:**

The efficiency is the ratio of output in KW to the

$$\text{Efficiency} = \frac{\text{Input in KW} - \text{Total Losses in KW}}{\text{Input in KW}}$$

**8 Heat Dissipation:**

- a) Heat Dissipation by tank walls excluding top and bottom plates should be 500 Watts/Sq. meter.
- b) Heat dissipation calculation should be based on maximum 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 rise test.
- c) Only fins type radiators 1.25 mm thick shall be used. The tender should submit 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 whichever is more.

KVA rating	Oil in liters (exclusive of oil absorbed in core & coil assembly)	Permissible oil absorption (in liters)
200KVA,11/ 0.433 kV	400	12
200KVA,22/ 0.433 kV	420	12.6

Note: Transformer shall be supplied complete with first filling of oil up

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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 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 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 filling hole (30mm) with cover.

**11 Breather:**

- a) The material used for Breather shall be only of Poly propylene and joints should be screwed type.
- b) The dehydrating agent shall be Silica gel confirming to IS 3401. The volume of breather shall be suitable for 500 gm upto 200 kVA transformers. Makes of the Bre ather shall be subject to purchaser's approval. The make and design of breather shall be subject to approval of C.E. (MMC).

**12 Terminals:**

- a) The Palm type terminal connector of adequate capacity shall be connected to L.V side suitable to connect it to the Bus e xtension.

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- b) On H.V. side the bimetallic connector to be provided.
- c) 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]]
- d) Brass rods 12 mm. diameter for HT with necessary nuts, check -nuts and plain thick tinned washer.

**13 Bushings :**

- 13.1 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 PVC/ XLPE cables of suitable size. The dimensions shall conform to IS 1180(Part 1): 2014 clause no. 10.1.5.
- 13.2 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].
- 13.3 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]
- 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 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 per 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.
- 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 the Bushing.
- 13.7 The minimum creepage distance for both HV & LV Bushings shall not be less than 25 mm per kV.

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- 13.8 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.
- 13.9 Supporting clamp for cable should be provided to avoid weight of cable on the bushing/bushing rod.

**14 Internal connections:**

**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 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.

**14.2 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 IS 1180(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 the transformer which shall conformed to latest IS -2026 (part - IV).
- b) Each Transformer shall be provided with rating plate having marking as per IS 1180 (part-1):2014 clause no 13 clearly indicating max. total losses

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- 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 marked with standard mark Governed by the provisions of the BIS act 1986.
  - d) Terminals shall be provided with terminal marking plates. The transformer shall be provided with riveted rating plate of minimum 18 SWG aluminum anodized material sheet in a visible position. The entries of the rating plate shall be 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 engraved on transformer main tank below L.T. bushings.
  - f) The name of the company, order No., capacity, month and year of manufacturing shall be engraved on separate plate which shall be firmly welded to main tank and shall form integral part of the tank.
  - g) The distribution transformer 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 made there under.
  - h) In addition to the BIS certification mark license No. (a seven digit number) represented as CM/L xxxxxxxx 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 bidding document.
  - 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.

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- (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 indelibly marked i.e. by engraving or stamping or etching).

**17 Fittings:**

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	6 nos. ( 4 nos. for tank and 2 nos. for top plate of the transformer )
4	Oil filling hole with cap (on conservator)	1 no
5	Drain valve - 32mm for all T/ Fs ( It shall be covered with metallic box spot welded to tank) IS554	1 no
6	Conservator with drain plug (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	Pressure Release Device or Explosion vent with diaphragm (only for 22kV transformers)	1 no
11	Silica gel breather 250 gm	1 no

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12	Platform mounting channel 75mmX40 mm X 5 mm, 460 mm long ( with hole suitable)	2 nos
13	Oil level gauge <b>indicating 2</b> positions of oil marked as below: Minimum (-) 5 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
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	2years guarantee plate	1 no.
19	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.

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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 bolts shall be such that no screw thread may form part of a shear 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 Lightning Arrestors:**

The Lightning Arrestors (Disconnecter type) of high surge capacity of 9kV, 5kA for 11k V class ( 8/20 micro wave shape) and 18 kVrms, 5 kA ( 8/20 micro wave shape) for 22 kV class transformers conforming to IS: 3070/1993 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 lightning or switching operations. The Earthing terminal of the lightning 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
<b>A. Function</b>			
1.	Viscosity at 40°C	IS : 1448 ( Part 25 )	15 mm <sup>2</sup> / s, Max.
2.	Viscosity at 0°C	IS : 1448 ( Part 25 )	1800 mm <sup>2</sup> /s, Max.
3.	Pour – Point	IS : 1448 ( Part 10/ Sec2 )	- 10°C, Max. , to be based on LCSET

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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>B. Refining / stability</b>			
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.
<b>C. Performance</b>			
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.

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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 load loss at 50 percent and 100 percent load [IS 2026 (Part 1)].
- d) Measurement of no load loss and current [IS 2026 (Part 1)] .
- e) Measurement of insulation resistance [IS 2026 (Part 1)].
- f) Induced over-voltage withstand test [IS 2026 (Part 3)].
- g) Separate-source voltage withstand test [IS 2026 (Part 3)].
- h) 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) Lightning 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

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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 by successful bidder shall be got approved from CE Testing as per tender terms & conditions.

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

The following shall constitute the special tests.

- a) Determination of sound levels [IS 2026 (Part 10)].
- b) No load current 112.5% 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 Tape Test).
- 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 one unit.

**20.5 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 CE Testing as per terms & conditions of tender.

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**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 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.

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

**20.5.3 Oil leakage Test (routine Test):**

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

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 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 within the guarantee period. The party challenged, challenger and the utility could witness the challenge testing.

The challenge testing would cover following tests:

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

The challenge test could be conducted at NABL Laboratory, like ERDA and CPRI. If the values are within the limits the products gets confirmed else not

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confirmed. No positive tolerances in losses is permitted. If the product is not confirmed, the manufacturer would pay the challenge fee and challenger would get the fee refunded. However as a redressal system, the challenger would be allowed 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 challenged, challenger and the utility.

If any one of the above sample does not confirm to the tests, 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 Type Tests report submission: -**

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

- (a) If above tests are carried out beyond 5 years.
- (b) Impulse Voltage Withstand test, Dynamic Short Circuit test, Temperature rise Test & Pressure Test not carried out from NABL approved Laboratory.
- (c) 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 Testing Cell. No extension in delivery period shall be entertained on this account.*

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 the offer.

**23 Drawings, Manual & Calculation sheet: -**

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

- (i) General Dimensional drawing.
- (ii) Core Assembly drawing.

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- (iii) Internal Construction Drawing.
  - (iv) Technical Detail drawing.
  - (v) Rating & Diagram Plate Drawing.(As per Cl.no.13.1 Fig.1 of IS:1180(Part1):2014
  - (vi) HV& LVBushings Assembly drawing
  - (vii) Creepage distances distance drawing of HV& LV Bushing
  - (viii) Operation and Maintenance Manual.
  - (ix) Silica gel Breather drawing.
  - (x) Calculation sheet for flux density
  - (xi) Heat dissipation
  - (xii) Oil absorption
- 23.2 The drawings shall be of A -3 (420 x 297 mm) size only. The bidder should also supply along with his offer the pamphlets/literatures etc. for fittings / accessories.
- 23.3 The bidder should not change design once offered as per A/ T, approved drawings and Type Test Reports.
- 23.4 The successful Bidders shall submit complete set of Drawings (as listed in Cl.No.23.1) of transformer in triplicate indicating dimensions to Testing cell for approval and get approved it as per terms & conditions of tender.

**24 Rejection :-**

- 24.1 Apart from rejection due to failure of the transformer to meet the specified test requirements the transformer shall be liable for rejection on any one of the following reasons.
- i. Maximum load losses at 50 % load & 100% Load loss exceeds the specified values mentioned in Cl. No.6.3 above.
  - ii. Impedance voltage value exceeds the guaranteed value plus tolerances as mentioned at Cl.No.6.5 above.
  - iii Type test not carried out as per clause no. 20.2 & 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.

**25 Cleaning and Painting.**

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i. The external surfaces shall be painted one coat of epoxy primer followed by two coats of polyurethane (finish coat) for (outside) and Inside of the tank shall be painted with hot oil

resistant paint/ varnish with one coat with dry film thickness as mentioned in Table 12, clause 15.5 of IS 1180(Part 1):2014.

ii. The certificate shall be produce by the manufacturer if seven tank facilities are availed from the other vendor about availability of the adequate size of tank for treatment.

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

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

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

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

**26 Guaranteed Technical Particulars:**

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

**27 Testing facility**

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

**28 Submission of Routine Test Certificate**

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

b) Instruction and operation Manual

The successful bidder shall be required to submit 5 copies of instruction and Operation manual for each lot of 100 Transformers (or part thereof) supplied. This instruction manual should give complete details about the

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pre -commissioning tests/ checks and the details of preventive maintenance etc.

**29 Stage Inspection: -**

- 29.1 Supplier shall give 15 days' advance intimation to the Chief Engineer (MMC) to organize stage inspection in which assembly of core, windings and other core materials etc. would be inspected. In respect of raw materials such as core stamping, winding conductor, oil etc. successful bidder shall use these materials manufactured/ supplied by the standard manufacturers and furnish the manufacturer's test certificates, as well as, proof of purchase from those manufacturers documentary evidence for having paid the excise duty for the information of the department.
- 29.2 Chief Engineer (MM Cell) will depute representatives from testing and inspection wing at the time of Stage inspection.
- 29.3 10 % of the transformers from the offered lot will be tested for acceptance tests at factory, in the presence of purchaser's representative before dispatch.
- 29.4 The inspection may be carried out by the purchaser at any stage of manufacture. The successful bidder shall grant free access to the purchaser's representatives at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications and shall not prevent subsequent rejection if the equipment is found to be defective.
- 29.5 The purchaser may at its option, open a transformer supplied to the Stores, in presence of supplier at site or at Stores. If any of the technical particulars are seen to be in variance than the guaranteed technical particulars, the whole lot of transformer will be rejected without any liability on purchaser.
- 29.1 In addition to the above, the purchaser may pick up any transformer and decide to get it type tested from any laboratory accredited by NABL at purchaser's cost. The Bidder will have to organize packing of the transformer at company's Stores for which they will be paid necessary charges. If the transformer fails to meet the requirement of type tests, the quantity of transformers ordered on them will be forthwith rejected and the purchaser may purchase these transformers at the risk and cost of the supplier.

**30 Inspection at Factory Premises:**

- 30.1 Supplier shall give 5 days' advance intimation for the lot offered for inspection. on email -id [cemmcmsedcl@gmail.com](mailto:cemmcmsedcl@gmail.com). Inspection call received on any other email id will not be entertained & the delay occurred due to this will be on suppliers' account.
- 30.2 10% of the transformers offered will be tested for all tests without opening the transformer. Heat Run Test / Temperature -rise test IS 2026 (Part -II) as per IS 1180 (Part -I):2014 clause no.
- 21.3 (b) will be carried out on one unit. Minimum total losses (No load + load

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loss at 75 °C reference temperature at 100% loading shall be supplied during temperature rise test. Further these 10% of the transformers offered will be tested for losses on 50% and 100% loading conditions as per IS.

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

30.4 Leakage test, Pressure test and Vacuum test on sample transformer shall be carried out during inspection as per relevant IS.

30.5 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.

30.6 The Executive Director (Infra) will depute one Inspecting Officer for inspection. The testing will be carried out within 2 -3 days after receipt of intimation of testing call. The Inspection Officer shall verify & collect all the sources for the raw material utilized in the transformer. The inspection reports shall be fed online by the Inspector at factory premises only & give clearance to the supplier to dispatch the material as per the dispatch instructions issued by MM Cell. One copy of Inspection report shall also be e -mailed to MM Cell immediately from the factory premises. The validity of the inspection letter will be 21 days from the date of inspection. The supplier should ensure that the material is received to consignee stores within time as per the dispatch instructions issued in this regard.

**31 Testing of all Distribution Transformers for losses at 50% load and 100% load at MSEDCL Stores:**

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 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.

**32 Random Sample Testing (RST):**

32.1 The tenderer should immediately intimate completion of dispatches of whole lot of Distribution Transformers to allocated Stores against tender to MM Cell such that the Executive Director (Infra) will select the Stores Centre for Random Sample Testing (RST) and depute the MSEDCL representative from Testing

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Division to carry out RST of the lot.

32.2 The MSEDCL representative from Testing Division will select a transformer from the lot of transformers already tested for 50% load and 100% load without opening the transformer. The RST shall be carried out within 5 days after receipt of intimation of testing call. 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.

32.3 In case the selected transformer fails in any of the tests, complete lot of transformers will be rejected.

32.4 The RST reports shall be communicated immediately by the MSEDCL representative from EE (HTM), MM Cell through ERP only.

**33 Inspection & Testing of Transformer Oil:**

The tenderer shall make arrangements for testing of transformer oil to be used in the transformers and testing will be done in presence of purchaser's representative.

To ascertain the quality of transformer oil, original manufacturer's test report should be furnished to EE (Testing) at the time of factory inspection for acceptance of the lot.

**34 Quality Assurance:**

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

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

- i. Aluminum /Copper conductor
- ii. Transformer oil
- iii. C.R.G.O.Core
- iv. Insulating / craft paper.
- v. Porcelain Bushings and Lamps
- vi. Steel Plate used for Tank, press board.

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

34.4 Information and copies of test certificate as in (33.3) above respect of bought

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out accessories including terminal connectors.

- 34.5 List of manufacturing facilities available, in this list the bidder shall specifically mention whether lapping machine, vacuum drying plant, air conditioned dust free room with positive air pressure for provision of insulation and winding etc are available with him.
- 34.6 Level of automation achieved and list of areas where manual processing still exists.
- 34.7 List of areas in manufacturing process where stage inspection are normally carried out for quality control and details of such tests and inspections.
- 34.8 Special features provided in the equipments to make it maintenance free
- 34.9 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 test requirements.
- 34.10 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, for conductors, insulating materials, Core materials, Bushing at the time of routine Testing of the fully assembled transformer.

**35 Performance Guarantee:**

All transformers supplied against this specification shall be guaranteed for a period of 24 months from the date from the date of receipt of purchaser, 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.

**36 COST DATA SHEET:-**

The bidders shall submit the cost data sheets indicating the break up prices and quantity of each raw material and components along with the unit rates required for manufacture the offered transformers along with the offer. The cost data sheet format is enclosed herewith.. If the rates quoted are not justified with the cost data sheets, the offer shall not be considered for evaluation and placement of the order.

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

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FORMAT FOR COST DATA					
ITEM ----- KVA ,----KV DISTRIBUTION TRANSFORMER					
Sr. No.	PARTICULARS	UNIT	UNIT RATE S Rs.	QTY	AM T (Rs.)
1	CORE (M4 or better )	KG			
2	Aluminum/ copper with DPC for HV WINDING	KG			
3	Aluminum /copper wth DPC for LV WINDING	KG			
3	INSULATION PAPER	Meter			
4	OIL	/ Kg/LTRS			
5	TANK	NO			
6	CHANNELS	KG			
7	Assembly of HV / LV BUSHINGS, Lightening Arrestors	KG			
8.	OTHERS	LUMPSUM			
				TOTAL	
	WASTAGE @ %				

**37 Schedules:**

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

Schedule `A' -Guaranteed Technical

Particulars Schedule `B' -Schedule of

Tenderer's Experience.

37.2 The discrepancies between the specification and the catalogs, Literatures and indicative drawings which are subject to change, submitted as part of the offer,

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shall not be considered and representation in this regard will not be entertained.

37.3 The Bidder shall submit the list of orders for similar type of equipments, executed or under execution during the last three years, with full details in the schedule of Tenderer's experience (Schedule 'B') to enable the purchaser to evaluate the tender.

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Schedule `A`

*GUARANTEED TECHNICAL PARTICULARS*

*As indicated in E-Tendering GTP Parameter*

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SCHEDULE – 'B'

SCHEDULE OF TENDERER'S EXPERIENCE

Tenderer shall furnish here a list of similar orders executed/under execution by him to whom a reference may be made by Purchaser in case he considers such a reference necessary.

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Sr. No.	Name of client & Description.	Value Of Order (along with cap. of T/ F)	Period of supply & commissioning	Name & Address to whom reference may be made.
------------	--	--	--	---

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1	2	3	4	5
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NAME OF FIRM \_\_\_\_\_

NAME & SIGNATURE OF TENDERER \_\_\_\_\_

DESIGNATION \_\_\_\_\_

DATE \_\_\_\_\_

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**Annexure I Air Pressure Test**

Name \_\_\_\_\_ of \_\_\_\_\_

Supplier: Order \_\_\_\_\_

No.: \_\_\_\_\_

Capacity & Voltage Ratio of Distribution Transformer : \_\_\_\_\_ kVA, \_\_\_\_\_ /0.433 kV

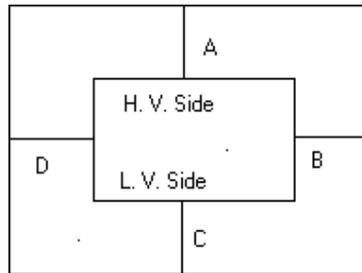
Vector Group Dyn11

Sr. No. of equipment Tested: \_\_\_\_\_

Date of Testing: \_\_\_\_\_

Reference Standard \_\_\_\_\_

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



Tank Thickness: Side \_\_\_\_\_ mm. Top & Bottom \_\_\_\_\_ mm Test Pressure : \_\_\_\_\_ kg/ cm<sup>2</sup> applied for 30 Minutes.

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

Permanent Deflection : \_\_\_\_\_ mm

Permissible Limit of Permanent Deflection as per Specification : \_\_\_\_\_ mm

Test witnessed by \_\_\_\_\_

Tested by \_\_\_\_\_

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**Annexure II Temperature Rise Test**

Name of Supplier:

Order No.:

Capacity & Voltage Ratio of Distribution Transformer: \_\_\_\_\_ kVA, \_\_\_\_\_ / 0.433 kV Vector C

Sr. No. of equipment Tested:

Date of Testing:

Reference Standard

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

Guaranteed No Load Losses \_\_\_\_\_ watt Load Losses \_\_\_\_\_ watt

Total Losses \_\_\_\_\_ watt

P. T. Ratio : \_\_\_\_\_ / \_\_\_\_\_ =

C. T. Ratio : \_\_\_\_\_ / \_\_\_\_\_ =

Wattmeter Constant =

Total Multiplying Factor (MF) =

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

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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 Resist

Time	Resistance

Hot winding Resistance at Ambient Temperature \_\_\_\_\_ °C (from graph) =

= 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

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respects shall be subjected to the pressure of 0.4 kg/ cm<sup>2</sup> and maintained for 8 hours . No leakage should occur.

Test witnessed by

Tested by

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<b>Standard Guaranteed Technical Particulars</b>			
200 KVA, 11/ 0.433 KV, ONAN, Aluminium Wound, O/D Distribution Transformer Star 1 (Level-2)			
Sr. No	GTP Parameters	REMARK	
1	Name of Manufacturer		Text
2	Reference Standards	IS-1180 Part-1 (2014)	Text
3	Rating of Transformer in KVA	200 KVA	Numerical
4	Primary voltage in kV	11 KV	Numerical
5	Secondary voltage in kV	0.433 KV	Numerical
6	Transformer shall be Oil Natural Air Natural (ONAN) type Yes/ No	ONAN	Text
7	Transformer shall be suitable for Indoor application. (Yes/No)	Outdoor	Boolean
8	Highest System Voltage in kV	12 KV	Numerical
9	Frequency in HZ.	50 Hz	Numerical
10	Transformer shall be suitable for solid neutral earthing (Yes/No)	YES	Boolean
11	Service condition shall be applicable as per Technical specification clause no. 3(Yes/No)	YES	Boolean
12	Transformer Colour as per IS:5	Air craft Blue, IS - 5,Shade-108	Text
13	Type of connection for H.V. Winding (Delta) (Yes/ No).	Delta	Text
14	Type of connection for L.V. Winding (Star) (Yes/ No)	Star	Text
15	Vector Group Dyn-11 (Yes/ No)	Dyn11	Text
16	Name Plate details are as per the requirement specified in tender (Yes/No)	YES	Boolean
17	Thickness of Name plate (in SWG)	18 SWG	Numerical
18	Maximum temperature rise of Windings over an Ambient temp. of 50°C in °C is	40°C	Numerical

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19	Maximum temperature rise of oil over an Ambient temp. of 50°C in °C is	35°c	Numerical
20	Approximate overall length of the Transformer in mm	Mfg to be specify	Numerical
21	Approximate overall breadth of the Transformer in mm	Mfg to be specify	Numerical
22	Approximate overall height of the Transformer in mm	Mfg to be specify	Numerical
23	Approximate length of the Transformer tank in mm	Mfg to be specify	Numerical
24	Approximate breadth of the Transformer tank in mm	Mfg to be specify	Numerical
25	Approximate height of the Transformer tank in mm	Mfg to be specify	Numerical
26	Thickness of the side of transformer tank plates in mm	3.15 mm	Numerical
27	Thickness of the bottom of transformer tank plates in mm	5 mm	Numerical
28	Thickness of the top of transformer tank plates in mm	5 mm	Numerical
29	Size of reinforced welded angle to the Transformer Tank in mm.	50 X 75 X 5 mm	Text
30	Degree of slope to the top plate of Transformer.	5° to 10° towards HV side	Text
31	Shape of transformer Tank	RECTANGULAR	Text
32	Type of Tank (Corrugated/ Conventional)	Corrugated / CONVENTIONAL Mfg to be specify	Text
33	In case of corrugated tank, thickness of corrugated sheet (in mm)	N.A	
34	Size of Transformer Base Channel in mm.	75 X40 mm	Text
35	Conservator tank to the transformer with oil level indicator (showing three levels) and drain plug is provided ( Yes/ No)	YES	Boolean
36	Dimensions of conservator Tank (LxD) in mm	Mfg to be specify	Text

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37	Drain Valve size provided to the transformer tank	32 mm	Numerical
38	Size of Oil filling hole with cap in mm. (on conservator) is provided.	32 mm	Numerical
39	Size of filter valve in mm. is provided.	32 mm	Numerical
40	No. & Size in mm of Lifting lugs provided to transformer	4 Nos, 12 mm	Text
41	No. & Size in mm of pulling lugs provided to transformer	4 Nos, 8 mm	Text
42	No. & Size in mm of transformer top cover lifting lugs provided to transformer	2 Nos, 8 mm	Text
43	No. of Earthing terminals with suitable size in (SWG)	2 Nos	Numerical
44	Thermometer pocket is provided (Yes/ No)	Yes	Boolean
45	Quantity of Silica -Gel filled in breather ( in gm) & make of breather	500gm, Yogya Enterprises / Press 'n' Force or equivalent other makes shall be specified by mfg.	Text
46	Explosion vent with diaphragm. (Yes/ No)	Yes	Boolean
47	No of radiators both on HV & LV side provided and location with arrangement & size.	4 Nos. (2 On LV & 2 On HV) ,	Text
48	Thickness of the radiator of transformer in mm. with size of fins	1.25 mm mfg to specify size fins	Text
49	No of radiator fins.	mfg to specify	Numerical
50	(A) Radiating surface of radiators in Sq. Mtrs.	mfg to specify	Numerical
51	(B) Radiating surface of Tank only in Sq. Mtrs.	mfg to specify	Numerical
52	Total radiating surface of transformer tank in Sq. mtrs.	mfg to specify	Numerical
53	Weight of Core in kgs	mfg to specify	Numerical
54	Weight of copper (Winding) in Kgs.	mfg to specify	Numerical

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55	Weight of Transformer Tank with fittings in Kgs.	mfg to specify	Numerical
56	Weight of Oil in kgs	mfg to specify	Numerical
57	Volume of Oil in Ltrs	mfg to specify	Numerical
58	Total weight of Transformer in Kgs	mfg to specify	Numerical
59	Rating of Lightning Arrestors and Make thereof (kV, kA)	NA	
60	Reference Standard of Lightning Arrestors.	NA	
61	Min. External Clearances of HV Bushing terminals between Ph to Ph (in mm ) (outdoor)	255 mm	Numerical
62	Min. External Clearances of HV Bushing terminals between Ph to E (in mm) ( outdoor)	140 mm	Numerical
63	Min. External Clearances of LV Bushing terminals between Ph to Ph (in mm) ( outdoor)	75 mm	Numerical
64	Min. External Clearances of LV Bushing terminals between Ph to E (in mm) ( outdoor)	40 mm	Numerical
65	The temperature shall in no case reach a value that will damage the core itself , other parts or adjacent materials (Yes/ No)	Yes	Boolean
66	Type of Core (stacked/ wound)	Stacked	Text
67	Core material used & its grade	CRGO, M-4 or Better	Text
68	Thickness of core lamination in mm	0.27 mm or thinner	Numerical
69	No of steps used in CRGO Core	mfg to specify	Numerical
70	Diameter of the core (in mm)	mfg to specify	Numerical
71	Effective Core Area ( Sq. cm)	mfg to specify	Numerical
72	Flux density at normal voltage and frequency in Tesla	1.69 T (Max)	Numerical
73	Material of H.V. Winding	Electrolytic Aluminum	Text
74	Material of L.V. Winding	Electrolytic Aluminum	Text
75	Size/diameter of conductor used for HV winding in mm	mfg to specify	Numerical

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76	Total cross section area of HV Winding in sq mm.	mfg to specify	Numerical
77	Size of strip used for LV winding conductor in mm	mfg to specify	Text
78	Total cross section of Copper used in LV Winding in sq. mm	mfg to specify	Numerical
79	No. of conductors in parallel of LV winding	mfg to specify	Numerical
80	Current density of HV winding , in Amps/ sq. mm.	1.6 A/sq.mm (Max)	Numerical
81	Current density of LV winding, in Amps / sq.mm.	1.6 A/sq.mm (Max)	Numerical
82	No of HV winding Turns	mfg to specify	Numerical
83	No of LV winding Turns	mfg to specify	Numerical
84	No of H.V. coils /phase	mfg to specify	Numerical
85	No. of L.V. coils/ phase	mfg to specify	Numerical
86	Resistance of HV winding at 20 ° C in Ohm/phase	mfg to specify	Numerical
87	Resistance of LV winding at 20 ° C in Ohm/phase	mfg to specify	Numerical
88	% impedance value at 75° C	4.5% (±IS TOL)	Numerical
89	Name of manufacturers of oil	Apar/ Savita or equivalent other makes shall be specified by mfg.	Text
90	Grade of Oil	Mineral oil as per IS:335/2018 Updated	Text
91	A. Minimum volume of oil in liters as per clause No. 9 of tech. specification	Mfg to specify	Numerical
92	B. Quantity of total oil absorption (in Ltrs) in first filling	Mfg to specify	Numerical
93	Total oil Volume including Total Oil absorption in liters i.e. (A+B)	Mfg to specify	Numerical
94	Breakdown value of oil at the time of first filling (KV/ mm) considering 2.5 mm gap	30kV	Numerical

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95	Total volume of conservator shall be such as to content 10% of total quantity of oil (Yes/ No)	Yes	Boolean
96	No load losses at rated voltage and frequency in Watts	Mfg to specify	Numerical
97	Max. Total losses (No load loss + Load Loss) at 50 % loading in Watts at 75°C	780 W	Numerical
98	Max. Total losses (No load loss + Load Loss) at 100 % loading in Watts at 75°C	2300 W	Numerical
99	Magnetizing current (No load) in Amps & its 3% of full load current & rated voltage referred to LV side	7.98 Amp at 3%	Text
100	Magnetizing current (No load) in amps & its 6 % of full load current at maximum voltage (112.5% of rated voltage ) referred to LV side	15.96 Amp at 6%	Text
101	Min Clearance between Core & L.V. in mm	3.5 mm (Rad)	Numerical
102	Min Clearances between L.V. & H.V. in mm	11 mm	Numerical
103	Min Clearances between winding to body of tank in mm	30 mm	Numerical
104	Min Clearance between HV phase to phase in mm	10 mm	Numerical
105	Min Clearances between end insulation to Earth in mm	25 mm	Numerical
106	Insulation materials provided for core	CARLITE COATING	Text
107	Insulation materials provided for H.V. Conductor	DPC	Text
108	Insulation materials provided for L.V. Conductor	DPC	Text
109	Thickness of locking spacers between HV coils in mm	2 mm	Numerical
110	Inter layer insulation provided in H.V winding to design for Top & bottom layer	Electrical Grade Insulating Kraft Paper	Text
111	Inter layer insulation provided in L.V winding to design for Top & bottom layer	Electrical Grade Insulating Kraft	Text

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		Paper	
112	Inter layer insulation provided in between all layer in H.V winding	Electrical Grade Insulating Kraft Paper	Text
113	Inter layer insulation provided in between all layer in L.V winding	Electrical Grade Insulating Kraft Paper	Text
114	Details of end insulation (thickness in mm)	25mm	Numerical
115	Whether wedges are Provided at 50% turns of the Coil (Yes/ No)	NO	Boolean
116	Thickness of insulating paper	0.25mm	Numerical
117	Regulation at 0.8 P.F. lag ( in %)	Mfg to specify	Numerical
118	Regulation at 0.8 P.F. leading ( in %)	Mfg to specify	Numerical
119	Regulation at unity P.F.. (in %)	Mfg to specify	Numerical
120	Reference standard of Bushing	IS : 3347	Numerical
121	Material of HV and L.V Bushings	PORCELAIN	Numerical
122	Makes of HV and L.V Bushings	Mfg to specify	Numerical
123	Rating of HV Bushing ( in KV,A)	12 KV,250Amps	Numerical
124	Rating of LV Bushing (in KV,A)	1 KV,630Amps	Numerical
125	Minimum Creepage Distance of HV Bushings in mm (min 25mm/ kV)	300 mm	Numerical
126	Minimum Creepage Distance of LV Bushings in mm (min 25mm/ kV)	66 mm	Numerical
127	Power frequency withstand voltage dry & wet in kV(rms) for HV Bushings for 1 min	28 KVrms	Numerical
128	Dry lightning impulse withstand voltage test in kV (Peak) stating the waveform adopted for HV Bushing.	75 Kvp	Numerical
129	Separate source power frequency withstand test for HV for 1minute in kV(min)	28 KVrms	Numerical
130	Separate source power frequency withstand test for LV for 1minute in kV(min)	3 KVrms	Numerical
131	Induced over voltage withstand test for 1 min. specify voltage frequency, time for	24/0.866 kV for 1min	Text

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	test.		
132	Impulse test value (in kVp) .	75 Kvp	Numerical
133	Efficiency at 75 ° C at unity P.F. at 125 % Load	Mfg to specify	Numerical
134	Efficiency at 75 ° C at unity P.F. at 100 % Load	Mfg to specify	Numerical
135	Efficiency at 75 ° C at unity P.F. at 75 % Load	Mfg to specify	Numerical
136	Efficiency at 75 ° C at unity P.F. at 50 % Load	Mfg to specify	Numerical
137	Efficiency at 75 ° C at 0.8 P.F. lag at 125 % Load	Mfg to specify	Numerical
138	Efficiency at 75 ° C at 0.8 P.F. lag at 100 % Load	Mfg to specify	Numerical
139	Efficiency at 75 ° C at 0.8 P.F. lag at 75 % Load	Mfg to specify	Numerical
140	Efficiency at 75 ° C at 0.8 P.F. lag at 50 % Load	Mfg to specify	Numerical
141	Efficiency at 75 ° C at 0.8 P.F. lag at 25 % Load	Mfg to specify	Numerical
142	Efficiency at 75 ° C at 0.8 P.F. leading at 125 % Load	Mfg to specify	Numerical
143	Efficiency at 75 ° C at 0.8 P.F. leading at 100 % Load	Mfg to specify	Numerical
144	Efficiency at 75 ° C at 0.8 P.F. leading at 75 % Load	Mfg to specify	Numerical
145	Efficiency at 75 ° C at 0.8 P.F. leading at 50 % Load	Mfg to specify	Numerical
146	Efficiency at 75 ° C at 0.8 P.F. leading at 25 % Load	Mfg to specify	Numerical
147	The test certificates of copper conductors, core , insulating paper, porcelain Bushings, steel plate used for enclosure of the offered transformer are enclosed with the offer (Yes/ No)	Shall be submitted at the time of stage inspection	Boolean

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148	All type test report carried out on transformer at NABL laboratory shall be submitted along with the offer as per cl. XXII (c) of Section (I) i.e. Instructions to tenderers. (Yes/ No). Firm may attach online.	Mfg to specify	Boolean
149	Unbalance current test, Air pressure test and temperature rise test shall be conducted as per format enclosed with the technical specification along with the offer (Yes/ No)	Mfg to specify	Boolean
150	All drawings shall be furnished for each offered item separately along with this offer(Yes/ No)	Mfg to specify	Boolean
151	Oil absorption calculation sheet shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean
152	Heat dissipation calculation shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean
153	Calculation sheet submitted for Flux density calculations (stating HV & LV turns) for each offered item separately along with the offer (Yes/ No)	Mfg to specify	Boolean
154	Calculation sheet for 112% of rated V/ f ratio (Over fluxing) calculation sheet shall be furnished for each item separately along with this offer (Yes/ No )	Mfg to specify	Boolean
155	Required documents, plant and machinery, testing equipment , list of order executed/under execution shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean
156	The information required under Quality Assurance shall be submitted with the offer in physical format & soft copy(Yes/ No)	Mfg to specify	Boolean

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

157	The cost data in the prescribed format shall be submitted with offer in physical format & soft copy (Yes/ No)	Mfg to specify	Boolean
158	The performance Guarantee of the transformers in years	5 YEARS from date of commissioning	Text

<b>Standard Guaranteed Technical Particulars</b> 200 KVA, 22/0.433 KV, ONAN, Copper Wound, O/D Distribution Transformer Star 1 (Level-2)			
Sr. No	GTP Parameters	REMARK	
1	Name of Manufacturer		Text
2	Reference Standards	IS-1180 Part-1 (2014)	Text
3	Rating of Transformer in KVA	200 KVA	Numerical
4	Primary voltage in kV	22 KV	Numerical
5	Secondary voltage in kV	0.433 KV	Numerical

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

6	Transformer shall be Oil Natural Air Natural (ONAN) type Yes/ No	ONAN	Text
7	Transformer shall be suitable for Indoor application. (Yes/No)	Outdoor	Boolean
8	Highest System Voltage in kV	24 KV	Numerical
9	Frequency in HZ.	50 Hz	Numerical
10	Transformer shall be suitable for solid neutral earthing (Yes/No)	YES	Boolean
11	Service condition shall be applicable as per Technical specification clause no. 3	YES	Boolean
12	Transformer Colour as per IS:5	Air craft Blue, IS- 5,Shade-108	Text
13	Type of connection for H.V. Winding (Delta) (Yes/ No).	Delta	Text
14	Type of connection for L.V. Winding (Star) (Yes/ No)	Star	Text
15	Vector Group Dyn-11 (Yes/ No)	Dyn11	Text
16	Name Plate details are as per the requirement specified in tender (Yes/No)	YES	Boolean
17	Thickness of Name plate (in SWG)	18 SWG	Numerical
18	Maximum temperature rise of Windings over an Ambient temp. of 50°C in °C is	40°C	Numerical
19	Maximum temperature rise of oil over an Ambient temp. of 50°C in °C is	35°C	Numerical
20	Approximate overall length of the Transformer in mm	Mfg to be specify	Numerical
21	Approximate overall breadth of the Transformer in mm	Mfg to be specify	Numerical
22	Approximate overall height of the Transformer in mm	Mfg to be specify	Numerical
23	Approximate length of the Transformer tank in mm	Mfg to be specify	Numerical
24	Approximate breadth of the Transformer tank in mm	Mfg to be specify	Numerical
25	Approximate height of the Transformer tank in mm	Mfg to be specify	Numerical
26	Thickness of the side of transformer tank plates in mm	3.15 mm	Numerical

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

27	Thickness of the bottom of transformer tank plates in mm	5 mm	Numerical
28	Thickness of the top of transformer tank plates in mm	5 mm	Numerical
29	Size of reinforced welded angle to the Transformer Tank in mm.	50 X 75 X 5 mm	Text
30	Degree of slope to the top plate of Transformer.	5° to 10° towards HV side	Text
31	Shape of transformer Tank	RECTANGULAR	Text
32	Type of Tank (Corrugated/ Conventional)	Corrugated /CONVENTIONAL Mfg to be specify	Text
33	In case of corrugated tank, thickness of corrugated sheet (in mm)	N.A	
34	Size of Transformer Base Channel in mm.	75 X40 mm	Text
35	Conservator tank to the transformer with oil level indicator (showing three levels) and drain plug is provided ( Yes/ No)	YES	Boolean
36	Dimensions of conservator Tank (LxD) in mm	Mfg to be specify	Text
37	Drain Valve size provided to the transformer tank ( Yes/No)	32 mm	Numerical
38	Size of Oil filling hole with cap in mm. (on conservator) is provided.	32 mm	Numerical
39	Size of filter valve in mm. is provided.	32 mm	Numerical
40	No. & Size in mm of Lifting lugs provided to transformer	4 Nos, 12 mm	Text
41	No. & Size in mm of pulling lugs provided to transformer	4 Nos, 8 mm	Text
42	No. & Size in mm of transformer top cover lifting lugs provided to transformer	2 Nos, 8 mm	Text
43	No. of Earthing terminals with suitable size in (SWG)	2 Nos	Numerical
44	Thermometer pocket is provided (Yes/ No)	Yes	Boolean

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

45	Quantity of Silica -Gel filled in breather ( in gm) & make of breather	500gm, Yogya Enterprises / Press 'n' Force or equivalent other makes shall be specified by mfg.	Text
46	Explosion vent with diaphragm. (Yes/ No)	Yes	Boolean
47	No of radiators both on HV & LV side provided and location with arrangement & size.	4 Nos. (2 On LV & 2 On HV) ,	Text
48	Thickness of the radiator of transformer in mm.	1.25 mm mfg to specify size fins	Text
49	No of radiator fins.	mfg to specify	Numerical
50	(A) Radiating surface of radiators in Sq. Mtrs.	mfg to specify	Numerical
51	(B) Radiating surface of Tank only in Sq. Mtrs.	mfg to specify	Numerical
52	Total radiating surface of transformer tank in Sq. mtrs.	mfg to specify	Numerical
53	Weight of Core in kgs	mfg to specify	Numerical
54	Weight of copper (Winding) in Kgs.	mfg to specify	Numerical
55	Weight of Transformer Tank with fittings in Kgs.	mfg to specify	Numerical
56	Weight of Oil in kgs	mfg to specify	Numerical
57	Volume of Oil in Ltrs	mfg to specify	Numerical
58	Total weight of Transformer in Kgs	mfg to specify	Numerical
59	Rating of Lightning Arrestors and Make thereof (kV, kA)	NA	
60	Reference Standard of Lightning Arrestors.	NA	
61	Min. External Clearances of HV Bushing terminals between Ph to Ph (in mm) ( outdoor)	330 mm	Numerical
62	Min. External Clearances of HV Bushing terminals between Ph to E (in mm) ( outdoor)	230 mm	Numerical
63	Min. External Clearances of LV Bushing terminals between Ph to Ph (in mm) ( outdoor)	75 mm	Numerical

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

64	Min. External Clearances of LV Bushing terminals between Ph to E (in mm) (outdoor)	40 mm	Numerical
65	The temperature shall in no case reach a value that will damage the core itself, other parts or adjacent materials (Yes/ No)	Yes	Boolean
66	Type of Core (stacked/ wound)	Stacked	Text
67	Core material used & its grade	CRGO, M-4 or Better	Text
68	Thickness of core lamination in mm	0.27 mm or thinner	Numerical
69	No of steps used in CRGO Core	mfg to specify	Numerical
70	Diameter of the core (in mm)	mfg to specify	Numerical
71	Effective Core Area ( Sq. cm)	mfg to specify	Numerical
72	Flux density at normal voltage and frequency in Tesla	1.69 T (Max)	Numerical
73	Material of H.V. Winding	Electrolytic Copper	Text
74	Material of L.V. Winding	Electrolytic Copper	Text
75	Size/diameter of conductor used for HV winding in mm	mfg to specify	Numerical
76	Total cross section area of HV Winding in sq mm.	mfg to specify	Numerical
77	Size of strip used for LV winding conductor in mm	mfg to specify	Text
78	Total cross section of Copper used in LV Winding in sq.mm	mfg to specify	Numerical
79	No. of conductors in parallel of LV winding	mfg to specify	Numerical
80	Current density of HV winding, in Amps/ sq. mm.	2.8 A/ sq.mm (Max)	Numerical
81	Current density of LV winding, in Amps / sq.mm.	2.8 A/ sq.mm (Max)	Numerical
82	No of HV winding Turns	mfg to specify	Numerical
83	No of LV winding Turns	mfg to specify	Numerical
84	No of H.V. coils /phase	mfg to specify	Numerical
85	No. of L.V. coils/ phase	mfg to specify	Numerical

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

86	Resistance of HV winding at 20 ° C in Ohm/phase	mfg to specify	Numerical
87	Resistance of LV winding at 20 ° C in Ohm/phase	mfg to specify	Numerical
88	% impedance value at 75° C	4.5% (±IS TOL)	Numerical
89	Name of manufacturers of oil	Apar/ Savita or equivalent other makes shall be specified by mfg.	Text
90	Grade of Oil	Mineral oil as per IS:335/ 2018 Updated	Text
91	A. Minimum volume of oil in liters as per clause No. 9 of tech. specification	Mfg to specify	Numerical
92	B. Quantity of total oil absorption (in Ltrs) in first filling	Mfg to specify	Numerical
93	Total oil Volume including Total Oil absorption in liters i.e. (A+B)	Mfg to specify	Numerical
94	Breakdown value of oil at the time of first filling (KV/ mm) considering 2.5 mm gap	30kV	Numerical
95	Total volume of conservator shall be such as to content 10% of total quantity of oil (Yes/ No)	Yes	Boolean
96	No load losses at rated voltage and frequency in Watts	Mfg to specify	Numerical
97	Max. Total losses (No load loss + Load Loss) at 50 % loading in Watts at 75°C	820 W	Numerical
98	Max. Total losses (No load loss + Load Loss) at 100 % loading in Watts at 75°C	2415 W	Numerical
99	Magnetizing current (No load) in Amps & its 3% of full load current & rated voltage referred to LV side	7.98 Amp at 3%	Text
100	Magnetizing current (No load) in amps & its 6 % of full load current at maximum voltage (112.5% of rated voltage ) referred to LV side	15.96 Amp at 6%	Text

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

101	Min Clearance between Core & L.V. in mm	4 mm (Rad)	Numerical
102	Min Clearances between L.V. & H.V. in mm	14 mm	Numerical
103	Min Clearances between winding to body of tank in mm	40 mm	Numerical
104	Min Clearance between HV phase to phase in mm	15 mm	Numerical
105	Min Clearances between end insulation to Earth in mm	40 mm	Numerical
106	Insulation materials provided for core	CARLITE COATING	Text
107	Insulation materials provided for H.V. Conductor	DPC	Text
108	Insulation materials provided for L.V. Conductor	DPC	Text
109	Thickness of locking spacers between HV coils in mm	2 mm	Numerical
110	Inter layer insulation provided in H.V winding to design for Top & bottom layer	Electrical Grade Insulating Kraft Paper	Text
111	Inter layer insulation provided in L.V winding to design for Top & bottom layer	Electrical Grade Insulating Kraft Paper	Text
112	Inter layer insulation provided in between all layer in H.V winding	Electrical Grade Insulating Kraft Paper	Text
113	Inter layer insulation provided in between all layer in L.V winding	Electrical Grade Insulating Kraft Paper	Text
114	Details of end insulation (thickness in mm)	25mm	Numerical
115	Whether wedges are Provided at 50% turns of the Coil (Yes/ No)	NO	Boolean
116	Thickness of insulating paper	0.25mm	Numerical
117	Regulation at 0.8 P.F. lag ( in %)	Mfg to specify	Numerical
118	Regulation at 0.8 P.F. leading ( in %)	Mfg to specify	Numerical

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

119	Regulation at unity P.F.. (in %)	Mfg to specify	Numerical
120	Reference standard of Bushing	IS : 3347	Numerical
121	Material of HV and L.V Bushings	PORCELAIN	Numerical
122	Makes of HV and L.V Bushings	Mfg to specify	Numerical
123	Rating of HV Bushing ( in KV,A)	24 KV,250Amps	Numerical
124	Rating of LV Bushing (in KV,A)	1 KV, 630Amps	Numerical
125	Minimum Creepage Distance of HV Bushings in mm (min 25mm/ kV)	600 mm	Numerical
126	Minimum Creepage Distance of LV Bushings in mm (min 25mm/ kV)	66 mm	Numerical
127	Power frequency withstand voltage dry & wet in kV(rms) for HV Bushings for 1 min	50 KVrms	Numerical
128	Dry lightning impulse withstand voltage test in kV (Peak) stating the waveform adopted for HV Bushing.	125 Kvp	Numerical
129	Separate source power frequency withstand test for HV for 1minute in kV(min)	50 KVrms	Numerical
130	Separate source power frequency withstand test for LV for 1minute in kV(min)	3 KVrms	Numerical
131	Induced over voltage withstand test for 1 min. specify voltage frequency, time for test.	44/ 0.866 kV for 1min	Text
132	Impulse test value (in kVp) .	125 Kvp	Numerical
133	Efficiency at 75 ° C at unity P.F. at 125 % Load	Mfg to specify	Numerical
134	Efficiency at 75 ° C at unity P.F at 100 % Load	Mfg to specify	Numerical
135	Efficiency at 75 ° C at unity P.F. at 75 % Load	Mfg to specify	Numerical
136	Efficiency at 75 ° C at unity P.F. at 50 % Load	Mfg to specify	Numerical
137	Efficiency at 75 ° C at 0.8 P.F. lag at 125 % Load	Mfg to specify	Numerical
138	Efficiency at 75 ° C at 0.8 P.F. lag at 100 % Load	Mfg to specify	Numerical

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

139	Efficiency at 75 ° C at 0.8 P.F. lag at 75 % Load	Mfg to specify	Numerical
140	Efficiency at 75 ° C at 0.8 P.F. lag at 50 % Load	Mfg to specify	Numerical
141	Efficiency at 75 ° C at 0.8 P.F. lag at 25 % Load	Mfg to specify	Numerical
142	Efficiency at 75 ° C at 0.8 P.F. leading at 125 % Load	Mfg to specify	Numerical
143	Efficiency at 75 ° C at 0.8 P.F. leading at 100 % Load	Mfg to specify	Numerical
144	Efficiency at 75 ° C at 0.8 P.F. leading at 75 % Load	Mfg to specify	Numerical
145	Efficiency at 75 ° C at 0.8 P.F. leading at 50 % Load	Mfg to specify	Numerical
146	Efficiency at 75 ° C at 0.8 P.F. leading at 25 % Load	Mfg to specify	Numerical
147	The test certificates of copper conductors, core , insulating paper, porcelain Bushings, steel plate used for enclosure of the offered transformer are enclosed with the offer (Yes/ No)	Shall be submitted at the time of stage inspection	Boolean
148	All type test report carried out on transformer at NABL laboratory shall be submitted along with the offer as per cl. XXII (c) of Section (I) i.e. Instructions to tenderers. (Yes/No). Firm may attach online.	Mfg to specify	Boolean
149	Unbalance current test, Air pressure test and temperature rise test shall be conducted as per format enclosed with the technical specification along with the offer (Yes/ No)	Mfg to specify	Boolean
150	All drawings shall be furnished for each offered item separately along with this offer(Yes/ No)	Mfg to specify	Boolean
151	Oil absorption calculation sheet shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

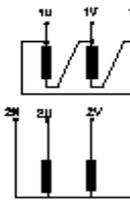
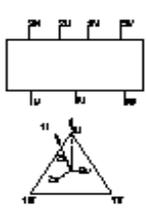
152	Heat dissipation calculation shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean
153	Calculation sheet submitted for Flux density calculations (stating HV & LV turns) for each offered item separately along with the offer (Yes/ No)	Mfg to specify	Boolean
154	Calculation sheet for 112% of rated V/ f ratio (Over fluxing) calculation sheet shall be furnished for each item separately along with this offer (Yes/ No )	Mfg to specify	Boolean
155	Required documents, plant and machinery, testing equipment , list of order executed/under execution shall be furnished for each offered item separately along with this offer (Yes/ No)	Mfg to specify	Boolean
156	The information required under Quality Assurance shall be submitted with the offer in physical format & soft copy(Yes/ No)	Mfg to specify	Boolean
157	The cost data in the prescribed format shall be submitted with offer in physical format & soft copy (Yes/ No)	Mfg to specify	Boolean
158	The performance Guarantee of the transformers in years	5 YEARS from date of commissioning	Text

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

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**Following are the indicative drawings. 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.**

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/ 0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

115			
REF. STANDARD : IS 2026-1977 & IS 1080 3 STAR RATING, 3 PH. DISTRIBUTION TRANSFORMER			
TYPE	OUT DOOR	TYPE OF COOLING	ONAN
RATED KVA	---	OIL TEMP. RISE	35
RATED HV (V)	11000	WDG TEMP RISE	40
VOLTAGE LV (V)	433	VOLUME OF OIL	l
RATED HV (A)	---	MASS OF OIL	kg
CURRENT LV (A)	---	WEIGHT OF CORE	kg
PHASES	3	WEIGHT OF WDGs	kg
FREQUENCY Hz	50	TOTAL MASS	kg
IMPEDANCE %	---	SERIAL NO	
GUARANTEED TOTAL LOSS	Wdg/Temp Losses At 20 Deg C	--- IN WATTS	
INSULATION LEVEL	U75 AC 2B	CORE	CRGO/AMDT
VECTOR GROUP	DYn-11	MONTH-YEAR OF MFG	--- & ---
OWNER	MSEDCL, MUMBAI.		
A./T.NO.			
 CONNECTION DIAGRAM		 VECTOR DIAGRAM	
4 HOLES Ø3			

MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.

**NOTE:**

- ACTUAL VALUES SHALL BE PUNCHED AT THE TIME OF DISPATCH.
- RATING PLATE MATERIAL: ALUMINIUM ANODIZED
- THICKNESS OF RATING PLATE: 18 SWG
- 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	<b>RATING &amp; TERMINAL MARKING PLATE</b> <b>---KVA, 11/0.433KV CRGO/AMDT, DIST. TRANSFORMER</b>	
DRN		
CHD		SCALE
APPD		DRG. NO
--- KVA      NTS		





**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/ 0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSSED OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

TECHNICAL DETAILS		AS ORDERED		AS OFFERED	
1. No. of Phases	3	1. No. of Phases	3	1. No. of Phases	3
2. Primary Voltage (KV)	11	2. Primary Voltage (KV)	11	2. Primary Voltage (KV)	11
3. Secondary Voltage (KV)	0.433	3. Secondary Voltage (KV)	0.433	3. Secondary Voltage (KV)	0.433
4. Vector Group	Yd11	4. Vector Group	Yd11	4. Vector Group	Yd11
5. Core Material	CR	5. Core Material	CR	5. Core Material	CR
6. Primary Voltage Regulation %	5	6. Primary Voltage Regulation %	5	6. Primary Voltage Regulation %	5
7. Temperature Rise at Full Load	65	7. Temperature Rise at Full Load	65	7. Temperature Rise at Full Load	65
8. Cooling Type	AN	8. Cooling Type	AN	8. Cooling Type	AN
9. Core Material	CR	9. Core Material	CR	9. Core Material	CR
10. No. of Steps of Core (mm)	10	10. No. of Steps of Core (mm)	10	10. No. of Steps of Core (mm)	10
11. Core Dia	100	11. Core Dia	100	11. Core Dia	100
12. Core Length	100	12. Core Length	100	12. Core Length	100
13. Core Area	7850	13. Core Area	7850	13. Core Area	7850
14. Core Perimeter	314	14. Core Perimeter	314	14. Core Perimeter	314
15. Core Volume	785000	15. Core Volume	785000	15. Core Volume	785000
16. Core Weight	785000	16. Core Weight	785000	16. Core Weight	785000
17. Core Density	7.85	17. Core Density	7.85	17. Core Density	7.85
18. Core Loss	100	18. Core Loss	100	18. Core Loss	100
19. Core Efficiency	98	19. Core Efficiency	98	19. Core Efficiency	98
20. Core Factor	1.0	20. Core Factor	1.0	20. Core Factor	1.0
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**TECHNICAL DETAILS**

1. No. of Phases: 3

2. Primary Voltage (KV): 11

3. Secondary Voltage (KV): 0.433

4. Vector Group: Yd11

5. Core Material: CR

6. Primary Voltage Regulation %: 5

7. Temperature Rise at Full Load: 65

8. Cooling Type: AN

9. Core Material: CR

10. No. of Steps of Core (mm): 10

11. Core Dia: 100

12. Core Length: 100

13. Core Area: 7850

14. Core Perimeter: 314

15. Core Volume: 785000

16. Core Weight: 785000

17. Core Density: 7.85

18. Core Loss: 100

19. Core Efficiency: 98

20. Core Factor: 1.0

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100. Core Factor: 1.0

**THIS IS AN INDICATIVE DRAWING**

STEP NO.	1	2	3	4	5	6	7	8
STEP WIDTH								
STEP THK								
TOTAL CROSS SECTION AREA -- C.M.								
EFFECTIVE CORE AREA = 0.874 * C.M.								

**DESCRIPTION**

**CORE WINDOW HEIGHT** H

**CORE WINDOW CENTRE TO CENTRE** W

**CORE STACK THK** T

**CORE DIA** D

**NOTE:**

1. ALL DIMENSIONS ARE IN mm.

2. DIMENSIONS & WEIGHTS ARE SUBJECT TO +10% TOLERANCE EXCEPT THOSE MENTIONED AS MIN.

3. KVA PHASES FREQUENCY COOLING

KVA	3	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000	
PHASES	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
FREQUENCY	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
COOLING	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN	AN



**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/ 0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

**TRANSFORMER BUSHING AS PER IS:3347**

**ELECTRICAL CHARACTERISTICS:**

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

**NOTE:**  
PERFORMANCE REQUIREMENTS OF THE BUSHING SHALL CONFIRM TO IS: 3347

BRASS NUT 3N05  
PLAIN WASHER 2N05  
TOP INSULATOR  
TANK SHEET  
BOTTOM INSULATOR

MAKE: -----

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

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. \_\_\_\_\_  
Notes \_\_\_\_\_

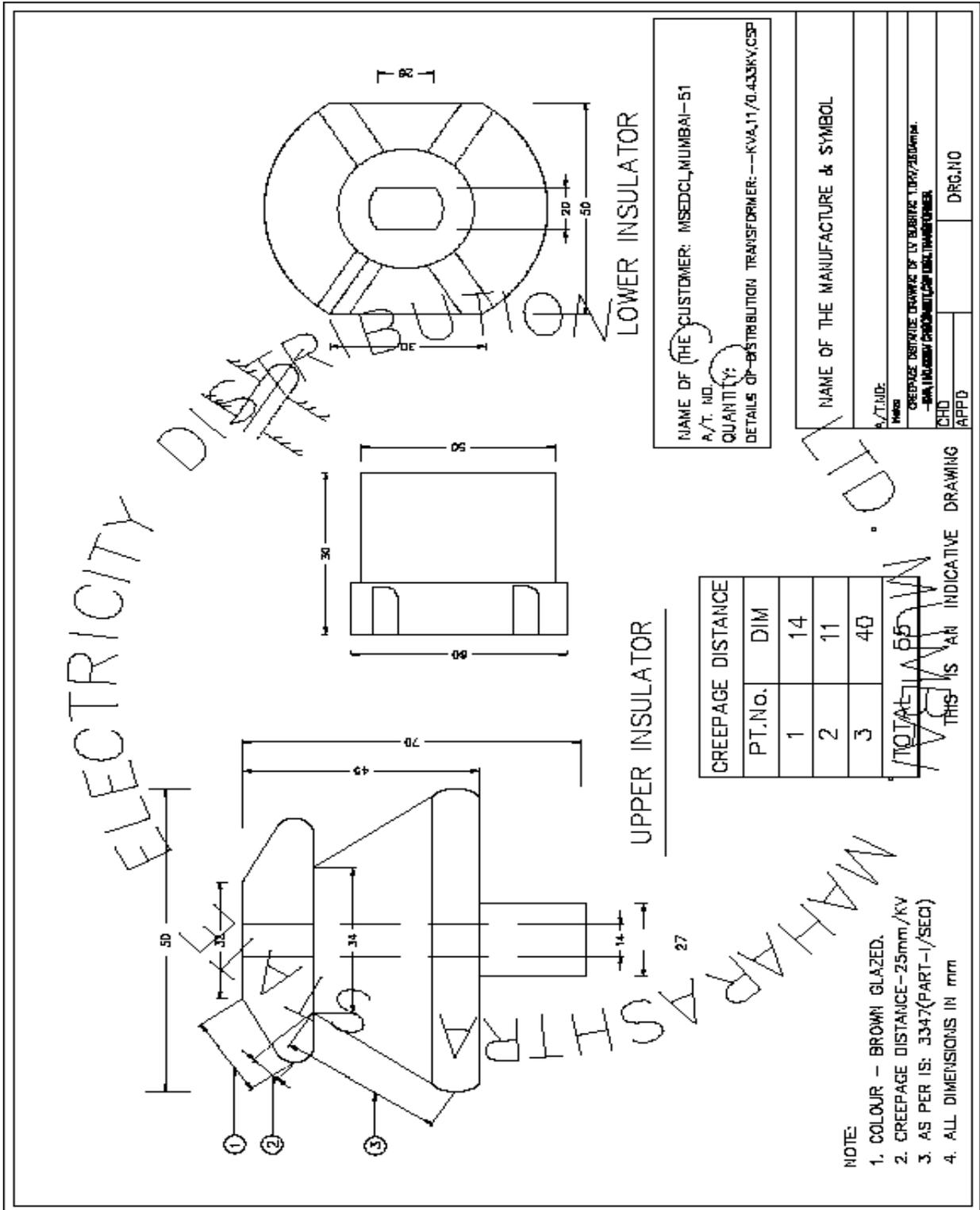
LD BUSHING ASSEMBLY DRAWING  
2000A, 11/0.433KV, CSP DIST. TRANSFORMER

CHD \_\_\_\_\_  
APPD \_\_\_\_\_

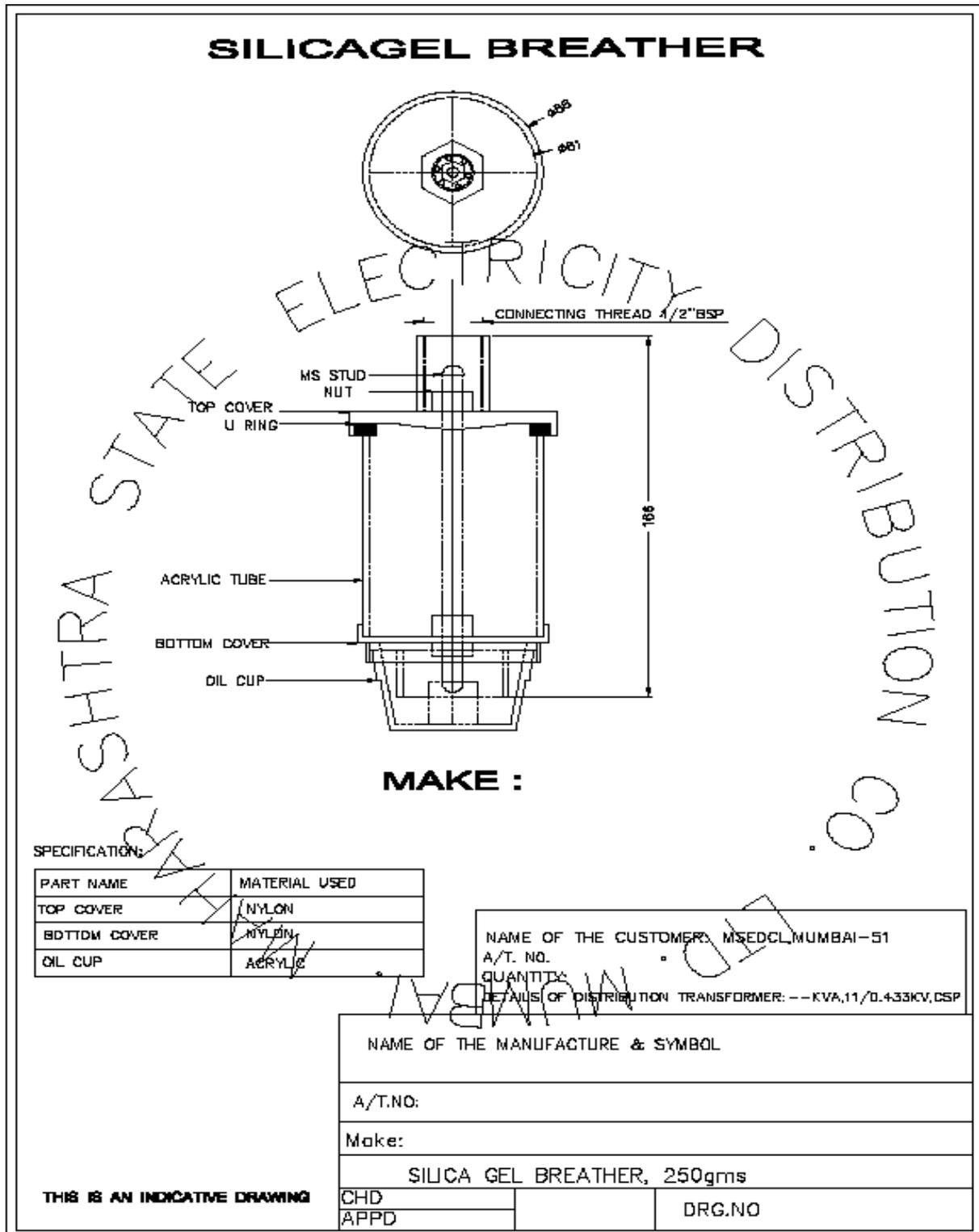
DRG. NO \_\_\_\_\_

**THIS IS AN INDICATIVE DRAWING**

**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/ 0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**



**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/ 0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**



**Note:- The drawings given below are indicative drawings, however for providing**

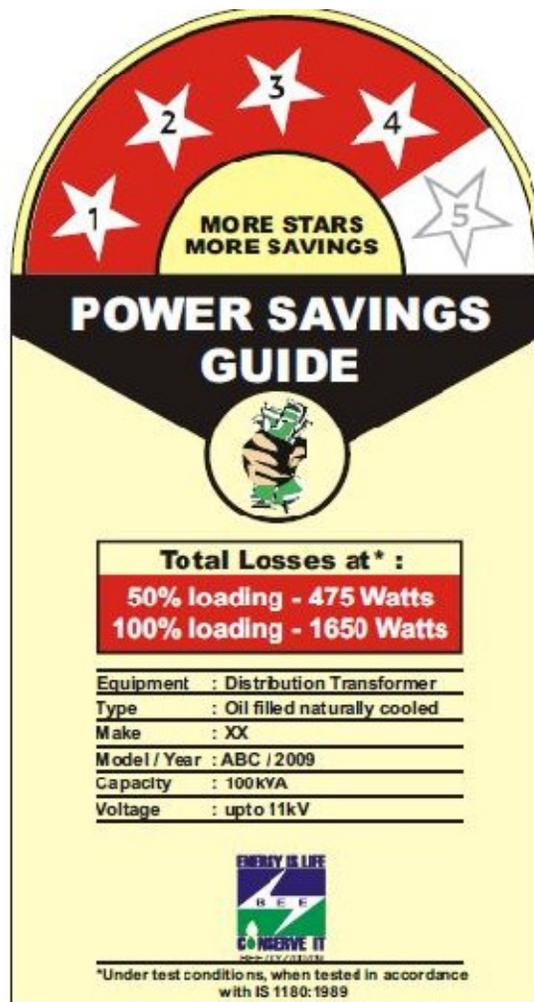
**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

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and affixing label for respective capacity kVA, should be followed as 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) is provided below:**

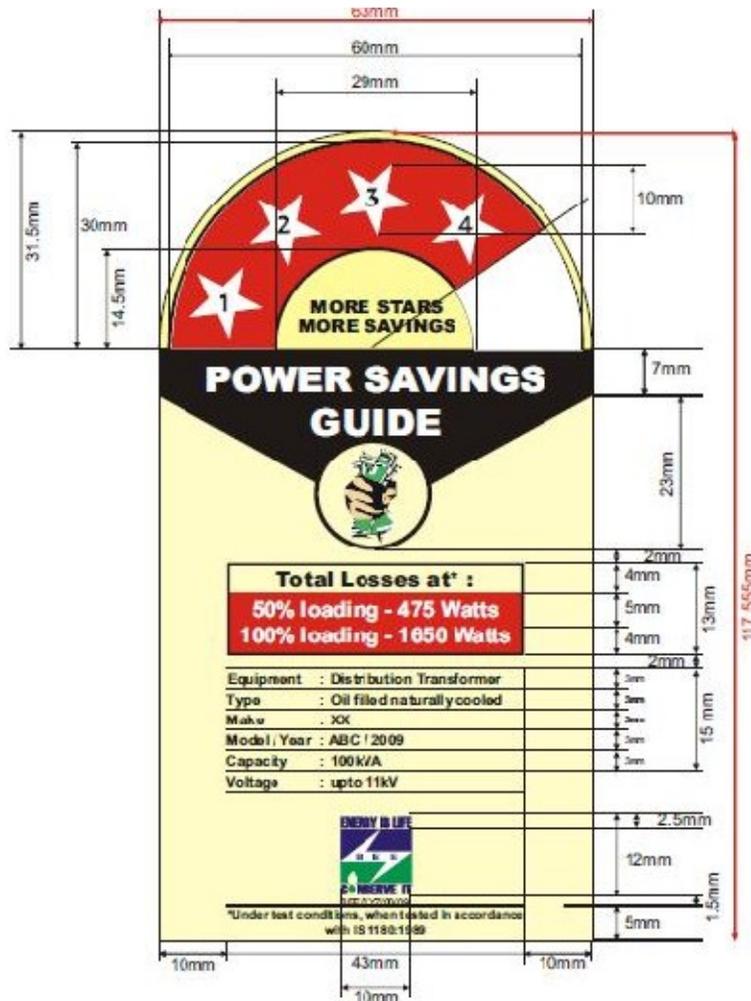


**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

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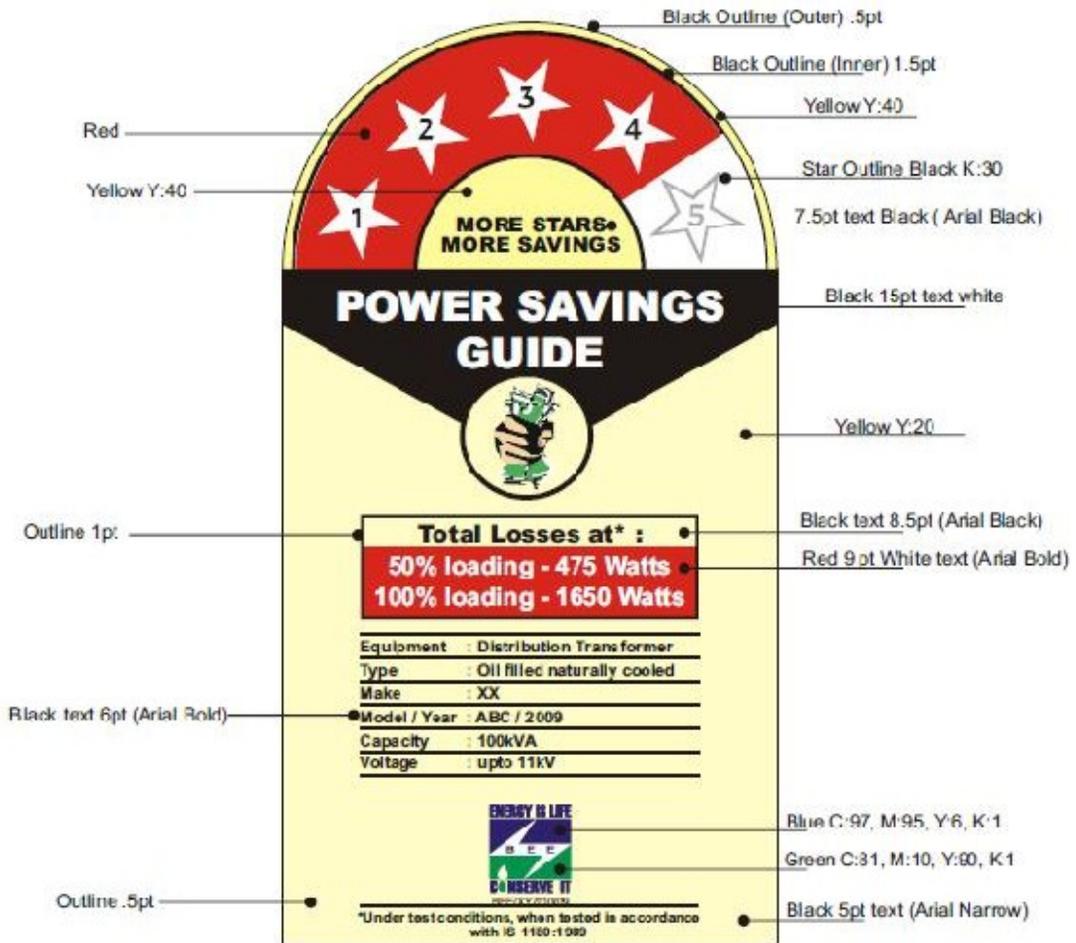
**Fig. 2. Manner of display of label:**

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:**

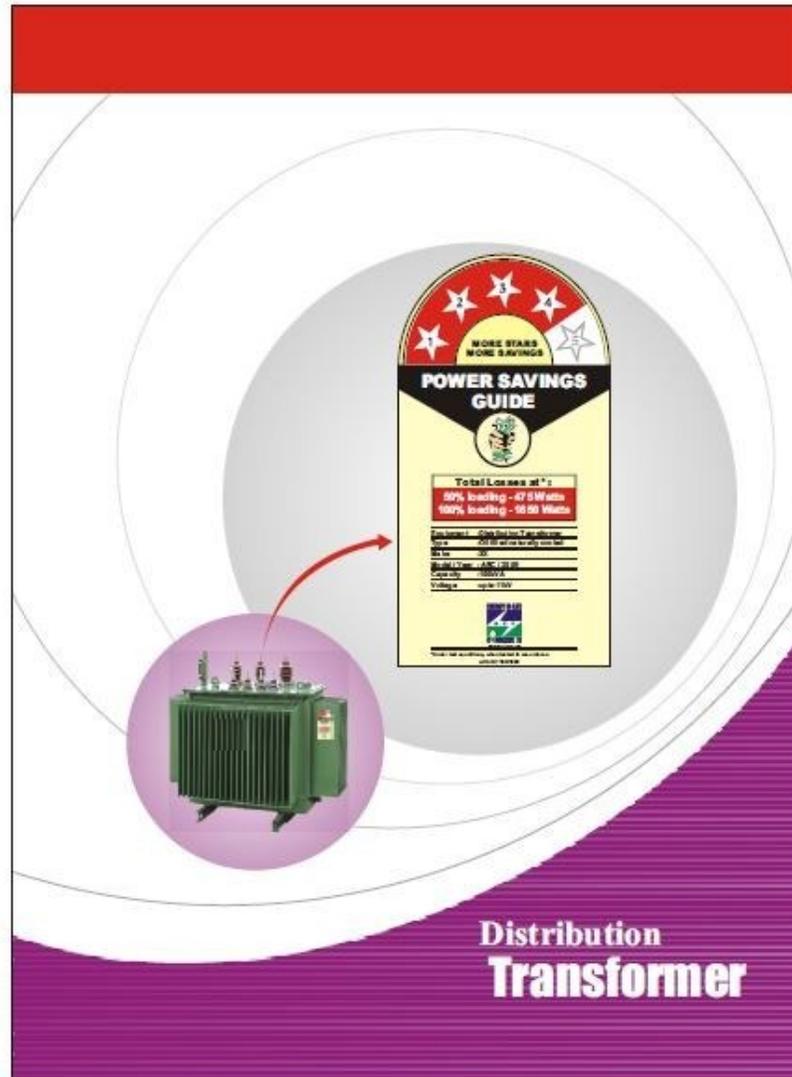
**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**



**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/  
0.433 kV, Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED  
OUTDOOR TYPE DISTRIBUTION TRANSFORMERS**

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**Sample Picture of manner of affixing of Label:**



**TECHNICAL SPECIFICATIONS OF 200 kVA, 11/ 0.433 kV and 22/ 0.433 kV,  
Star 1 (Level-2) THREE PHASE, NON SEALED, OIL IMMERSED OUTDOOR TYPE  
DISTRIBUTION TRANSFORMERS**

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