MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

OF

16 kVA AND 25kVA, 11/0.433 kV LEVEL-2 THREE PHASE, SEALED/NON SEALED TYPE DISTRIBUTION TRANSFORMERS OUTDOOR TYPE OIL IMMERSED WITHOUT CSP FEATURE

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1.0 Scope

This specification covers design, manufacturing, testing and delivery of 16 and 25 kVA, 11kV /0.433 kV level-2 three phase, sealed/non sealed type distribution transformers outdoor type oil immersed without CSP feature, Oil natural Air Natural (ONAN) suitable for 11 kV , 50 Hz, Distribution system.

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.

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 sufficiently long life in service as per statutory requirements.

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

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.

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.

2.0 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.

I. Nominal System Voltage: 11 kV
II. Corresponding Highest System Voltage: 12kV
III. Rated Basic Insulation Level: 75 KVp
IV. Neutral earthling: Solidly earthed Frequency: 50 Hz with ±3 % tolerance
V. Number of Phases: 3

3.0 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	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 Distribution Transformer shall be of suitable design to work satisfactorily under these conditions.

3.3 The Distribution Transformer 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 1of BEE) ratings label approved by BIS (Bureau of Indian Standard) as per IS 1180 (Part1):2014 (Amendment-1 August 2016).

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.

4.0 APPLICABLE STANDARDS:-

4.1 The design, manufacture and performance of the Distribution Transformer 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.

4.3 The applicable standards are as follows:

Sr.No.	IS number	IS name
i	IS:1180(Part-1) : 2014 with (Amendment-1 August 2016)	Outdoor type oil immersed distribution transformers up to and including 2500 kVA, 33kV
ii	IS:2026(Part I to IV)	Specification for power transformer
iii	IS:335/1993	Newinsulatingoil-Specification(fourth revision)

Sr.No.	IS number	IS name
iv	IS:2099/1986, IS: 7421-1988, IS:3347 (Part-I/Sec-2)-1979, IS:3347 (Part-I /Sec-1)-1982 amended up to date	Bushing
v	IS 5	Colours for ready mixed paints and Enamels.
vi	IS 13730 (Part-27)1996	Specification for particular types of winding wires.
vii	IS: 3073/1974, IS: 3070(Part- II)	Specifications for L.A's
viii	CEA Guidelines August -2008	Manual on transformers
ix	Gazette notification by Ministry of Power dated 16.12.2016	Revised losses of distribution transformers

4.4 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.

5.0 Specific Technical requirement:

5.1 Standard kVA Ratings:-

The standard ratings for three phase transformer shall be 16 & 25kVA as per IS 1180 (Part-I):2014

A) Nominal voltage ratings

I. Primary voltage: 11 kV

II. Secondary voltage: 0.433 kV

B)Winding connections:-

i. H.V. Winding: Delta (Δ)

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

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

5.2 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 (Part2)]

5.3 No load voltage ratio:-

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

6.0 Design &construction

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

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

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

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

6.1 Core

i The core shall be stacked/ wound type.

a) For Stack core :- The core shall be of high grade cold rolled grain oriented (C.R.G.O) annealed steel lamination having low loss and good grain properties, coated with hot oil proof insulation, 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 core 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:

a. Core clamping shall be with top and bottom U- shaped core clamps made of sheet steel clamped.

b. M.S. core clamps shall be painted with oil-resistant paint.

c. Suitable provision shall be made in the bottom core clamp / bottom plate of the transformer to arrest movement of the active part.

1. Core shall be clamped by minimum 12 mm diameter MS Tie rods.

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

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

iii The successful bidder shall be required to submit the manufacturer's test report showing the Watt Loss per kg and the thickness of the core lamination, to ascertain

the quality of Core materials.

The purchaser reserves the right to get sample of the core material tested at any Government recognizedlaboratory.

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

v Flux density:-

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

vi The No load current at rated voltage shall not exceed the percentage as given below. The no load current of 16kVA& 25 kVA transformers shall not exceed 3%the full load current and will be measured by energizing the transformer at rated voltage and frequency. Increase of 12.5 percent of rated voltage shall not increase the no load current by 6% of full load current. (As per IS 1180 (Part1):2014).

Number of steps of CRGO stacked core shall be minimum of stack core transformer

Sr. No.	Rating (kVA)	Number of steps
1	16	Min. 5 standard steps
2	25	Min. 5 standard steps

vii The CRGO core material shall be used for 16 KVA &25 KVA transformer.

6.2 **Winding:-**

The material for winding shall be Aluminum for 11kV and 22 KV class transformers.

i. Super enameled of thermal grade of 220 degree C or Double paper covered Aluminum conductor shall be used for HV/LV winding for 16KVA,25KVA Distribution Transformers for 11 kV&.

ii. Current Density:- Current density for HV and LV winding should not be more than 1.3 A/sq. mm (including tolerance) for Aluminum.

iii. L.V. Neutral formation shall be at side wall of tank.

iv. No of HV coil per phase shall be as below

a) CRGO stack core – Minimum 2 coils per phase.

b) CRGO wound core- Single coil per phase.

6.3 **Losses:**

The total losses (no-load + load losses at 75 deg. Centigrade) at 50% of rated load &

total losses at 100% of rated load shall not exceed the maximum total loss values indicatedas below:-

for 11kV class transformers. *The indicated losses in the table for CRGO as per IS: 1180 (Part-I) 2014.*

Rating (KVA)	Impedance (Percentage)	Max. total losses in watts up to 11 kV Class, Level- 2 (Star-1)	
		At 50% Load	At100% Load
16	4.5	135	440
25	4.5	190	635

Note - For 22 KV voltage Class Transformers the permissible total loss values shall not exceed by 5 % of the Maximum total loss values mentioned in above table. (IS 1180 – Part-1 2014 Clause No 6.8 Sub Clause 6.8.1.2)

Tolerances:

No positive tolerance shall be allowed on the maximum total 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.

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

The tolerance on electrical performance excluding total losses at 50% of rated load & total losses at 100% of rated load shall be as given in IS 2026(Part 1).

6.4 **Insulation material and clearances:**

Materials –

Makes of Electrical grade insulating Kraft paper, Press Board, Perma wood/ Haldi wood insulation shall be declared in GTP by the bidder. The test reports for all properties as per relevant IS amended up to date shall be submitted during inspection .Compliance to Kraft paper IS 9335 [Cl.No.9.1(d) of IS 1180 (Part 1):2014] and for press board IS 1576 [Cl.No.9.1(e) of IS 1180 (Part 1):2014] and gasket shall be ensured through test certificate of the supplier.

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

ii Radial clearances of LV coil (bare conductor) to core shall be minimum 3.5 mm for 11kV & 4mm for 22kV

iii Radial clearance between HV & LV winding shall be minimum 11mm for 11kV & 14mm for 22kV

iv Phase to Phase clearance between HV conductor shall be minimum 10mm for 11kV & 15mm for 22kV

v Minimum End insulation to Earth shall be 11kV - 25 mm & 22kV- 40mm

vi Minimum external clearances between bushing terminals

Voltagelevel	Details	11 kV	22kV
HV	Ph to Ph	255 mm	330 mm
	Ph to E	140 mm	230 mm
LV	Ph-to-Ph	75 mm.	75 mm
	Ph to E	40 mm.	40 mm

6.5 Impedance Value–

The percentage impedance at 75 º C. for different ratings shall be as per clause no 6.3 table above.

6.6 Tank

6.6.1 The transformer tank shall be made up of prime quality M.S. sheets of rectangular shape. No other shape will be accepted. The transformer tank shall be of robust construction. All joints of tank and fittings should be oil tight and no bulging shall occur during service. The tank design shall be such that the core and windings can be lifted freely. The tank plates shall be of such strength that the complete transformer when filled with oil may be lifted bodily by means of the lifting lugs provided. Tank inside shall be painted by varnish or oil resistant paint. Top cover plate shall be slightly sloping; approximately 5 to 10 deg. Opposite to LV 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 1.6mm. Corrugation panel shall be used for cooling. The transformer shall be capable of giving continuous rated output without exceeding the specified temperature rise. Bidder shall submit the detailed calculation sheet alongwith offer. The safe guard angle frame 25X25X5 mm shall be welded for corrugated side to the tank.

6.6.3 In rectangular shape tanks, horizontal or vertical joints in tank side walls and its bottom or top cover will be not allowed.

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. (All figures in mm)

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

6.6.4 Reinforced by welded angle 25X25X5 MM on all the outside walls on the edge of tank to form two equal compartments.

6.6.5 When transformer tank without oil is subject to air pressure of 80 KPa above atmospheric pressure for 30 min as per IS 1180 (Part 1):2014. Pressure test shall be performed carefully as per IS 1180 (Part 1):2014 Clause no.21.5.1 at the time of 1st stage inspection only to confirm the adequacy of reinforcement angle and gauge of the tank and certified by E.E. (IW).

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

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

6.6.8 Pulling lugs: 2 nos. of welded heavy duty pulling lugs of MS plate of 8mm thickness shall be provided to pull the transformer horizontally.

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

a) Size 12mm or below—stainless steel.

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

6.6.10 Top cover fixing bolts: GI nut bolts of 1/2" diameter (min) with one plain washer shall be used for top cover fixing, spaced at 4" apart. 6 mm neoprene bonded cork oil resistance gaskets conforming to type B/C IS 4253 Part-II amended up to date will be placed between tank and cover plate.

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

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

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

6.6.14 Plain tank shall be capable of withstanding a pressure of 80kPa for 30 minutes and a vacuum of 250 mm of mercury for 30 minutes (Type Test). The permanent deflection
of flat plates shall not exceed the values given in IS 1180(Part 1): 2014 clause no. 21.5.1.1.

6.6.15 Thermometer pocket must be located at center of top cover or high side of tank height for true valve of max top oil temperature

6.6.16 The construction of the tank should be sealed/ non sealed. The space on the top of the oil shall be filled with dry air or nitrogen for sealed transformers. The dry air or nitrogen plus oil volume inside the tank shall be such that even under extreme operating conditions, the pressure generated inside the tank does not exceed 0.4kg/sq.cm positive or negative. The nitrogen shall conform to commercial grade of the relevant standard. Oil level indicator with only minimum position corresponding to the operating temperature of 30°C (for sealed type transformers) shall fixed on side wall of the tank.

6.6.17 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.

6.7 **Off Load Taps:**

6.7.1 No taps are required for 16kVA & 25kVA Transformers.

7.0 **Efficiency:**

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

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

8.0 **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 loss at rated excitation + load loss at 100% Loading converted to 75 deg' C reference temperature) shall be supplied during temperature rise test.

c) The heat dissipation by tank wall should be increased to appropriate value considering the climatic temperature rise. If required, the radiators shall be provided as following d and e clause:

d) Only fins type radiators 1.25 mm thick shall be used. The tender should submit the heat dissipation calculations with the offer.

e) 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

9.0 **Total Minimum Oil Volume:**

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

Sr.No.	KVA rating	Oil in liters	(exclusive of oil absorbed in core & coil assembly)
		Voltage rating11/0.433 kV	Voltage rating22/0.433 kV
1	16	50	70
2	25	70	100

Note:

Transformer shall be supplied complete with first filling of oil up to minimum position corresponding to the operating temperature of 30°C (for sealed type transformers) on oil indicator fixed on side wall of the tank and Transformer shall be supplied complete with first filling of oil up to the mark indicator level of conservator(for non-sealed type transformer). Detailed calculation of absorption should be submitted.

10.0 **Conservator: (For Non Sealed Type Transformer)**

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

b. Oil level indicator shall be provided on the side which will be with fully covered detachable flange with single gasket and tightened with MS nut-bolt. Level indication by color shall not 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 the oil gauge indicator of the conservator.

Note : For sealed type transformer no conservator is required

11.0 **Breather: (For Non Sealed Type Transformer)**

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

b. The dehydrating agent shall be silica gel. The volume of breather shall be suitable for 250 gm to 16 & 25 kVA silica gel conforming to IS 3401. Makes of the breather shall be subject to purchaser's approval. The make and design of breather shall be subject to approval of CE (Testing & QC).

c. Note : For sealed type transformer no breather is required

12.0 **Terminals:**

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

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

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

d. Brass Rod of 12 mm diameter with LT extension with suitable cable lugs, necessary nuts, check-nuts and plain thick tinned washer.

13.0 **Bushings &Connections:**

13.1 The transformers shall be fitted on high voltage and low voltage sides with outdoor type bushings of appropriate voltage and current ratings. The high voltage bushings (3nos.) shall be provided with R-Y-B colour coding marking & shall conform to IS 2099. The low voltage bushings (4 nos.) shall conform to IS 7421. Alternatively, the low voltage side may be made suitable for adoption of XLPE cables of suitable size. The dimensions shall conform to IS 1180(Part 1): 2014 clause no. 10.1.5.

13.2 The bushing shall be made in two parts. The outer bushing shall be of porcelain. The dimensions of the outer bushing shall confirm to the relevant Part/Section of 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 11 kV class 12 kV bushing shall be used and for 433 volts 1.0 kV bushing shall be used. Bushings of the same voltage class shall be interchangeable. Bushings with plain shed shall be as per relevant IS:3347 amended up to date. HV bushings shall be mounted on the top of the transformer tank & LV bushings shall be mounted on side of the 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.

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

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

14.0 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 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) For Aluminum windings inter coil connections crimping & silver brazing shall be used.

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

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

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

15.0 Tank base channel / Mounting Arrangement:

The under-base of the transformer shall be provided as per clause 14.1 of IS 1180(Part1):2014

16.0 Terminal Marking Plates and Rating Plates :

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

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

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

(d) Terminals shall be provided with terminal marking plates. The transformer shall be provided with riveted rating plate of minimum 18 SWG aluminum anodized material sheet in a visible position. The entries of the rating plate shall be in indelibly marked (i.e. by etching, engraving or stamping).

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

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

part of the tank.

(g) The distribution transformer 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 thereunder.

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

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

(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.

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

17.0 Fittings:

The following standard fittings shall be provided

1	Rating and terminal marking plate	1 no.
2	Earthing terminals with lugs.	2 nos.
3	Lifting lugs	4 nos. (2 nos. for tank and 2 nos. fortop plate of the tran former)

4	Pulling lugs	2 nos
5	Drain valve - 32mm for all T/Fs (It shall be covered with metallic box spot welded to tank) IS554	1 No.
6	Silica gel breather 250gms	1No.
7	Oil filling hole with cap (On Conservator)	1No.
8	Conservator with drain plug	1No.
9	The pipe connecting the conservator to the main tank	1No.
10	Thermometer pocket with cap	1No.
11	Oil filling hole with cap on top cover	1No.
12	Air release device (for non- sealed transformer) Pressure Relief device (for sealed transformer)	1No. 1No.
13	On transformer side tank wall Oil level gauge indicating oil level at minimum, 30°C and maximum operating temperature; or on conservator with 3 position Minimum (-) 5 deg.C. Normal 30deg.C, Maximum 98 deg.C.	1No.
14	HT & LT bushing and terminal connectors	3 nos. of HT bushing and 4 nos. of LT bushing shall be provided with brass terminal rods with 3 nos. of brass nuts and 2 plain brass washers.
15	Lightening Arrestors for HT bushings	3 Nos.
16	Years Guarantee plate	1 No.
17	Anti-theft stainless steel fasteners with breakaway nut at top cover	4 Nos.

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

17.0 **Fasteners.**

1. All bolts, studs, screw threads, pipe threads, bolt heads and nuts shall comply with the appropriate Indian standards for metric threads or the technical equivalent.
2. Bolts or studs shall not be less than 6 mm in diameter except when used for small wiring terminals.
3. All nuts and pins shall be adequately locked.
4. Wherever possible bolts shall be fitted in such a manner that in the event of failure of locking resulting in the nuts working loose and falling off, the bolt will remain in position.
5. All ferrous bolts, nuts and washers placed in outdoor positions shall be treated to prevent corrosion by hot dip galvanizing except high tensile steel bolts and spring washers, which shall be Electro, galvanized. Appropriate precautions shall be taken to prevent electrolytic action between dissimilar materials.
6. Each bolt or stud shall project at least one thread but not more than three threads through the nut, except when otherwise approved for terminal board studs or relay stems. If bolts are provided at inaccessible places for ordinary spanners, special spanners shall be provided.
7. The length of screwed portion of the bolts shall be such that no screw thread may form part of a sheer plane between members.
8. Taper washers may be provided where necessary. Protective washers of suitable material shall be provided front and back of the securing screws.
9. LT side should be of Pad type terminal.

18.0 **Lightening Arrestors:**

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

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

19.0 **Transformer Oil**

Transformer oil to be used in all the Distribution transformers shall comply with the requirements of latest IS 335/2018 amended up to date thereof. The Unused Mineral Insulating Oils (type II)are obtained by distillation and refining of crude petroleum as required to meet the properties specified below.

Sr. No.	Property	Test Method	Permissible Values
A. Function			
1.	Viscosity at 40°C	IS : 1448 (Part 25)	15 mm^2/s, Max.
2.	Viscosity at 0°C	IS : 1448 (Part 25)	1800 mm^2/s, Max.
3.	Pour – Point	IS : 1448 (Part 10/Sec2)	- 10°C, Max. , to be based on LCSET
4.	Water content	IEC 60814	30 mg/kg , Max. / 40 mg/kg, Max.
5.	Breakdown voltage	IS : 6792	30kV / 70kV, Min.
6.	Density at 20°C	IS : 1448 (Part 16)	0.895 g / ml. Max.
7.	DDF at 90°C	IS : 16086	0.005, Max.
8.	Particle content	IS : 13236	No general requirement.
B. Refining / stability			
9.	Appearance	----	Clear, free from sediment and suspended matter.
10.	Acidity	IEC 62021-1	0.01 mg.KOH / g, Max.
11.	Interfacial tension	ASTM D 971	No general requirement.
12.	Total sulphur content	ISO 14596 or ASTM D 4294	No general requirement.
13.	Corrosive sulphur	DIN 51353	Not corrosive.
14.	Potentially corrosive sulphur	IS : 16310	Not corrosive.
15.	DBDS	IS : 16497 (Part 1)	Not detectable (<5mg/kg)
16.	Inhibitors according to IS : 13631 / IEC : 60666	IS : 13631	(U) Uninhibited oil: not detectable (<0.01%)
			(T) Trace inhibited oil : <0.08%
			(I) Inhibited oils : 0.08%-0.40%
17.	Metal passivator additives according to IS : 13631 / IEC : 60666	IS : 13631	Not detectable (<5mg/kg)
18.	Other additives	---	See 7
19.	2-Furfural and related compounds content	IS : 15668	Not detectable (<5mg/kg) For each individual compound.
C. Performance			
20.	Oxidation stability	IS : 15668(Method C) (U) Uninhibited oil : 164h (T) Trace inhibited oil :332h (I) Inhibited oil :500h	For oils with other antioxidant additives and metal passivator.
a)	• Total acidity,9	1.9.4 of IS : 12422	1.2mg KOH/g, Max.
b)	• Sludge,9	1.9.1 of IS : 12422	0.8%, Max.
c)	• DDF at 90°C. 9	1.9.6 of IS : 12422	0.500, Max
21.	Gassing tendency	IEC : 60628, Method A	No general requirement.
22.	ECT	--	No general requirement.
D. Health, Safety and Environment (HSE)			
23.	Flash point	IS : 1448 (Part 21)	135°C, Min.
24.	PCA content	IP : 346	3%, Max.

25.	PCB content	IS : 16082	Not detectable (<2mg/kg)

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

20.0 **Test and Inspection:-**

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

20.1 Routine Tests:

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 and load loss at 50 percent and 100 percent load [IS 2026 (Part 1)].

d) Measurement of no load loss and current [IS 2026 (Part 1)].

e) Measurement of insulation resistance [IS 2026 (Part 1)].

f) Induced over-voltage withstand test [IS 2026 (Part 3)].

g) Separate-source voltage withstand test [IS 2026 (Part 3)].

h) Pressure test

i) Oil leakage test

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

a) Lightening impulse test [IS 2026 (Part 3)].

b) Temperature-rise test [IS 2026 (Part 2)].

Note – Minimum total loss (No load + load loss at 75 deg' C reference temperature) at 100 % loading shall be supplied during temperature rise test.

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

d) Pressure test.

In addition to that the successful bidder shall submit the type test report of transformer Oil & HV/LV bushings as per relevant IS with offer

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

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

20.5 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 percent voltage [refer clause 7.9.2 of IS 1180(Part 1): 2014].

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

20.6 Pressure and Oil leakage Test

20.6.1 Pressure Test (Type Test)

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 750mm	5.0 mm
751 mm to 1250 mm	6.5 mm

20.6.2 Pressure Test (Routine Test) :

a) Plain tanks:

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

b) Corrugated tanks:

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

20.6.3 Oil leakage Test (routine Test):

The assembled transformer for sealed/ non-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.

21.0 Challenge Testing:

21.1 The manufacturer can also request challenge testing for any test based on specification and losses.

21.2 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.

21.3 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.

21.4 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.

21.5 The challenge test could be conducted at NABL Laboratory, like ERDA and CPRI.

21.6 If the values are within the limits, the products gets conformed.

21.7 No positive tolerances in losses are permitted.

21.8 If the product is not conformed, the manufacturer would pay the challenge fee and challenger would get the fee refunded. However as a redress system the challenger would be allow to ask for fresh testing of two or more samples from the store and the same be tested in NABL Laboratory in presence of party challenge, challenger and the utility.

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

22.0 Type Test report submission:-

22.1 In respect of the successful bidder, the purchaser reserves the right to demand repetition of some or all the type tests in presence of the purchaser's representative.

In case the unit fails in the type tests, the complete supply shall be rejected. The bidders are therefore requested to quote unit rates for carrying out each type test, which however, will not be considered for evaluation of the offer.

23.0 Drawings & Calculation sheet:-

23.1 Following drawings shall be uploaded by the bidder duly sealed & signed if bidder does not agree to supply the transformers as per MSEDCL standard drawings as given in standard GTP attached with this specification Rating & Diagram Plate Drawing.(As per Cl.no.13.1 Fig.1 of IS 1180(Part1):2014

i. General Dimensional Drawing.

ii. Internal Construction Drawing

iii. Core Assembly drawing

iv. HV& LV Bushings Assembly drawing

v. Creepage distances distance drawing of HV& LV Bushing

vi. Silica gel breather drawings

vii. BEE certification

viii. Calculation sheet for flux density and total losses at 50% and 100% loading

ix. Heat dissipation calculations

x. Oil absorption calculations

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 a set of legible and clear drawings (as listed in Cl.No.23.1) of the transformer to CE (Testing & QC) for approval before offering first factory inspection of the transformers.

24.0 **Rejection :-**

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

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

ii. Impedance voltage value exceeds he guaranteed value plus tolerances as mentioned at Cl.No.6.5 above.

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

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

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

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

25.0 **Cleaning and Painting.**

i. The external surface of transformers shall be painted with one coat of Epoxy primer (30 micron)and two coats of Polyurethane (finish coat) Liquid paint (each 25 micron) and inside surface of the tank hot oil resistant paint/ varnish with one coat with dry film thickness as mentioned in Table 12 , Cl.no.15.5 of IS 1180(Part 1):2014.

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

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

26.0 **Standard Guaranteed & Technical Particulars:**

The specific requirement of MSEDCL is given in GTP attached wi h this specification, the bidder if agreed to all technical parameters given as listed in GTP the statement such as “as per MSEDCL’s requirement” shall be considered and if he is wants offer deviations to specific requirement they can offer their technical parameters in column given in GTP. The GTP should be filled otherwise offer shall liable for rejection.

27.0 **Testing facility:**

The bidder should have adequate testing facility for all routine and acceptance tests and

also arrangement for measurement of losses, resistance, etc. details of which will be enumerated in the tender.

28.0 **Submission Routine Test Certificate:**

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

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

29.0 **Stage Inspection:**

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

30.0 Final Inspection:

1. After completion of manufacturing process of all quantity (Lot) as per MSEDCL's clearance letter, Supplier shall give intimation to the Chief Engineer (MMD) to organize final inspection.
2. After receipt of intimation from successful bidder, Chief Engineer (MMD) will depute MSEDCL's representative to visit factory of bidder for final Inspection.

Activities below will be carried out during final Inspection:

(a) Visual inspection of outer side, design, dimensions, color, name plate etc. of all

(100%) ready transformers from offered lot.

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

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

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

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

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

31.0 Testing of all Distribution Transformers for total losses at 50% load and 100% load at MSEDCL stores:

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

32.0 Random Sample Testing (RST)

32.1 The bidder should intimate to Chief Engineer (MMD) of completion of dispatches of whole lot of Distribution Transformers to stores against this tender.

32.2 Chief Engineer (MMD), M.S.E.D.C.L will select the stores for Random Sample Testing (RST) and depute Executive Engineer (Testing) to carry out RST of the lot.

32.3 Advance intimation of 15 days will be given to supplier for joint inspection.

32.4 The date of RST will not be altered to the convenience or request of supplier. If supplier's representative fails to attend on the date fixed for RST, the RST will be carried out in his absence and results of RST will be binding on supplier. In case the selected transformer fails in any of the tests, complete lot of transformers will be rejected.

32.5 Activities below will be carried out by EE (Testing) during Random Sample Testing:
Visual inspection of design, dimensions, color, name plate, radiator, bushings, LAs, Conservator tank, breather etc. of all (100%) transformers from supplied lot.

32.6 EE (Testing) will select one transformer at random from the lot of transformers already tested for total Losses at 50% load and 100% load which shall be opened and all design technical parameters shall check as per approved GTP, approved drawings and technical specifications.
That Selected transformer for random testing shall be tested for all routine testing before opening.

32.7 If any technical parameters are found deviating from the approved GTP, approved drawings & technical specifications during Random Sample Testing, whole lot shall be rejected.

33.0 Inspection & Testing of Transformer Oil:

The tenderer shall make arrangements for testing of transformer oil as per IS 335/2018 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.

34.0 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. Copper / Aluminum conductor
ii. Transformer oil
iii. C.R.G.O.Core.
iv. Insulating / Kraft paper.
v. Porcelain Bushings
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 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 equipment 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, Copper
for conductors, insulating materials, Core materials, Bushing at the time of routine Testing of the fully assembled transformer.

35.0 **Qualifying Requirement: Deleted**

36.0 **Performance Guarantee:**

All transformers supplied against this specification shall be guaranteed for a period of 24 months from the date of receipt of material at concern stores / consignee. However, any engineering error, omission, wrong provisions, etc. which do not have any effect on the time period, shall be attended to as and when observed/ pointed out without any price implication.

Annexure I

Air Pressure Test

Name of Supplier:

Order No.:

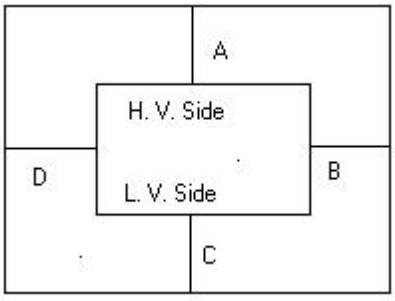
Capacity&VoltageRatioofDistributionTransformer:_____kVA,____/0.433kVVector Group Dyn11

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 places around the tank, the distance between string and tank as shown in following diagram were recorded before applying the pressure and after releasing pressure.



TankThickness: Side_____mm.			Top & Bottom_____mm	
TestPressure:_____kg/cm2 applied for 30 Minutes				
	Test Point	DistancebeforeTestIn mm	Distance afterreleaseof Pressure in mm	DeflectionInmm
	A			
	B			
	C			
	D			

PermanentDeflection:_____mm

PermissibleLimitofPermanentDeflectionasperSpecification:_mm Test

witnessedby Testedby

Annexure II

Temperature Rise Test

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

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

GuaranteedNoLoadLosses _____watt
Load Losses _____watt
TotalLosses _____watt

P.T.Ratio: _____/_____ =
C.T.Ratio: _____/_____ =
WattmeterConstant =
Total MultiplyingFactor(MF) =

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

Calculation of Temperature Rise in Winding

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

Temperature Rise in LV Winding = _____ °C

HV Winding Resistance across 1U1V at _____ °C = _____ ohm

Measurement of Hot Resistance of HV Winding after Shut Down.

Time	Resistance

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

Temperature Rise in H. V. Winding is

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

Results :

1) Temperature Rise in Oil = __ °C

2) Temperature Rise in LV Winding = __ °C

3) Temperature Rise in HV Winding = __ °C

4) Oil leakage test:

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

Test witnessed by Tested by

Annexure -III

Standard GTP - 16 KVA, 11/0.433 KV Distribution Transformers (Level-2) Sealed /Non sealed Type

Sr.No.	Guaranteed Technical Particular	Specific Requirement of MSEDCL	Specific Requirement of MSEDCL whether agree within yes or not	If not, please specify value
1	Name of Manufacturer.			
2	Reference Standard	IS 1180 (part-i)2014		
3	Whether transformer is Oil Natural Air Natural cooled type (Yes/No)	Yes		
4	Whether transformer is suitable for Indoor /Outdoor installation	Outdoor		
5	Rating of transformer in KVA	16		
6	Primary Voltage in kV	11		
7	Secondary Voltage in kV	0.433		
8	Whether neutral is solidly earthed (Yes/ No)	Yes		
9	Colour of transformer	Aircraft Blue (Shade no 108)		
10	Vector Group	Dyn-11		
11	Approximate overall length of transformer in mm	915		
12	Approximate overall breadth of transformer in mm	585		
13	Approximate overall height of transformer in mm	1070		
14	Approximate length of transformer tank in mm	715		
15	Approximate breadth of transformer tank in mm	275		
16	Approximate height of transformer tank in mm	690 (Avg)		
17	Thickness of the side of transformer Tank plate in mm	3.15		
18	Thickness of the bottom of transformer tank plate in mm	5		
19	Thickness of the top of transformer tank plate in mm	5		
20	Weight of Tank & fittings in kgs	78		
21	Total Weight of Transformer in kgs	290		

22	Type of Tank (corrugated/conventional)	conventional		
23	Degreeof slopetothetopplateof Transformer.	5°To10°towards HV side		
24	In case ofCorrugated tank, Thickness of corrugated sheet (in mm)	N.A.		
25	Name plate details are as per the requirement specified in tender. (Yes/ No)	Yes		
26	Total radiating surface of transformer tank in Sq. mtrs.	1.3662 Sq.mm		
27	Core material used & its grade	CRGO,M4		
28	Type of core	Stacked		
29	Weight of Core in kgs	64		
30	No. of steps of core for CRGO core	6		
31	Diameter of core in mm	75		
32	Effective core area.(sq.cm)	39		
33	Flux density in Tesla	1.69 Tesla max		
34	Thickness of core lamination in mm	0.27		
35	Thetemperatureshallinnocase reached a valuethatwill damagethecore itself, other partsoradjacentmaterials(Yes/No)	Yes		
36	Type of connectionforH.V.Winding (Delta) (Yes/No)	Yes ,Delta		
37	Type of connectionforL.V.Winding (Star) (Yes/No)	Yes,Star		
38	Material of H.V. winding	Aluminium		
39	Material of L.V.Winding	Aluminium		
40	Insulation provided to H.V winding.	DPC		
41	Insulation provided to L.V. winding.	DPC		
42	Current density of H.V. winding(in Ampere/ sq.mm)	1.3 A/sq.mmMax		
43	No of LV winding turns	188		
44	No of HV winding turns	8272		
45	ResistanceofLVwindingperphaseat 20 deg C in ohms	0.0703		
46	ResistanceofHVwindingperphase at 20 deg C in ohms	204.25		
47	Currentdensity ofL.V.winding(in Ampere/sq. mm.)	1.3 A/sq.mm Max		
48	ClearancebetweenCore&L.V.winding in mm	3.5		
49	Clearances between L.V.&H.V.winding in mm	11		
50	Clearances betweenHV PhasetoPhase in mm	10		

51	Clearances between end insulation to Earth in mm	25		
52	Clearances between windingtotankin mm (min 30 mm)Yes/No	Yes		
53	Weight of Aluminum/Copper in kgs	36		
54	Interlayerinsulationprovidedin H.V winding to designforTop&bottom Layer	Electrical Grade insulating Paper Min. 2 milx.2 Thk		
55	Inter layer insulation provided in L.V windingtodesignforTop&bottom layer	Electrical Grade Insulating Paper Min. 2 milx.2 Thk		
56	Interlayerinsulationprovidedin betweenalllayerinH.Vwinding	Electrical Grade insulating Paper Min. 2 milx.2 Thk		
57	Interlayerinsulationprovidedin betweenalllayerinL.Vwinding	Electrical Grade insulating Paper Min. 2 milx.2 Thk		
58	Details of end insulation	Press Board, Blocks & Sheet		
59	Whether wedges are Provided at 50% turns of the Coil (Yes/ No)	No		
60	Insulation materials provided for core	Hot oil proof insulation Varnish		
61	Length of coil used for HV winding in meter.	4406.62		
62	Crosssectionareaofthecoilusedfor HV winding (sq.mm)	0.59		
63	Length of coil used for LV winding in meter.	57.46		
64	Size of strip used for LV winding in mm	6.8mm × 3.4 mm		
65	No. of conductors in parallel for LV Winding	1		
66	TotalcrosssectionareaofLVconductor in sq.mm	22.26		
67	No. of H.V coils /phase	4		
68	Thickness of locking spacers between H.V. coils (in mm)	6		
69	Weight of Oil in kgs	68		
70	Volume of Oil in Ltrs	85		
71	Quantityoftotaloilabsorption(in liters) in first filling	2.6		
72	TotaloilVolumeincludingTotalOil absorption inliters	88		
73	Grade of Oil used.	Mineral Oil confirmingtoIS-335amendedupto date		
74	NameofOil manufacturerstobe supplied.			

75	Breakdown Values of Oil at the time of first filling (kV/mm) considering 2.5 mm gap	60 kV for Filtered & 30 kV Unfiltered Oil		
76	Conservator with Oil level indicator (showing three levels) (Yes/ No)	Yes (-5,30,98)		
77	Conservator tank to the Transformer with oil level indicator	Yes		
78	Drain Valve (32 mm) provided to the transformer tank (Yes/No)	Yes(32mm)		
79	Earthing terminals with lugs is provided (Yes/No)	Yes		
80	Lifting lugs provided (Yes/No)	Yes		
81	Thermometer pocket is provided (Yes/No)	Yes		
82	Material of HV and LV Bushings and makes thereof	Porcelain		
83	Reference standard of Bushings	IS : 3347		
84	Rating of L.V. Bushing	1kV/250Amp		
85	Minimum Creepage Distance of HV Bushing in mm (min.25 mm per kV)	305		
86	Minimum Creepage Distance of LV Bushing in mm (min.25 mm per kV)	65		
87	Rating of H.V. Bushings (in kV)	12 kV/ 250 Amp.		
88	Rating of L.V. Bushing (in kV, kA)	1.0 kV/ 250 Amp.		
89	Min. External clearances of H.V. bushing terminals between ph. to ph (255 mm)	255mm		
90	Min. External clearances of H.V. bushing terminals between ph. to earth (140 mm)	140mm		
91	Min. External clearances of L.V. bushing terminals between ph. to ph (75 mm)	75mm		
92	Min. External clearances of L.V. bushing terminals between ph to earth (40mm)	40mm		
93	Rating of Lightening Arrestors and Make thereof	9kv rms/5kA (8/20 microwave shape), Oblum/ Lamco		
94	Reference Standard of Lightening Arrestors.	IS: 3070/1974		
95	Maximum winding temperature rise in °C over an Ambient temp. of 50°C by Resistance Method	40		
96	Maximum temperature rise of Oil in °C over an Ambient temp. of 50°C by thermometer.	35		

97	Magnetizing current (No load) in Amps and its % of full load current at rated voltage referred to L.V. side.	0.64 Amps 3% of full load current		
98	Magnetizing current (No load) in Amps and its % of full load current at maximum voltage (112.5% of rated voltage) referred to L.V. side.	1.28 Amps 6% of full load current		
99	Max. core (No load) losses at rated voltage and rated frequency(Watts).	60		
100	Max. Total losses (No Load + Load Losses at 75 °C) at 50% loading in Watts	135		
101	Max. Total losses (No Load + Load Losses at 75 °C) at 100% loading in Watts	440		
102	Efficiency at 75°C at unity P.F. at 125% load	97.71		
103	Efficiency at 75°C at unity P.F. at 100% load	97.25		
104	Efficiency at 75°C at unity P.F. at 75% load	97.75		
105	Efficiency at 75 °C at unity P.F. at 50% Load	98.31		
106	Efficiency at 75°C at unity P.F. at 25% load	98.12		
107	Efficiency at 75°C at 0.8 P.F. lag at 125% load	95.88		
108	Efficiency at 75°C at 0.8 P.F. lag at 100 % load	96.56		
109	Efficiency at 75°C at 0.8 P.F. lag at 75% load	97.19		
110	Efficiency at 75°C at 0.8 P.F. lag at 50% load	97.89		
111	Efficiency at 75°C at 0.8 P.F. lag at 25% load	97.65		
112	Efficiency at 75°C at 0.8 P.F. leading at 125% load	95.88		
113	Efficiency at 75°C at 0.8 P.F. leading at 100% load	96.56		
114	Efficiency at 75°C at 0.8 P.F. leading at 75% load	97.19		
115	Efficiency at 75°C at 0.8 P.F. leading at 50%load	97.89		
116	Efficiency at 75°C at 0.8 P.F. leading at 25 % load	97.65		
117	Regulation at Unity P.F (in %)	0.4895		
118	Regulation at 0.8 P.F. lag. (in %)	3.0573		
119	Regulation at 0.8 P.F. leading. (in %)	3.0573		

120	% Impedance value at 75°C	4.5± 10%		
121	Separate source power frequency withstand test for HV for 1 minute in kv(min)	28kV rms		
122	Separate source power frequency withstand test for LV for 1 minute in kv(min)	3kV rms		
123	Induced overvoltage withstand test for 1 min. specify voltage frequency, time for test.	866Volt,100Hz.for one minute		
124	Impulse test value (in kVp) .	75kVp,1.2/50 microsecond		
125	The test certificates of Aluminium/copper conductor,core, insulating paper, porcelain bushings, steel plate used for enclosure of offer transformer is enclosed alongwith the offer in soft copy.(Yes/ No)	Yes		
126	All type test report of type tests carried out on transformer at NABL laboratory shall be submitted alongwith the offer as per cl. XXII (c) of Section (I) i.e. Instructions to tenderers.(Yes/ No)	Yes		
127	Air pressure test and temperature rise test shall be conducted as per format enclosed with the technical specification along with the offer (Yes/ No)	Yes		
128	All drawings shall be furnished for each offered item separately alongwith this offer (Yes/No)	Yes		
129	Oil absorption calculations sheet shall be furnished for each offered item separately along with this offer (Yes/ No)	Yes		
130	Heat dissipation calculation shall be furnished for each offered item separately alongwith this offer (Yes/ No)	Yes		
131	Flux density calculation sheet with no. of Primary & Secondary turns shall be furnished for each offered item Separately alongwith this offer (Yes/ No)	Yes		
132	Calculation sheet for 112.5% of Rated V/f ratio (over fluxing calculation sheet) shall be furnished for each offered item Separately alongwith this offer (Yes/ No)	Yes		

133	Required documents, plant and machinery, list of order executed/under execution shall be furnished for each offered item separately along with this offer (Yes/ No)	Yes		
134	The information required under Quality Assurance shall be submitted with the offer in physical format& softcopy(Yes/ No)	Yes		
135	The cost data in the prescribed format shall be submitted with offer in physical format & soft copy (Yes/ No)	Yes		
136	The performance Guarantee of the transformers in years	24 months from date of receipt of material		
137	Power frequency withstand voltage dry & wet in kV(rms) for H.V Bushing	28kV rms for one minute		
138	Dry lightning Impulse withstand voltage test in kV (peak) Stating the wave form adopted for H.V. bushing	75kVp,1.2/50 microsecond		
139	Oil filling hole with cap (On Conservator) is provided (Yes/No)	Yes		
140	Quantity of Silica Gel filled in Breather and makes	250 Grms		
141	No.of radiators providers and location with arrangement	As required		
142	Thickness of the radiator of transformer in mm	1.25mm		
143	No of radiator fins	As required		

Standard GTP - 25 KVA, 11/0.433 KV Distribution Transformers (Level-2) Sealed / Non - Sealed Type

Sr.No	Guaranteed Technical Particular	Specific Requirement of MSEDCL	Specific Requirement of MSEDCL whether agree withit yes or not	If not , please specify value
1	Name of Manufacturer.			
2	Reference Standard	IS 1180(part-i)2014		
3	Whether transformer is Oil Natural Air Natural cooled type (Yes/ No)	Yes		
4	Whether transformer is suitable for Indoor /Outdoor installation	Outdoor		
5	Rating of transformer in KVA	25		
6	Primary Voltage in kV	11		
7	Secondary Voltage in kV	0.433		
8	Whether neutral is solidly earthed (Yes/ No)	Yes		
9	Colour of transformer	Aircraft Blue (Shade no 108)		
10	Vector Group	Dyn-11		
11	Approximate overall length of transformer in mm	960		
12	Approximate overall breadth of transformer in mm	665		
13	Approximate overall height of transformer in mm	1300		
14	Approximate length of transformer tank in mm	750		
15	Approximate breadth of transformer tank in mm	285		
16	Approximate height of transformer tank in mm	765 (Avg)		
17	Thickness of the side of transformer Tank plate in mm	3.15		
18	Thickness of the bottom of transformer tank plate in mm	5		
19	Thickness of the top of transformer tank plate in mm	5		
20	Weight of Tank & fittings in kgs	95		
21	Total Weight of Transformer in kgs	360		
22	Type of Tank	conventional		

	(corrugated/conventional)			
23	Degree of slope to the top plate of Transformer.	5 °To 10 ° towards HV side		
24	In case of Corrugated tank, Thickness of corrugated sheet (in mm)	N.A.		
25	Name plate details are as per the requirement specified in tender. (Yes/ No)	Yes		
26	Total radiating surface of transformer tank in Sq. mtrs.	1.583 Sq.mm		
27	Core material used & its grade	CRGO,M4		
28	Type of core	Stacked		
29	Weight of Core in kgs	84		
30	No. of steps of core for CRGO core	7		
31	Diameter of core in mm	81		
32	Effective core area.(sq.cm)	48.73		
33	Flux density in Tesla	1.69 Tesla max		
34	Thickness of core lamination in mm	0.27		
35	The temperature shall in no case reach a value that will damage the core itself, other parts or adjacent materials (Yes/No)	Yes		
36	Type of connection for H.V. Winding (Delta) (Yes/ No)	Yes		
37	Type of connection for L.V. Winding (Star) (Yes/ No)	Yes		
38	Material of H.V. winding	Aluminium		
39	Material of L.V.Winding	Aluminium		
40	Insulation provided to H.V winding.	DPC		
41	Insulation provided to L.V. winding.	DPC		
42	Current density of H.V. winding (in Ampere/ sq.mm)	1.3 A/sq.mm Max		
43	No of LV winding turns	164		
44	No of HV winding turns	7216		
45	Resistance of LV winding per phase at 20 deg C in ohms	0.0465		
46	Resistance of HV winding per phase at 20 deg C in ohms	111		
47	Current density of L.V. winding (in Ampere/sq. mm.)	1.3 A/sq.mm Max		
48	Clearance between Core & L.V. winding in mm	3.5		
49	Clearances between L.V. & H.V. winding in mm	11		

50	Clearances between HV Phase to Phase in mm	10		
51	Clearances between end insulation to Earth in mm	25		
52	Clearances between winding to tank in mm (min 30 mm)Yes/No	Yes		
53	Weight of Aluminum/Copper in kgs	53		
54	Inter layer insulation provided in H.V winding to design for Top & bottom layer	Electrical Grade insulating Paper Min. 2 milx.2 Thk		
55	Inter layer insulation provided in L.V winding to design for Top & bottom layer	Electrical Grade insulating Paper Min. 2 milx.2 Thk		
56	Inter layer insulation provided in between all layer in H.V winding	Electrical Grade insulating Paper Min. 2 milx.2 Thk		
57	Inter layer insulation provided in between all layer in L.V winding	Electrical Grade insulating Paper Min. 2 milx.2 Thk		
58	Details of end insulation	Press Board, Blocks & Sheet		
59	Whether wedges are Provided at 50% turns of the Coil (Yes/ No)	No		
60	Insulation materials provided for core	Hot oil proof insulation Varnish		
61	Length of coil used for HV winding in meter.	4104		
62	Cross section area of the coil used for HV winding (sq.mm)	1.09		
63	Length of coil used for LV winding in meter.	57.96		
64	Size of strip used for LV winding in mm	10mm × 3.5 mm		
65	No. of conductors in parallel for LV winding	1		
66	Total cross section area of LV conductor in sq. mm	34.45		
67	No. of H.V coils /phase	4		
68	Thickness of locking spacers between H.V. coils (in mm)	9		
69	Weight of Oil in kgs	95		
70	Volume of Oil in Ltrs	115		
71	Quantity of total oil absorption (in liters) in first filling	4		
72	Total oil Volume including Total Oil absorption in liters	119		
73	Grade of Oil used.	Mineral Oil confirming to IS - 335 amended		

		upto date		
74	Name of Oil manufacturers to be supplied.			
75	Breakdown Values of Oil at the time of first filling (kV/mm) considering 2.5 mm gap	60 kV for Filtered & 30 kV Unfiltered Oil		
76	Oil level indicator (showing three levels) on tank (Yes/ No)	Yes (-5,30,98)		
77	Conservator tank to the Transformer with oil level indicator	Yes		
78	Drain Valve (32 mm) provided to the transformer tank (Yes/No)	Yes(32mm)		
79	Earthing terminals with lugs is provided (Yes/No)	Yes		
80	Oil filling hole with cap (On conservator)	Yes		
81	Lifting lugs provided (Yes/No)	Yes		
82	Thermometer pocket is provided (Yes/No)	Yes		
83	Quantity of silica gel filled in breather	250gms		
84	Material of HV and LV Bushings and makes thereof	Porcelain		
85	Reference standard of Bushings	IS : 3347		
86	Rating of L.V. Bushing	1kV/250Amp		
87	Minimum Creepage Distance of HV Bushing in mm (min.25 mm per kV)	305		
88	Minimum Creepage Distance of LV Bushing in mm (min.25 mm per kV)	65		
89	Rating of H.V. Bushings (in kV)	12 kV/ 250 Amp.		
90	Rating of L.V. Bushing (in kV, kA)	1.0 kV/ 250 Amp.		
91	Min. External clearances of H.V. bushing terminals between ph.to ph (255mm)	255mm		
92	Min. External clearances of H.V. bushing terminals between ph.to earth (140mm)	140mm		
93	Min. External clearances of L.V. bushing terminals between ph.to ph (75 mm)	75mm		
94	Min. External clearances of L.V. bushing terminals between ph.to earth (40 mm)	40mm		
95	Rating of Lightening Arrestors and Make thereof	9kv rms/5kA (8/20 micro wave shape)		
96	Reference Standard of Lightening	IS: 3070/1974		

	Arrestors.			
97	Maximum winding temperature rise in °C over an Ambient temp. of 50°C by Resistance Method	40		
98	Maximum temperature rise of Oil in °C over an Ambient temp. of 50°C by thermometer.	35		
99	Magnetizing current (No load) in Amps and its % of full load current at rated voltage referred to L.V. side.	0.99 Amps 3% of full load current		
100	Magnetizing current (No load) in Amps and its % of full load current at maximum voltage (112.5% of rated voltage) referred to L.V. side.	1.98 Amps 6% of full load current		
101	Max. core (No load) losses at rated voltage and rated frequency (Watts) .	80		
102	Max. Total losses (No Load + Load Losses at 75 °C) at 50% loading in Watts	190		
103	Max. Total losses (No Load + Load Losses at 75 °C) at 100% loading in Watts	635		
104	Efficiency at 75°C at unity P.F. at 125% load	97.06		
105	Efficiency at 75°C at unity P.F. at 100% load	97.52		
106	Efficiency at 75°C at unity P.F. at 75 % load	97.94		
107	Efficiency at 75°C at unity P.F. at 50% load	98.5		
108	Efficiency at 75°C at unity P.F. at 25% load	98.15		
109	Efficiency at 75 °C at 0.8 P.F. lag at 125% load	36.36		
110	Efficiency at 75 °C at 0.8 P.F. lag at 100 % load	96.92		
111	Efficiency at 75 °C at 0.8 P.F. lag at 75 % load	97.44		
112	Efficiency at 75 °C at 0.8 P.F. lag at 50 % load	98.14		
113	Efficiency at 75 °C at 0.8 P.F. lag at 25% load	97.7		
114	Efficiency at 75 °C at 0.8 P.F. leading at 125% load	96.36		
115	Efficiency at 75 °C at 0.8 P.F. leading at 100% load	96.92		

116	Efficiency at 75 °C at 0.8 P.F. leading at 75% load	97.44		
117	Efficiency at 75 °C at 0.8 P.F. leading at 50%load	98.14		
118	Efficiency at 75°C at 0.8 P.F. leading at 25 % load	97.7		
119	Regulation at Unity P.F (in %)	0.6517		
120	Regulation at 0.8 P.F. lag. (in %)	3.1737		
121	Regulation at 0.8 P.F. leading. (in %)	3.173		
122	% Impedance value at 75°C	4.5± 10%		
123	Separate source powerfrequency withstand test for HV for 1 minute in kv(min)	28kV rms		
124	Separate source powerfrequency withstand test for LV for 1 minute in kv(min)	3kV rms		
125	Induced over voltage withstand test for 1 min. specify voltage frequency, time for test.	866Volt,100Hz.for one minute		
126	Impulse test value (in kVp) .	75kVp,1.2/50 micro second		
127	The test certificates of Aluminium/copper conductor, core , insulating paper, porcelainbushings, steel plate used for enclosure of offer transformer is enclosed along with the offer in soft copy.(Yes/ No)	Yes		
128	All type test report of type tests carried out on transformer at NABL laboratory shall be submitted along with the offer as per cl. XXII (c) of Section (I) i.e. Instructions to tenderers.(Yes/ No)	Yes		
129	Air pressure test and temperature rise test shall be conducted as per format enclosed with thetechnical specification along with the offer (Yes/ No)	Yes		
130	All drawings shall be furnished for each offered item separately along with this offer (Yes/No)	Yes		
131	Oil absorption calculation sheet shall be furnished for each offered item separately along with this offer (Yes/ No)	Yes		

132	Heat dissipation calculation shall be furnished for each offered item separately along with this offer (Yes/ No)	Yes		
133	Flux density calculation sheet with no. of Primary & Secondary turns shall be furnished for each offered item separately along with this offer (Yes/ No)	Yes		
134	Calculation sheet for 112.5% of Rated V/f ratio (over fluxing calculation sheet) shall be furnished for each offered item separately along with this offer (Yes/ No)	Yes		
135	Required documents, plant and machinery, list of order executed/under execution shall be furnished for each offered item separately along with this offer (Yes/ No)	Yes		
136	The information required under Quality Assurance shall be submitted with the offer in physical format & soft copy(Yes/ No)	Yes		
137	The cost data in the prescribed format shall be submitted with offer in physical fo mat & soft copy (Yes/ No)	Yes		
138	The performance Guarantee of the transformers in years	24 months from date of receipt ofmaterial		
139	Power frequency withstand voltage dry & wet in kV(rms)for H.V Bushing	28kV rms for one minute		
140	Dry lightning Impulse withstand voltage test in kV (peak) Stating the wave form adopted for H.V. bushing	75kVp,1.2/50 micro second		
141	No.of radiators providers and location with arrangement	As required		
142	Thickness of the radiator of transformer in mm	1.25mm		
143	No of radiator fins	As required		

Annexure IV- Technical specification for QR Code generation

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

2. SERVICE CONDITIONS:

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

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

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

3. GENERAL TECHNICAL REQUIREMENT:

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

4. TECHNICAL DETAILS :

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

5. TECHNICAL DATA :

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

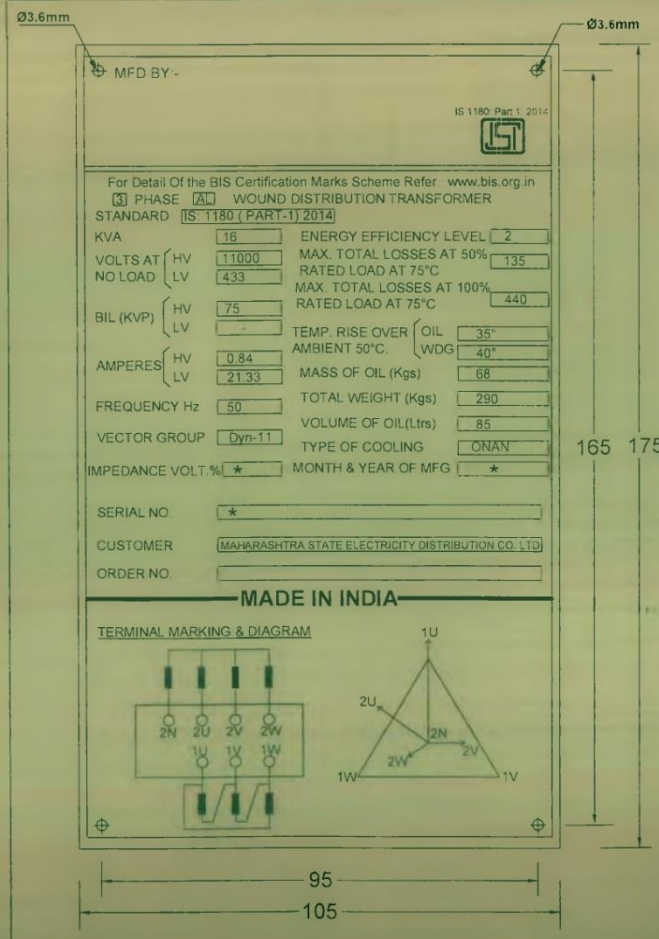
1) Name of Manufacture :
2) Rating :
3) Sr. No. :
4) Date of Manufacturing :
5) A/T No. :

6. LOCATION OF QR CODE :

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

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

QRcode for details.



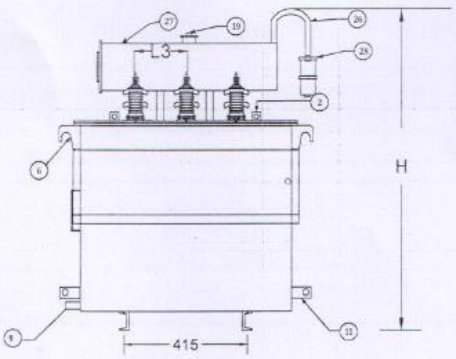
NOTE:-

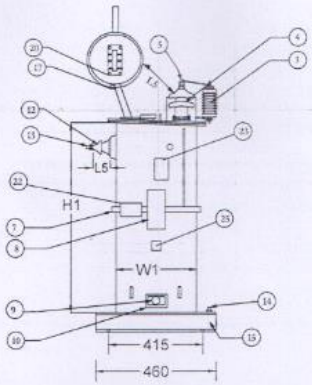
1) (*) MARKED VALUE WILL BE PUNCHED AT THE TIME OF DISPATCH.
2) MATERIAL ALUMINIUM ANODIZED.
3) THICKNESS -18 SWG.MIN.
4) ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.

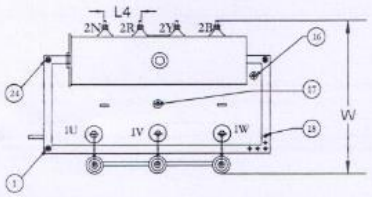
QUANTITY: NOS

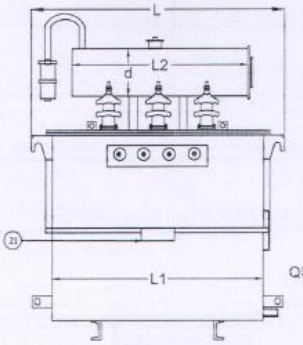
SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD
DRN BY		RATING & DIAGRAM DRAWING.
CHD BY		16 KVA, 11/0.433KV,3P=ASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER ENERGY EFFICIENCY LEVEL- 2 AS PER IS 1180 (PART-1) 2014
SCALE		DRAWING NO.- MSEDCL/HVDS/16/11 3φ/EEL2/01.









SR. NO.	ACCESSORIES.	QTY	DETAIL
1.	SEALING BOLT	2.	M.S.
2.	LIFTING LUGS (FOR TOP COVER) 8MM	2.	M.S.
3.	LIGHTNING ARRESTORS	3.	9KV / 5KA
4.	HV BUSHING 12 KV, 250 AMP.	3.	PORCELAIN
5.	HV TERMINAL WITH STUDS - M12	3.	BRASS
6.	LIFTING LUGS 8 MM FOR TANK	2.	M.S.
7.	REINFORCING ANGLE (25X25X5 MM)	1.	M.S.
8.	RATING & DIAGRAM PLATE- RIVETED/SCREWED	1.	ANODIZED AL
9.	DRAIN VALVE (32 MM)	1.	T- VALVE
10.	DRAIN VALVE METALLIC COVER SPOT WELDED	1.	M.S.
11.	PULLING LUGS 8 MM	4.	M.S.
12.	LV BUSHINGS 1KV/250 AMP.	4.	PORCELAIN
13.	LV TERMINAL STUDS - M12	4.	BRASS
14.	EARTHING TERMINAL 10 MM	2.	M.S.
15.	BASE CHANNEL- 75MMx40MM WITH HOLES	2.	M.S.
16.	THERMOMETER POCKET WITH CAP	1.	M.S.
17.	AIR RELEASE PLUG- 1/2 " DIA.	1.	M.S.
18.	TOP COVER FIXING BOLTS- 1/2 " DIA. WITH PLAIN WASHER	--	GI
19.	OIL FILLING HOLE WITH CAP./GAUGE FOR TEST	1.	M.S.
20.	OIL LEVEL INDICATOR (-5, 30, 98)	1.	M.S.
21.	CLAMP SUPPORT FOR LT CABLE CLAMP	1.	M.S.
22.	2 YEARS GARRANTY PLATE	1.	M.S.
23.	BEE LABLE	1.	STRIKER
24.	ANTI THEFT STAILNESS STEEL FASTNERS WITH BREAK AWAY AT TOP COVER	4	S.S
25.	QR CODE LABLE	1.	STRIKER
26.	BEATHER PIPE	1.	M.S.
27.	CONSERVATOR TANK (SIZE D-175 X L-500 MM)	1.	M.S.
28.	SILICA GEL BREATHER 250GRMS	1.	POLYPROPLENE

RADIATING SURFACE AREA		
	TANK	1.378 Sq. m/s
	TOTAL	5.378 Sq. m/s

WEIGHT IN KGS		
1.	CORE	69
2.	WINDINGS	88
3.	CORE & ASSEMBLY WEIGHT	194
4.	TANK & FITTINGS	98
5.	OIL in Kgs	85
6.	TOTAL WEIGHT	380

DIMENSIONS ARE IN mm			
	OVERALL	TANK	
L	915	L1	715
W	585	W1	385
H	1070	H1	930(Avg)

MIN. BUSHING CLEARENCE IN AIR		THICKNESS ARE IN mm	
L3 (H.V.)	255 PHASE TO PHASE	TANK SIDE PLATES MIN	3.15
L4 (L.V.)	75 PHASE TO PHASE	TOP AND BOTTOM PLATES MIN.	5
L5 (H.V.)	140 PHASE TO EARTH		
L6 (H.V)	40 PHASE TO EARTH		

DIMENSION OF CONSERVATOR	
INSIDE DIAMETER(D)	175mm
LENGTH (L2)	500 mm
CAPACITY (TOTAL)	12 LTR

QUANTITY: NOS

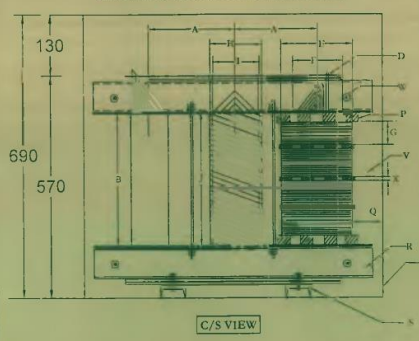
SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

NOTE:

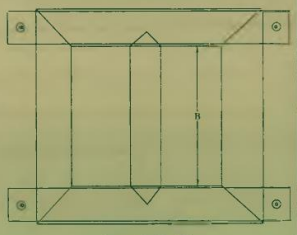
1. WIDTH OF TOP COVER BEND PLATE - MIN. 25 mm.
2. COLOR OF TRANSFORMER:- AIRCRAFT BLUE SHED NO.108 OF IS: 5

16 kVA 11/0.433 kV Three Phase Aluminium wound CRGO Core Dist. Transformer

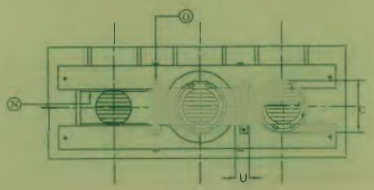
WINDING & CONSTRUCTIONAL DETAILS



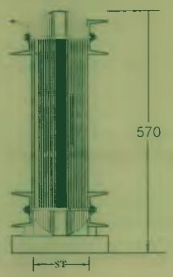
C/S VIEW



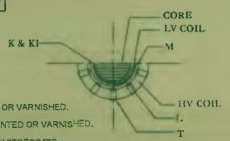
FRONT VIEW



TOP VIEW



SIDE VIEW



DESCRIPTION		UNIT	AS PER OFFER TECH. SPECIFICATONS
CORE			II
			16 KVA
A	LEG CENTRE	mm	225
B	WINDOW HEIGHT	mm	380
C	CORE CIRCLE	mm	75
D	NO OF STEPS	No.	6
	EFFECTIVE CORE AREA	cm^2	39.129

HV COIL.			
	NO. OF HV COIL PER PHASE		4
I	OUTER DIAMETER	mm	215
T	INNER DIAMETER	mm	135
G	AXIAL LENGTH	mm	78
	CONDUCTOR CROSS SECTION/SIZE	mm^2	0.594 (DIA-0.87)
	CONDUCTOR INSULATION		DPC
	CONDUCTOR MATERIAL		AL
	RESISTANCE AT 20°C PER PHASE	OHMS	215

LV COIL.			
H	OUTER DIAMETER	mm	113
t	INNER DIAMETER	mm	82.5
J	AXIAL LENGTH	mm	361
	CONDUCTOR CROSS SECTION/SIZE	mm^2	22.57(6.8X3.4XIP)
	CONDUCTOR INSULATION		DPC
	CONDUCTOR MATERIAL		AL
	RESISTANCE AT 20 C PER PHASE	OHMS	0.074

INSULATION			
K	WRAP ON CORE	NOS.	COTTON TAPE
KI	CLEARENCE TO LV COIL	mm	3.5
L	WEDGES BETWEEN HV & LV COILS	mm	8
M	CLEARANCE BETWEEN HV & LV	mm	11
MI	CLEARANCE BETWEEN HV PHASE TO PHASE	mm	10
N	FRAME CHANNEL INSULATION	mm	2
O	PHASE BARRIER	mm	2 X 1
P	END INSULATION	mm	25
Q	CLEARANCE TO TANK WALL	mm	30
R	CORE FIXING CHANNEL SIZE	mm	75 X 40 X 5 MM
S	BASE CHANNEL SIZE	mm	75 X 40 X 5 MM
T	NO. OF SPACER BETWEEN HV AXIAL COIL		6 PER CIRCLE
U	INTER PHASE CLEARANCE		10
V	TIE ROD SIZE	mm	12mm X 4NOS.
W	CORE BOLT SIZE	mm	12mm X 4NOS.
X	INTER COIL INSULATION	mm	6

NOTE:

1. CORE CLAMPS ARE PAINTED WITH OIL RESISTANCE PAINT OR VARNISHED.
2. ALL TOP & BOTTOM YOKE BOLTS, NUTS, TIE RODS ARE PAINTED OR VARNISHED.
3. MAKE OF INSULATION CRAFT PAPER:- MUNKSJO/ RAMAN/ AMITOFOS/ITC.
4. MAKE OF PRESS BOARD :- RAMAN / SENAPATHY / UMANG RAJ TECHNO / KUBERA INNOVATIVE.
5. NO NEGETIVE TOLERANCE ON MINIMUM SPECIFIED PARAMETER.
6. ALL HV INTER COIL CONNECTION SHALL BE DONE BY SOLDERING / BRAZING & CRIMPING.
7. HV DELTA CONNECTION SHALL BE DONE BY SOLDERING / BRAZING.
8. DELTA LEAD FROM DELTA JOINT TO BUSHING STEM BY BRAZING
9. LV STAR POINT BY BRAZING & CRIMPING .
10. LV WINDING TO LV BUSHING STEM BY "L" SHAPPED AL FLAT BRAZING
11. "L" SHAPED AL FLAT CLAMPED TO LV BUSHING METAL PART USING NUT. LOCK NUT WASHERS.
12. L&T ALKAPEE AL BRAZING ROD WITH FLUX USED FOR BRAZING.

QUANTITY: NOS

SIGNATURE OF AUTHORISED PERSON & STAMP OF THE FIRM	

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD
DRN BY		CORE & COIL ASSEMBLY DRAWING.
CHD BY		16 KVA, 11/0.433KV, 3PHASE, ALU WOUND CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- MSEDCL/HVDS/16/11.3ϕ/EEL2/03

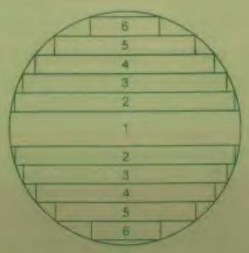
SR. NO.	DESCRIPTION	TECHNICAL DETAILS AS PER OFFER
1.	PRIMARY VOLTAGE (KV)	11 KV
2.	SECONDARY VOLTAGE (KV)	0.433 KV
3.	RATING (KVA)	16 KVA
4	VECTOR GROUP	Dny. 11
5	CONFORMING TO I.S.S.	IS: 1180 & PART-1 2014
6	PERMISSIBLE VOLTAGE FLUCTUATION %	12.5%
7	TEMPERATURE RISE OF OIL OVER AMBIENT 50°C	35
8	TEMPERATURE RISE OF WINDING OVER AMBIENT 50°C	40
9	THICKNESS OF CORE LAMINATION	0.27 mm
	a) CORE MATERIAL	CRGO ANNEALED STEEL
	b) PRINCIPLE SOURCE OF CORE MATERIAL	IMPORTED
	c) GRADE OF LAMINATION	M4
	d) FLUX DENSITY W/m^2	1.69 Max.
	e) NO. OF STEPS OF CORE (NOS.)	6
10.	% IMPEDANCE	4.5% ±10%
11.	CORE DIMENSIONS (Lc X Wh X Cd)	225 X 380 X 75.5

STEP NO.	1	2	3	4	5.	6
L mm.	70	65	60	50	40	30
W mm.	28.1	10	7.3	10.5	7.3	5.4
CROSS SECTION Cm^2	19.67	6.50	4.38	5.25	2.92	1.62

TOTAL CROSS SECTION AREA Cm^2 = 40.34

EFFECTIVE CORE AREA = 40.34X 0.97

= 39.129 Cm^2



SR. NO.	DESCRIPTION	AS PER OFFERED H.V.	AS PER OFFERED L.V.
1.	WINDING		
	a) MATERIAL	ALU	ALU
	b) SPECIFIC CONDUCTIVITY	—	—
	c) CONDUCTOR SIZE IN mm	0.87	6.8X3.4X1
	d) CONDUCTOR CROSS SECTION mm^2	0.590	22.26
	e) INSULATION MATERIAL	DPC	DPC
	f) CURRENT DENSITY A/mm^2 Max	1.3	1.3
	g) NO. OF TURNS	8272	188
	h) OUTER DIAMETER mm	210	113
	i) INSIDE DIAMETER mm	135	82.5
	j) AXIAL LENGHT mm	78 PER COIL	361 PER COIL
	k) NO. OF COIL PER PHASE NO.	4	1
	l) RESISTANCE PER PHASE Ohms at 75°C	215	0.074

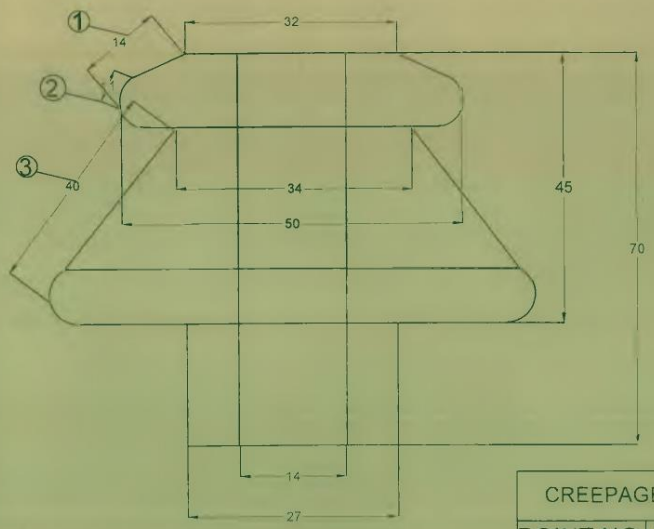
		AS PER OFFERED	
2	BUSHING		
	MINIMUM CREEPAGE DISTANCE IN MM	HV	LV
		305 mm	65 mm
3	LOSSES		
	NO LOAD LOSS	60 WATTS	
	TOTAL LOSSES AT 75°C AT 50% LOAD (Watts)	135 (MAX)	
	TOTAL LOSSES AT 75°C AT 100% LOAD (Watts)	440 (MAX)	
4	TANK		
	SIDE WALL THICKNESS mm.(MIN)	3.15	
	TOP & BOTTOM PLATE THICKNESS mm.(MIN)	5	
5	OIL USED		
	NAME OF MANUFACTURER	SAVITA/COLUMBIA/RAJ/APAR/ GP PETROLIUM	
	GRADE	MINERAL OIL CONFORMING TO IS.335 AMENDED UPTO DATED	
6	VOLUME (LITRE'S)	—	
	IN TANK	85	
	TOTAL	85	

QUANTITY: NOS

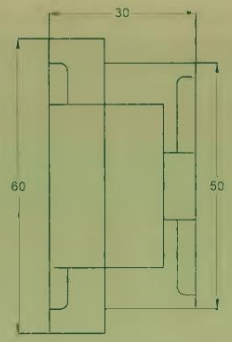
SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

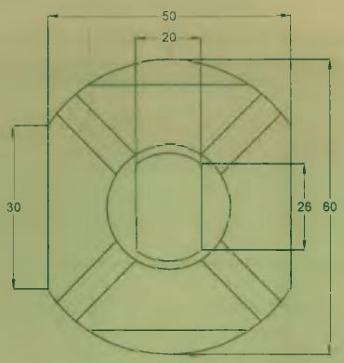
CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD
DRN BY		TECHNICAL SPECIFICATION DRAWING
CHD BY		16 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- MHEDCL/HVDS/16/11 3φ/EEL2/04

CREEPAGE DISTANCE DRAWING OF LV BUSHING 1.0KV/250 Amps.



UPPER INSULATOR





LOWER INSULATOR

CREEPAGE DISTANCE	
POINT NO.	DIMENSIONS
1	14
2	11
3	40
TOTAL	65 mm

QUANTITY: NOS

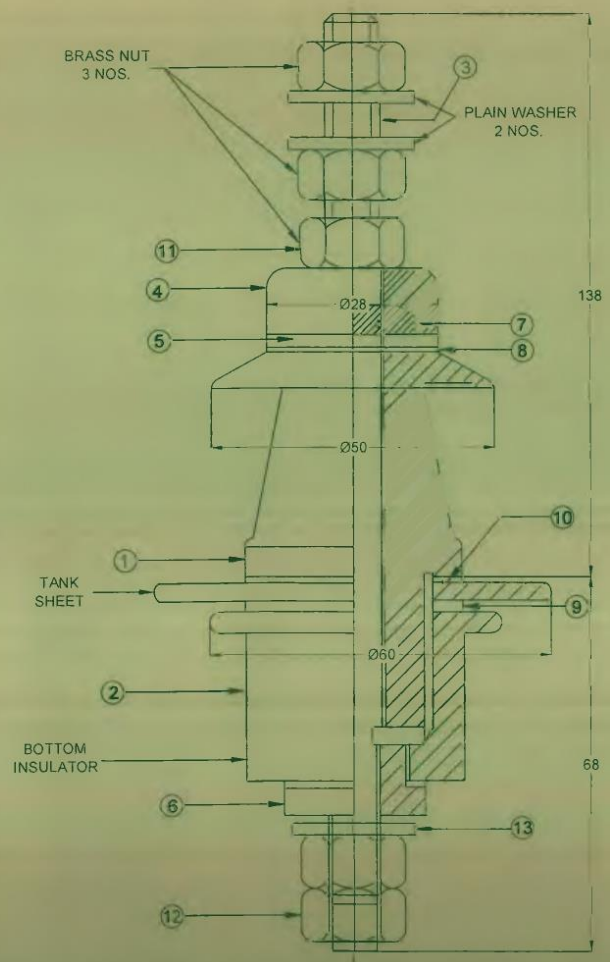
SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

NOTE:

1. COLOR- BROWN GLAZED
2. CREEPAGE DISTANCE -25mm/KV(Min.)
3. AS PER IS:3347 (PART-I/SECI)
4. ALL DIMENSIONS IN mm.
5. RATED VOLTAGE- 1.0 KV
6. RATED CURRENT- 250 AMP.
7. WEIGHT OF BUSHING ASSEMBLY- 0.7Kg. (APPROX.)
8. PERFORMANCE REQUIRMENTS OF THE BUSHING SHALL CONFORM TO IS: 2099-1996
9. TOTAL CREEAPGE DISTANCE- 65mm.
10. ALL DIMENSIONS ARE IN mm.

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.LTD
DRN BY		CREEPAGE DISTANCE DRAWING OF LV BUSHING 1.0KV/250 Amps
CHD BY		16 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST. TRANSFORMER (ENERGY EFFICIENCY LEVEL -2 AS PER IS:1180 (PART-1):2014
SCALE		DRAWING NO - MSEDCL/HVDS/16/11 3φ/EEL2/08

TRANSFORMER LV BUSHING ASSEMBLY DRAWING AS PER IS: 3347



ELECTRICAL CHARECTERISTICS:

1. RATED VOLTAGE 1KV
2. RATED CURRENT: 250 Amp
3. POWER FREQUENCY WITHSTAND VOLTAGE: 3KV
4. CREEPAGE DISTANCE: 65 mm.

NOTE:

PERFORMANCE REQUIREMENTS OF THE BUSHING SHALL CONFIRM TO IS: 7421- 1988

MAKE: JAIPUR/TAYAL/BIKANER/TEK MEK/RR/SHINE/JS GROUP/RR.

SR.NO.	DESCRIPTION	MATERIAL	QUANTITY
1.	UPPER INSULATOR	PORCELAIN	1
2	LOWER INSULATOR	PORCELAIN	1
3	STEM- (M12x1.75) (E. TINNING)	BRASS	1
4	TOP END WASHER (E. TINNING)	BRASS	1
5	STEM WASHER (E. TINNING)	BRASS	1
6	BOTTOM NUT (E. TINNING)	BRASS	1
7	SEALING WASHER (STEM)	SYNTHETIC RUBBER	1
8	SEALING GASKET WASHER	NRBC	1
9	SEALING GASKET WASHER	NRBC	1
10.	SEALING GASKET WASHER	NRBC	1
11	HEXAGONAL NUT M-12	BRASS	3
12.	HEXAGONAL LOCKING NUT M-12	BRASS	2
13.	PLAIN WASHER (TYPE- N)	BRASS	3

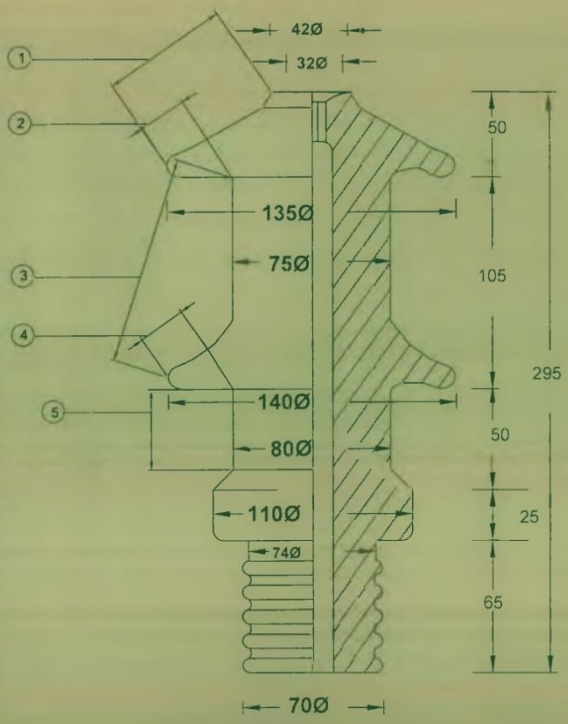
QUANTITY: NOS

SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

CUSTOMER		MAHARASHTRA STATE ELECTRICITYDISTRIBUTION CO.LTD
DRN BY		LV BUSHING ASSEMBLY DRAWING
CHD BY		16 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL - 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- MSEDCL/HVDS/16/11 3φ/EEL2/07

NOTE:

1. DIMENSIONS ARE CONFORMING TO IS: 3347 (PART-III/SEC.1)- 1988.
2. COLOUR: DARKEN BROWN
3. CREEAPGE DISTANCE: 305mm. (MIN.)



ALL DIMENSIONS ARE IN mm.

RATED RATING	12 KV/250A
STANDARD APPLICABLES IS	IS- 3347 (PART-III)/2009
ONE MINUTE DRY P.F.VOLTAGE WITHSTAND	28 KV (RMS)
ONE MINUTE WET P.F.VOLTAGE WITHSTAND	28 KV (RMS)
1.2/50 MICRO. SEC. IMPULSE VOLTAGE WITHSTAND	75 KVP
WEIGHT OF ASSEMBLED BUSHING	3.54 Kg
TOTAL CREEPAGE DISTANCE (AIR) 25mm/kv	305 mm.

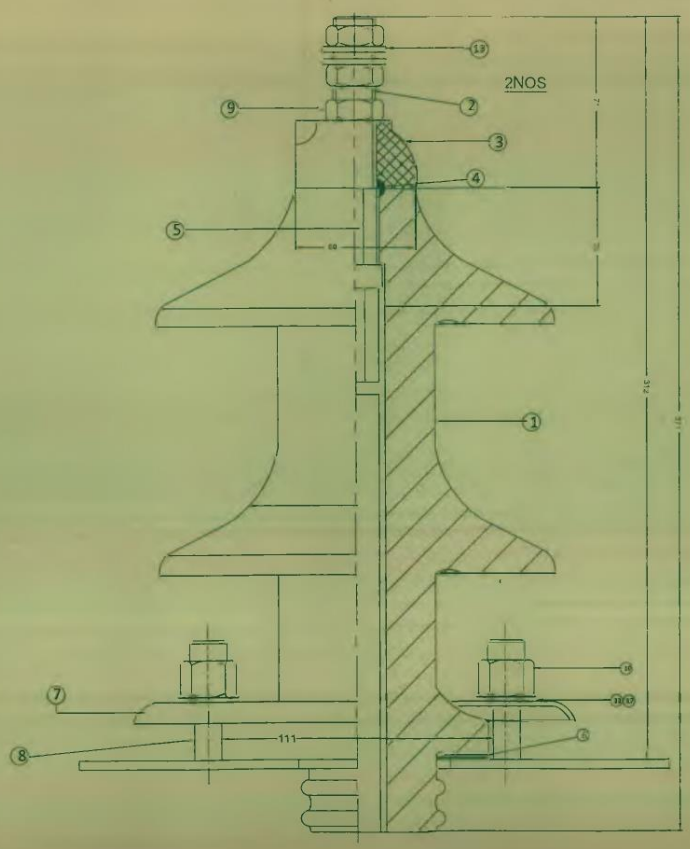
CREEPAGE DISTANCE	
POINT NO.	DIMENSIONS
1	79
2	30
3	80
4	43
5	30
6	43
TOTAL	305 mm

SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

QUANTITY: NOS

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.LTD
DRN BY		**CREEPAGE DISTANCE DRAWING OF HV BUSHING 12KV/250 Amps**
CHD BY		16 KVA, 11/0.433KV, 3PHASE, ALU WOUND CRGO CORE, DIST TRANSFORMER
SCALE		(ENERGY EFFICIENCY LEVEL- 2 AS PER IS:1180 (PART-1):2014
		DRAWING NO:- MSEDCL/HVDS/16/11 3ϕ/EEL2/06.

TRANSFORMER HV BUSHING ASSEMBLY DRAWING AS PER IS:3347



ALL DIMENSIONS ARE IN mm.

QUANTITY: NOS

ELECTRICAL CHARECTERISTICS:

1. RATED VOLTAGE: 12KV
2. RATED CURRENT: 250 Amp
3. POWER FREQUENCY WITHSTAND VOLTAGE: 28KV
4. IMPULSE WITHSTAND VOLTAGE 75 KVP
5. CREEPAGE DISTANCE: 305 mm.

NOTE:
PERFORMANCE REQUIREMENTS OF THE BUSHING SHALL CONFIRM TO IS: 2099-1986
NRBC= NITRILE RUBBER BONDED CORK.

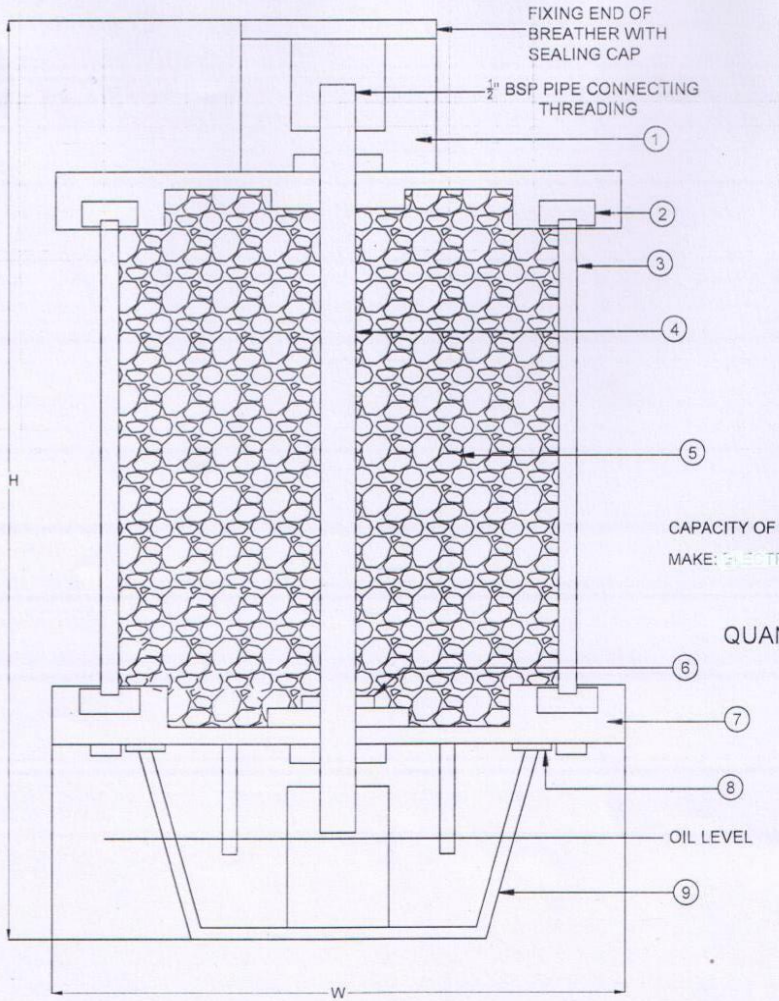
MAKE: JAIPUR/ SAMPAT/ UDYOG CENTRE/TAYAL/CJI/BIKANER/ SAMRAKSHANA/RR/TEK MEK/SHINE/JS GROUP/ RR.

SR.NO.	DESCRIPTION	QUANTITY
1	INSULATOR 12KV, 250 AMP.	1
2	STEM- M12x1.75 (E.TINNING)	1
3	END CAP (E.TINNING)	1
4	SEALING WASHER (STEM)	1
5	SEPARATOR	1
6	SEALING WASHER FOR GEN. PURPOSE	1
7	CLAMPING RING	1
8	CLAMPING MEMBER	4
9	HEX. NUT FOR STEM-M12x1.75(E.TINNING)	3
10.	HEX. NUT- M10 (HDG)	4
11.	PLAIN WASHER- M10 (HDG)	4
12.	SPRING WASHER- M10 (HDG)	4
13.	PLAIN WASHER- M12 (E.TINNING)	2

SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD
DRN BY		HV BUSHING ASSEMBLY DRAWING
CHD BY		16 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO.- MHEDCL/HVDS/16/11 3φ/EEL 2/05

250 GM. SILICA GEL BREATHER (POLYPROPYLENE BODY)



SR.NO.	DESCRIPTION	MATERIAL	QUANTITY
1.	TOP COVER	ALUMINIUM	1.
2.	U- GASKET	NITRILE RUBBER	1.
3.	TRANSPARENT TUBE	SAN	1.
4.	STUD	M.S.	1.
5.	SILICA JEL (BLUE)	SILICA JEL	250 GMS
6.	LOCK NUT	M.S.	1.
7.	BOTTOM COVER	ALUMINIUM	1.
8.	PLAIN GASKET	NITRILE RUBBER	1.
9.	OIL CUP		1.

REMARKS:

FOLLOWING INSTRUCTIONS TO BE FOLLOWED BEFORE FIXING BREATHER

1. REMOVE THE SEALING CAP PROVIDED AT THE FIXING END OF BREATHER AND ALSO PVC PROVIDED AT THE END OF BREATHER FIXING PIPE ON CONSERVATOR.

2. FILL THE OIL IN THE TANK CAP TO THE LEVEL IS SHOWN IN THE DRAWING.

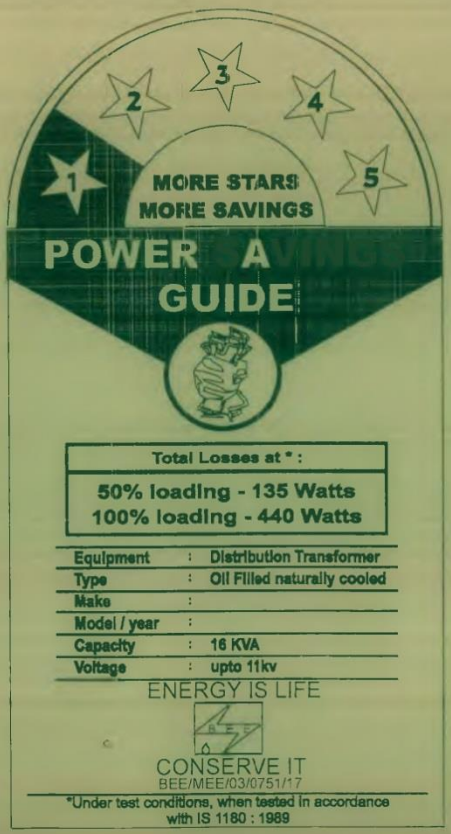
CAPACITY OF SILICA GEL: 250 gm.

MAKE: ELECTRICAL ENGINEER/VASHIVANTRAO AT FORGING/ RENU TRANSCO

QUANTITY: NOS

SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.LTD
DRN BY		SILICA GEL BREATHER 250GMS
CHD BY		25 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- 25/11 3ϕ/EEL2/09.



NOTE:

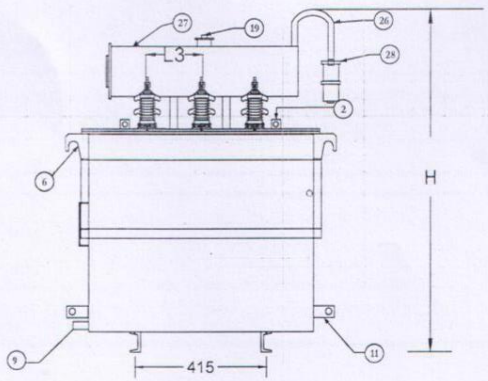
1) THE UNIQUE LABEL SERIES CODE PROVIDED IN THE LATTER HAS TO BE MENTIONED IN THE LABEL AFFIXED ON THE DISTRIBUTION TRANSFORMER

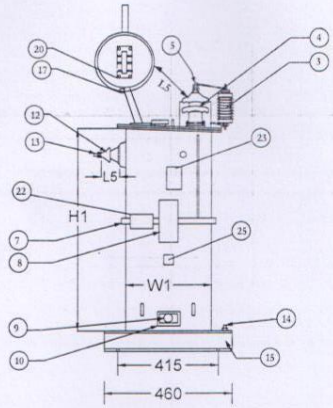
2) THE LABEL DESIGN SIZE, COLOR SCHEME , MATERIAL TO BE USED FOR THE LABEL CONTENT OF THE LABEL AND COLOR SCHEME OF THE BUREUS LOGO SHALL BE AS SCHEDULED TO THE BUREAU OF ENERGY EFFICIENCY (PARTICULARS AND MANNER OF THEIR DISPLAY ON LABEL OF DISTRIBUTION TRANSFORMER) REGULATION 2009

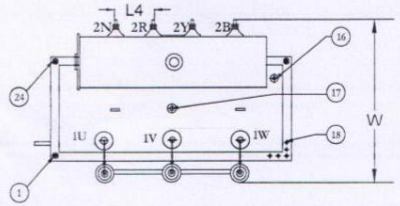
QUANTITY: NOS

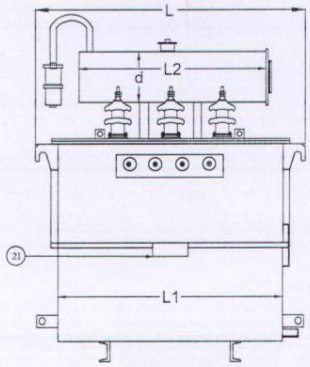
SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.LTD
DRN BY		BEE 1 STAR LABEL DRAWING
CHD BY		16 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL - 2, AS PER IS:1180 (PART-1):2014
SCALE		DRAWING NO:- MSEDCL/HVDS/16/11 3φ/EEL2/09









SR. NO.	ACCESSORIES.	QTY	DETAIL
1.	SEALING BOLT	2.	M.S.
2.	LIFTING LUGS (FOR TOP COVER) 8MM	2.	M.S.
3.	LIGHTNING ARRESTORS	3.	9KV / 5KA
4.	HV BUSHING 12 KV, 250 AMP.	3.	PORCELAIN
5.	HV TERMINAL WITH STUDS - M12	3.	BRASS
6.	LIFTING LUGS 8 MM FOR TANK	2.	M.S.
7.	REINFORCING ANGLE (25X25X5 MM)	1.	M.S.
8.	RATING & DIAGRAM PLATE- RIVETED/SCREWED	1.	ANODIZED AL
9.	DRAIN VALVE (32 MM)	1.	T- VALVE
10.	DRAIN VALVE METALLIC COVER SPOT WELDED	1.	M.S.
11.	PULLING LUGS 8 MM	4.	M.S.
12.	LV BUSHINGS 1KV/250 AMP.	4.	PORCELAIN
13.	LV TERMINAL STUDS - M12	4.	BRASS
14.	EARTHING TERMINAL 10 MM	2.	M.S.
15.	BASE CHANNEL- 75MMx40MM WITH HOLES	2.	M.S.
16.	THERMOMETER POCKET WITH CAP	1.	M.S.
17.	AIR RELEASE PLUG- 1/2 " DIA.	1.	M.S.
18.	TOP COVER FIXING BOLTS- 1/2 " DIA. WITH PLAIN WASHER	--	GI
19.	OIL FILLING HOLE WITH CAP /GAUGE FOR TEST	1.	M.S.
20.	OIL LEVEL INDICATOR (-5, 30, 98)	1.	M.S.
21.	CLAMP SUPPORT FOR LT CABLE CLAMP	1.	M.S.
22.	2 YEARS GARRANTY PLATE	1.	M.S.
23.	BEE LABLE	1.	STRIKER
24.	ANTI THEFT STAILNESS STEEL FASTNERS WITH BREAK AWAY AT TOP COVER	4	S.S
25.	QR CODE LABLE	1.	STRIKER
26.	BEATHER PIPE	1.	M.S.
27.	CONSERVATOR TANK (SIZE D-175 X L-500 MM)	1.	M.S.
28.	SILICA GEL BREATHER 250GRMS	1.	POLYPROPLENE

RADIATING SURFACE AREA	TANK	1.583 Sq. mtrs
	TOTAL	1.583 Sq. mtrs

WEIGHT IN KGS		
1.	CORE	84
2.	WINDINGS	53
3.	CORE & ASSEMBLY WEIGHT	168
4.	TANK & FITTINGS	95
5.	OIL in Kgs	95
6.	TOTAL WEIGHT	360

DIMENSIONS ARE IN mm			
OVERALL		TANK	
L	960	L1	750
W	665	W1	285
H	1300	H1	765(Avg)

MIN. BUSHING CLEARENCE IN AIR	
L3 (H.V.)	255 PHASE TO PHASE
L4 (L.V.)	75 PHASE TO PHASE
L5 (H.V.)	140 PHASE TO EARTH
L6 (H.V)	40 PHASE TO EARTH

THICKNESS ARE IN mm	
TANK SIDE PLATES MIN.	3.15
TOP AND BOTTOM PLATES MIN.	5

DIMENSION OF CONSERVATOR	
INSIDE DIAMETER(D).	175mm
LENGTH (L2)	500 mm
CAPACITY (TOTAL)	12 LTR

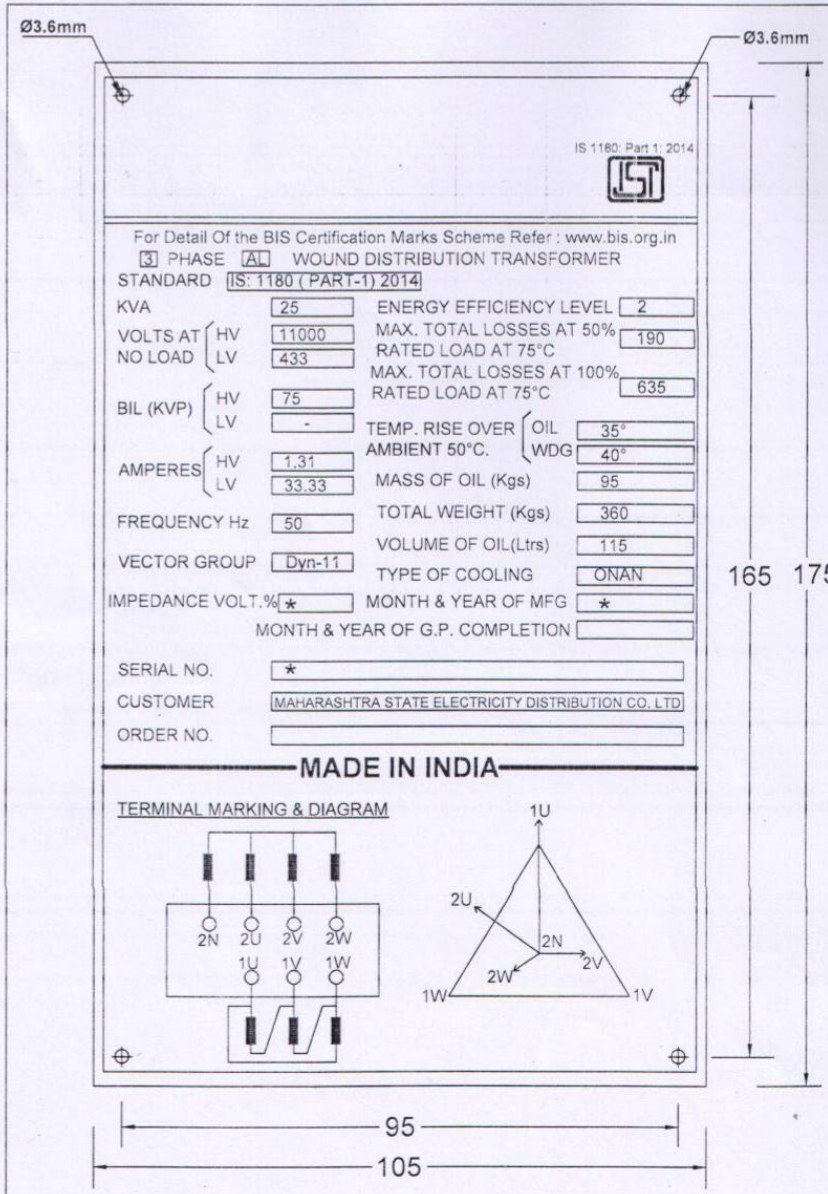
QUANTITY: NOS

SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

NOTE:

1. WIDTH OF TOP COVER BEND PLATE - MIN. 25 mm.
2. COLOR OF TRANSFORMER:- AIRCRAFT BLUE SHED NO.108 OF IS: 5
3. GASKET BETWEEN TOP COVER & TANK SHALL BE AS PER IS: 4253
4. LIGHTENING ARRESTOR (AS PER IS: 3070/1974)
   MAKE-
5. MAKE OF PRESS BOARD- RAMAN/UMANG/SENAPATHY/ ITC / RAJ TECHNO / KUBERA INNOVATIVE.
6. ALL WELDING OPERATIONS SHALL BE CARRIED OUT BY MIG PROCESS.
7. TRANSFORMER TOP COVER SHALL BE SLOPING UPTO 5° TO 10° TOWARDS HV SIDE
8. WEIGHT ARE SUBJECT TO + 5% TOLERANCE.
9. MAKE OF BREATHER- ELECTRIC ENGINEERS/ RAJSHREE/ YASHWANT/BHARAT FORGING/RENU TRANSCO.

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD
DRN BY		GENERAL ARRANGEMENT DRAWING
CHD BY		25 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- 25/11 3ϕ/EEL2/02.



NOTE:-

1) (*) MARKED VALUE WILL BE PUNCHED AT THE TIME OF DISPATCH.
2) MATERIAL ALUMINIUM ANODIZED.
3) THICKNESS -18 SWG.MIN.
4) ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.

QUANTITY: NOS

SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD
DRN BY		RATING & DIAGRAM DRAWING.
CHD BY		25 KVA, 11/0.433KV,3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL-'2', AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- 25/11 3ϕ/EEL2/01.

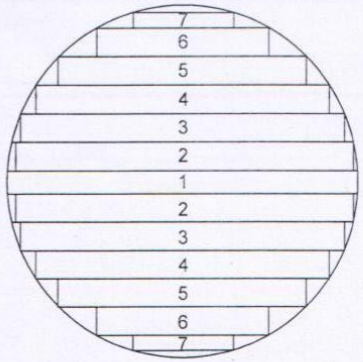
SR. NO.	DESCRIPTION	TECHNICAL DETAILS
		AS PER OFFER
1.	PRIMARY VOLTAGE (KV)	11 KV
2.	SECONDARY VOLTAGE (KV)	0.433 KV
3.	RATING (KVA)	25 KVA
4.	VECTOR GROUP	Dny. 11
5.	CONFORMING TO I.S.S.	IS: 1180 & PART-1 2014
6.	PERMISSIBLE VOLTAGE FLUCTUATION %	12.5%
7.	**TEMPERATURE RISE OF OIL OVER AMBIENT 50°C**	35
8.	**TEMPERATURE RISE OF WINDING OVER AMBIENT 50°C**	40
9.	THICKNESS OF CORE LAMINATION	0.27 mm
	a) CORE MATERIAL	CRGO ANNEALED STEEL
	b) PRINCIPLE SOURCE OF CORE MATERIAL	IMPORTED
	c) GRADE OF LAMINATION	M4
	d) FLUX DENSITY W/m^2	1.69 Max.
	e) NO. OF STEPS OF CORE (NOS.)	7
10.	% IMPEDANCE	4.5% (±10%)
11.	CORE DIMENSIONS (Lc X Wh X Cd)	235X455X81

STEP NO.	1.	2.	3.	4.	5.	6.	7.
L mm.	75	70	65	60	50	40	30
W mm.	30.2	9.7	7.6	6.5	9.7	6.5	4.3
CROSS SECTION Cm^2	22.65	6.79	4.94	3.90	4.85	2.60	1.29

TOTAL CROSS SECTION AREA Cm^2 = 47.02

EFFECTIVE CORE AREA = 47.02X 0.97

= 45.609 Cm^2



QUANTITY: [illegible] NOS

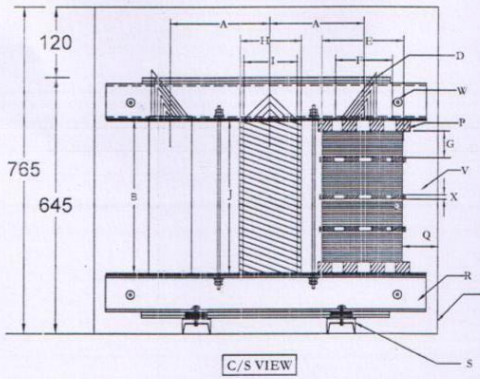
SR. NO.	DESCRIPTION	AS PER OFFERED	
		H.V.	L.V.
12.	WINDING		
	a) MATERIAL	ALU	ALU
	b) SPECIFIC CONDUCTIVITY	-	-
	c) CONDUCTOR SIZE IN mm	1.18	10X3.5X1
	d) CONDUCTOR CROSS SECTION mm^2	1.09	34.45
	e) INSULATION MATERIAL	DPC	DPC
	f) CURRENT DENSITY A/mm^2 Max	1.3	1.3
	g) NO. OF TURNS	7216	164
	h) OUTER DIAMETER mm	225	117.5
	i) INSIDE DIAMETER mm	139.5	88
	j) AXIAL LENGHT mm	97 PER COIL	438 PER COIL
	k) NO. OF COIL PER PHASE NO.	4	1
	l) RESISTANCE PER PHASE Ohms at 75°C	111	0.0435

13.	BUSHING	AS PER OFFERED	
	MINIMUM CREEPAGE DISTANCE IN MM	HV	LV
		305 mm	65 mm
14.	LOSSES		
	NO LOAD LOSS	85 WATTS	
	TOTAL LOSSES AT 75°C AT 50% LOAD (Watts)	190 (MAX)	
	TOTAL LOSSES AT 75°C AT 100% LOAD (Watts)	635 (MAX)	
15.	TANK		
	SIDE WALL THICKNESS mm.(MIN)	3.15	
	TOP & BOTTOM PLATE THICKNESS mm.(MIN)	5	
16.	OIL USED		
	NAME OF MANUFACTURER		
	GRADE	MINERAL OIL CONFORMING TO IS 335 AMENDED UPTO DATED	
	VOLUME (LITRE'S)	---	
	IN TANK	110	
	CONSERVATOR	5.5	
	TOTAL	115	

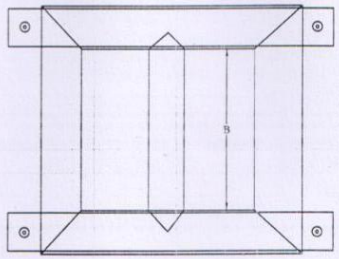
SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD
DRN BY		TECHNICAL SPECIFICATION DRAWING
CHD BY		25 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- 25/11 3ϕ/EEL2/04.

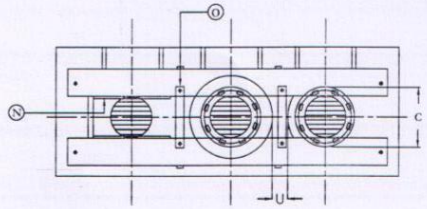
WINDING & CONSTRUCTIONAL DETAILS



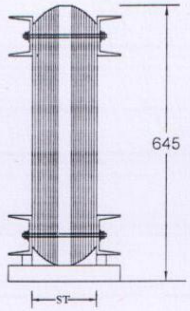
C/S VIEW



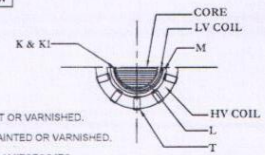
FRONT VIEW



TOP VIEW



SIDE VIEW



NOTE

1. CORE CLAMPS ARE PAINTED WITH OIL RESISTANCE PAINT OR VARNISHED.
2. ALL TOP & BOTTOM YOKE BOLTS, NUTS, TIE RODS ARE PAINTED OR VARNISHED.
3. MAKE OF INSULATION CRAFT PAPER:- MUNKSJO/ RAMAN/ AMITOFOS/ITC.
4. MAKE OF PRESS BOARD :- RAMAN / SENAPATHY/UMANG.
5. NO NEGETIVE TOLERANCE ON MINIMUM SPECIFIED PARAMETER.
6. ALL HV INTER COIL CONNECTION SHALL BE DONE BY BRAZING & CRIMPING.
7. HV DELTA CONNECTION SHALL BE DONE BY BRAZING.
8. DELTA LEAD FROM DELTA JOINT TO BUSHING STEM BY BRAZING .
9. LV STAR POINT BY BRAZING & CRIMPING .
10. LV WINIDING TO LV BUSHING STEM BY "L" SHAPPED AL FLAT BRAZING
11. "L" SHAPED AL FLAT CLAMPED TO LV BUSHING METAL PART USING NUT, LOCK NUT, WASHERS.
12. L&T ALKAPEE AL BRAZING ROD WITH FLUX USED FOR BRAZING.

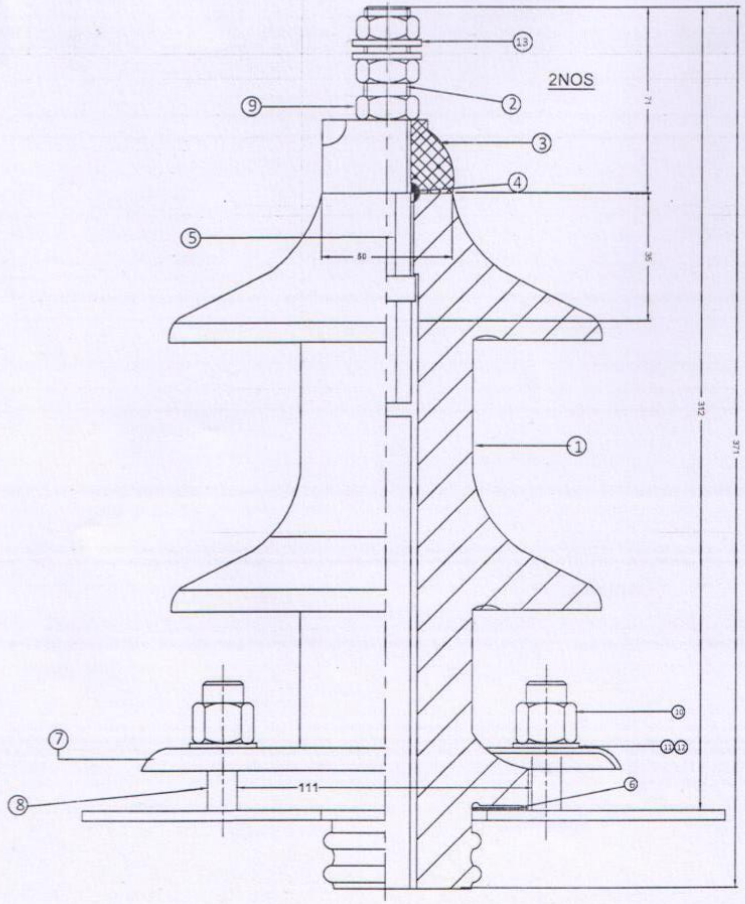
QUANTITY: NOS

DESCRIPTION		UNIT	AS PER OFFER TECH. SPECIFICATONS
CORE			11
			16 KVA
A	LEG CENTRE	mm	235
B	WINDOW HEIGHT	mm	455
C	CORE CIRCLE	mm	81
D	NO OF STEPS	No.	7
	EFFECTIVE CORE AREA	cm^2	45.609
HV COIL			
	NO. OF HV COIL PER PHASE		4
E	OUTER DIAMETER	mm	225
F	INNER DIAMETER	mm	139.5
G	AXIAL LENGTH	mm	97
	CONDUCTOR CROSS SECTION/SIZE	mm^2	1.09 (Dia 1.18)
	CONDUCTOR INSULATION		DPC
	CONDUCTOR MATERIAL		AL
	RESISTANCE AT 20°C PER PHASE	OHMS	111
LV COIL			
H	OUTER DIAMETER	mm	117.5
I	INNER DIAMETER	mm	88
J	AXIAL LENGTH	mm	438
	CONDUCTOR CROSS SECTION/SIZE	mm^2	34.45 (10 x 3.5)
	CONDUCTOR INSULATION		DPC
	CONDUCTOR MATERIAL		AL
	RESISTANCE AT 20° C PER PHASE	OHMS	0.0465
INSULATION			
K	WRAP ON CORE	NOS.	COTTON TAPE
K1	CLEARENCE TO LV COIL	mm	3.5
L	WEDGES BETWEEN HV & LV COILS	mm	8
M	CLEARANCE BETWEEN HV & LV	mm	11
N	FRAME CHANNEL INSULATION	mm	2
O	PHASE BARRIER	mm	2 X 1
P	END INSULATION	mm	25
Q	CLEARANCE TO TANK WALL	mm	30
R	CORE FIXING CHANNEL SIZE	mm	75 X 40 X 5 MM
S	BASE CHANNEL SIZE	mm	75 X 40 X 5 MM
T	NO. OF SPACER BETWEEN HV AXIAL COIL		8 PER CIRCLE
U	INTER PHASE CLEARANCE		10
V	TIE ROD SIZE	mm	12mm X 4NOS.
W	CORE BOLT SIZE	mm	12mm X 4NOS.
X	INTER COIL INSULATION	mm	9

SIGNATURE OF AUTHORISED PERSON & STAMP OF THE FIRM

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD
DRN BY		CORE & COIL ASSEMBLY DRAWING.
CHD BY		25 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- 25/11 3ϕ/EEL2/03.

TRANSFORMER HV BUSHING ASSEMBLY DRAWING AS PER IS:3347



ALL DIMENSIONS ARE IN mm.

QUANTITY: NOS

ELECTRICAL CHARECTERISTICS:

1. RATED VOLTAGE : 12KV
2. RATED CURRENT: 250 Amp
3. POWER FREQUENCY WITHSTAND VOLTAGE: 28KV
4. IMPULSE WITHSTAND VOLTAGE 75 KVP
5. CREEPAGE DISTANCE: 305 mm.

NOTE:
PERFORMANCE REQUIREMENTS OF THE BUSHING SHALL CONFIRM TO IS: 2099-1986
NRBC= NITRILE RUBBER BONDED CORK.

MAKE: [illegible] GROUP.

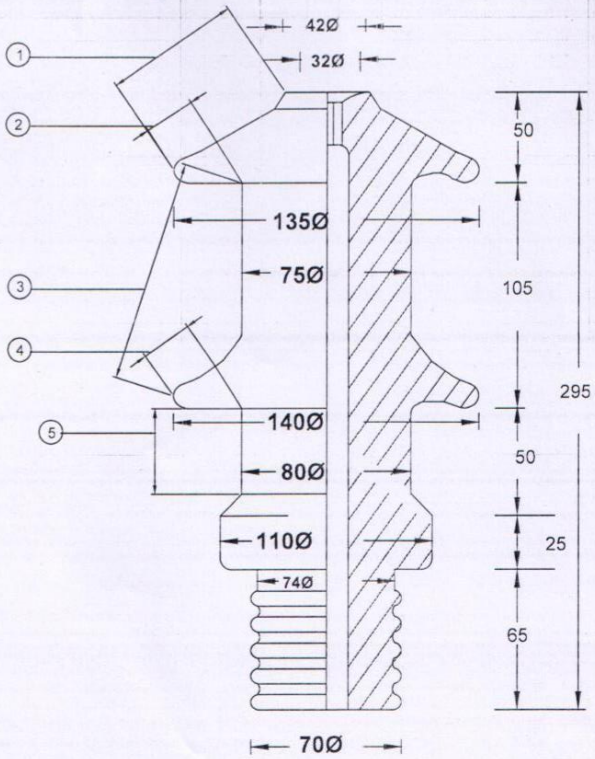
SR.NO.	DESCRIPTION	QUANTITY
1.	INSULATOR 12KV, 250 AMP.	1
2.	STEM- M12x1.75 (E.TINNING)	1
3.	END CAP (E.TINNING)	1
4.	SEALING WASHER (STEM)	1
5.	SEPARATOR	1
6.	SEALING WASHER FOR GEN. PURPOSE	1
7.	CLAMPING RING	1
8.	CLAMPING MEMBER	4
9.	HEX. NUT FOR STEM-M12x1.75(E.TINNING)	3
10.	HEX. NUT- M10 (HDG)	4
11.	PLAIN WASHER- M10 (HDG)	4
12.	SPRING WASHER- M10 (HDG)	4
13.	PLAIN WASHER- M12 (E.TINNING)	2

SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD
DRN BY		HV BUSHING ASSEMBLY DRAWING 12 KV/250A
CHD BY		25 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- 25/11 3Φ/EEL2/05.

NOTE:

1. DIMENSIONS ARE CONFORMING TO IS: 3347 (PART-III/SEC.1)- 1988.
2. COLOUR: DARKEN BROWN
3. CREEAPGE DISTANCE: 305mm. (MIN.)



ALL DIMENSIONS ARE IN mm.

RATED RATING	12 KV/250A
STANDARD APPLICABLES IS	IS- 3347 (PART-III)/2009
ONE MINUTE DRY P.F.VOLTAGE WITHSTAND	28 KV (RMS)
ONE MINUTE WET P.F.VOLTAGE WITHSTAND	28 KV (RMS)
1.2/50 MICRO. SEC. IMPULSE VOLTAGE WITHSTAND	75 KVP
WEIGHT OF ASSEMBLED BUSHING	3.54 Kg
TOTAL CREEPAGE DISTANCE (AIR) 25mm/kv	305 mm.

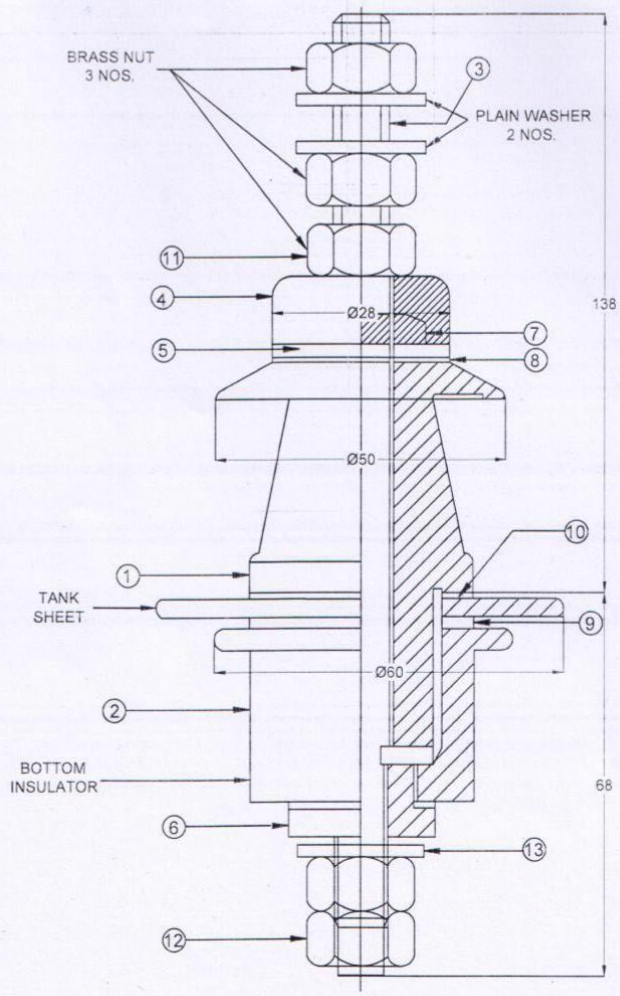
CREEPAGE DISTANCE	
POINT NO.	DIMENSIONS
1	79
2	30
3	80
4	43
5	30
6	43
TOTAL	305 mm

SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

QUANTITY: NOS

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.LTD
DRN BY		**CREEPAGE DISTANCE DRAWING OF HV BUSHING 12KV/250 Amps**
CHD BY		25 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- 25/11 3φ/EEL2/06.

TRANSFORMER LV BUSHING ASSEMBLY DRAWING AS PER IS: 3347



ELECTRICAL CHARECTERISTICS:

1. RATED VOLTAGE : 1KV
2. RATED CURRENT: 250 Amp
3. POWER FREQUENCY WITHSTAND VOLTAGE: 3KV
4. CREEPAGE DISTANCE: 65 mm.

NOTE:

PERFORMANCE REQUIREMENTS OF THE BUSHING SHALL CONFIRM TO IS: 7421- 1988

MAKE:

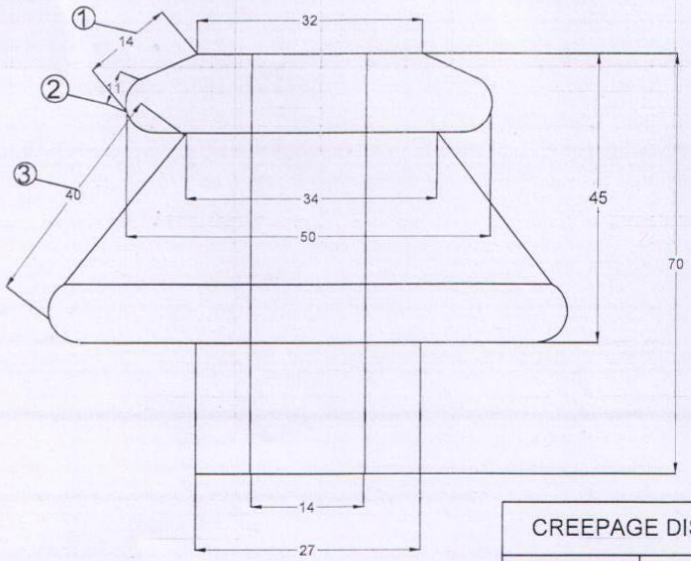
SR.NO.	DESCRIPTION	MATERIAL	QUANTITY
1.	UPPER INSULATOR	PORCELAIN	1
2.	LOWER INSULATOR	PORCELAIN	1
3.	STEM- (M12x1.75) (E. TINNING)	BRASS	1
4.	TOP END WASHER (E. TINNING)	BRASS	1
5.	STEM WASHER (E. TINNING)	BRASS	1
6.	BOTTOM NUT (E. TINNING)	BRASS	1
7.	SEALING WASHER (STEM)	SYNTHETIC RUBBER	1
8.	SEALING GASKET WASHER	NRBC	1
9.	SEALING GASKET WASHER	NRBC	1
10.	SEALING GASKET WASHER	NRBC	1
11.	HEXAGONAL NUT M-12	BRASS	3
12.	HEXAGONAL LOCKING NUT M-12	BRASS	2
13.	PLAIN WASHER (TYPE- N)	BRASS	3

QUANTITY: NOS

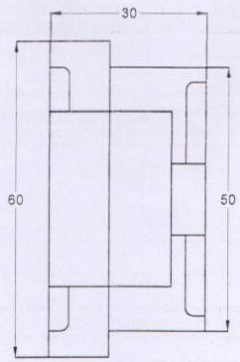
SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

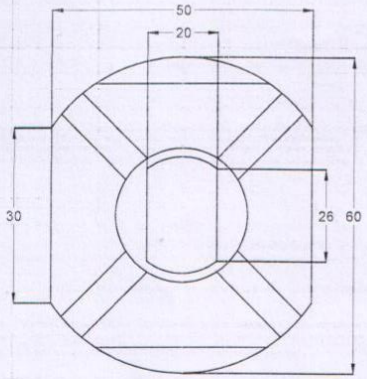
CUSTOMER		MAHARASHTRA STATE ELECTRICITYDISTRIBUTION CO.LTD	
DRN BY		LV BUSHING ASSEMBLY DRAWING	
CHD BY		25 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014	
SCALE			
		DRAWING NO:- 25/11 3ϕ/EEL2/07.	

CREEPAGE DISTANCE DRAWING OF LV BUSHING 1.0KV/250 Amps.



UPPER INSULATOR





LOWER INSULATOR

CREEPAGE DISTANCE	
POINT NO.	DIMENSIONS
1	14
2	11
3	40
TOTAL	65 mm

QUANTITY: NOS

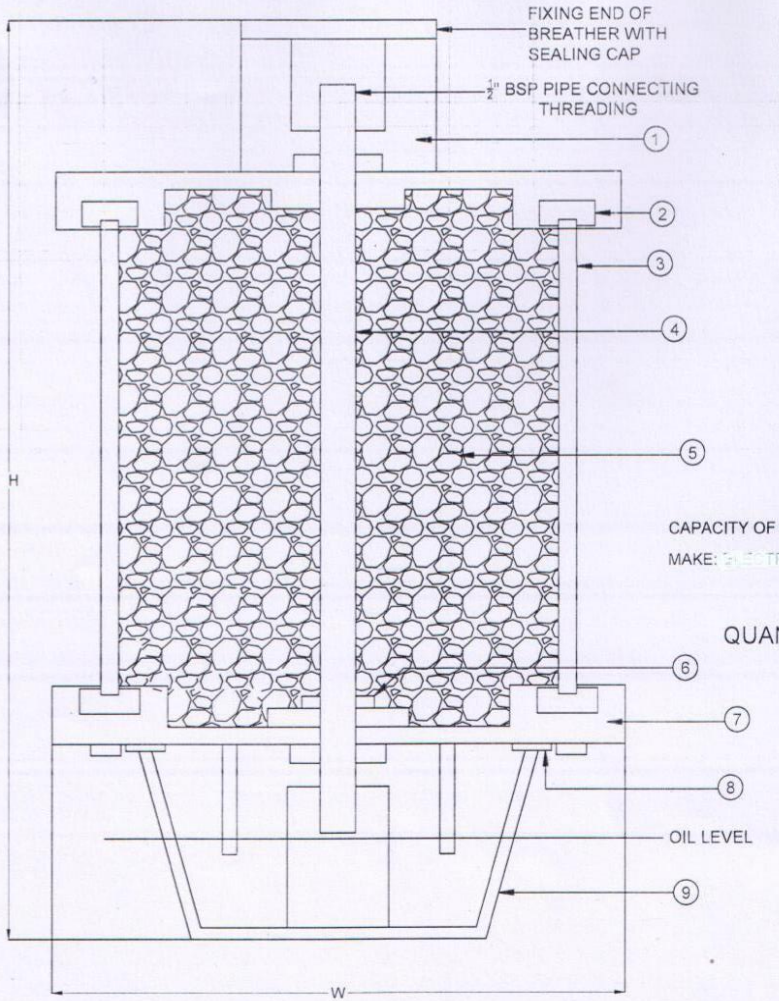
SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

NOTE:

1. COLOR- BROWN GLAZED
2. CREEPAGE DISTANCE -25mm/KV(Min.)
3. AS PER IS:3347 (PART-I/SECI)
4. ALL DIMENSIONS IN mm.
5. RATED VOLTAGE- 1.0 KV
6. RATED CURRENT- 250 AMP.
7. WEIGHT OF BUSHING ASSEMBLY- 0.7Kg. (APPROX.)
8. PERFORMANCE REQUIRMENTS OF THE BUSHING SHALL CONFORM TO IS: 2099-1996
9. TOTAL CREEAPGE DISTANCE- 65mm.
10. ALL DIMENSIONS ARE IN mm.

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.LTD
DRN BY		CREEPAGE DISTANCE DRAWING OF LV BUSHING 1.0KV/250 Amps
CHD BY		25 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL-2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- 25/11 3ϕ/EEL2/08.

250 GM. SILICA GEL BREATHER (POLYPROPYLENE BODY)



SR.NO.	DESCRIPTION	MATERIAL	QUANTITY
1.	TOP COVER	ALUMINIUM	1.
2.	U- GASKET	NITRILE RUBBER	1.
3.	TRANSPARENT TUBE	SAN	1.
4.	STUD	M.S.	1.
5.	SILICA JEL (BLUE)	SILICA JEL	250 GMS
6.	LOCK NUT	M.S.	1.
7.	BOTTOM COVER	ALUMINIUM	1.
8.	PLAIN GASKET	NITRILE RUBBER	1.
9.	OIL CUP		1.

REMARKS:

FOLLOWING INSTRUCTIONS TO BE FOLLOWED BEFORE FIXING BREATHER

1. REMOVE THE SEALING CAP PROVIDED AT THE FIXING END OF BREATHER AND ALSO PVC PROVIDED AT THE END OF BREATHER FIXING PIPE ON CONSERVATOR.

2. FILL THE OIL IN THE TANK CAP TO THE LEVEL IS SHOWN IN THE DRAWING.

CAPACITY OF SILICA GEL: 250 gm.

MAKE: ELECTRICAL ENGINEER/VASHIVANTRAO AT FORGING/ RENU TRANSCO

QUANTITY: NOS

SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.LTD
DRN BY		SILICA GEL BREATHER 250GMS
CHD BY		25 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- 25/11 3ϕ/EEL2/09.

Total Losses at * :	
50% loading - 190 Watts	
100% loading - 635 Watts	

Equipment	:	Distribution Transformer
Type	:	Oil Filled naturally cooled
Make	:	
Model / year	:	
Capacity	:	25KVA
Voltage	:	upto 11kv

ENERGY IS LIFE

CONSERVE IT

BEE/MEE/03/0751/17

*Under test conditions, when tested in accordance with IS 1180 : 1989

NOTE:

1) THE UNIQUE LABEL SERIES CODE PROVIDED IN THE LATTER HAS TO BE MENTIONED IN THE LABEL AFFIXED ON THE DISTRIBUTION TRANSFORMER

2) THE LABEL DESIGN SIZE, COLOR SCHEME , MATERIAL TO BE USED FOR THE LABEL CONTENT OF THE LABEL AND COLOR SCHEME OF THE BUREUS LOGO SHALL BE AS SCHEDULED TO THE BUREAU OF ENERGY EFFICIENCY (PARTICULARS AND MANNER OF THEIR DISPLAY ON LABEL OF DISTRIBUTION TRANSFORMER) REGULATION 2009

QUANTITY: NOS

SIGNATURE OF AUTHORIZED PERSON & STAMP OF THE FIRM	

CUSTOMER		MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.LTD
DRN BY		BEE 1 STAR LABEL DRAWING
CHD BY		25 KVA, 11/0.433KV, 3PHASE, ALU WOUND, CRGO CORE, DIST TRANSFORMER (ENERGY EFFICIENCY LEVEL- 2 , AS PER IS:1180 (PART-1):2014
SCALE		
		DRAWING NO:- 25/11 3ϕ/EEL2/10.