



Maharashtra State Electricity Distribution Co. Ltd.

SPEC. NO.STORES:MSC-II/ Low Losses Power TF/ 2011

TECHNICAL SPECIFICATION

OF

5 MVA and 10 MVA, 33/11 kV, 33/22 kV & 22/11 kV

LOW LOSSES POWER TRANSFORMERS

SUITABLE TO

DISTRIBUTION SYSTEM

IN

MAHARASHTRA STATE

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MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.
TECHNICAL SPECIFICATION FOR
5 MVA and 10 MVA 33/11 kV, 33/22 kV & 22/11 KV
LOW LOSSES POWER TRANSFORMERS

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1 Scope:-

- 1.1 This specification covers design, manufacturing, testing and delivery of **Oil immersed, Oil Natural Air Natural (ONAN), Outdoor Type, Three Phase, 50 Hz, 5 MVA and 10 MVA 33/11 kV, 33/22 kV & 22/11 kV Step Down LOW LOSSES Power Transformers with On Load Tap Changer (OLTC) and Remote Tap Change Control (R.T.C.C.) panel**, to be used in Sub Transmission/ Distribution systems.
- 1.2 The equipment offered shall be complete with all parts necessary for their effective and trouble-free operation. Such parts will be deemed to be within the scope of the supply irrespective of whether they are specifically indicated in the commercial order or not.
- 1.3 It is not the intent to specify herein complete details of design and construction. The equipment offered shall conform to the relevant standards and be of high quality, sturdy, robust and of good design and workmanship complete in all respects and capable to perform continuous and satisfactory operations in the actual service conditions at site and shall have sufficiently long life in service as per statutory requirements. The dimensional drawings attached with this specification and the notes thereto are generally of illustrative nature. In actual practice, notwithstanding any anomalies, discrepancies, omissions, incompleteness, etc. in these specifications and attached drawings, the design and constructional aspects, including materials and dimensions, will be subject to good engineering practice in conformity with the required quality of the product, and to such tolerances, allowances and requirements for clearances etc. as are necessary by virtue of various stipulations in that respect in the relevant Indian Standards, IEC standards, I.E. Rules, I.E. Act and other statutory provisions.
- 1.4 The Tenderer/supplier shall bind himself to abide by these considerations to the entire satisfaction of the purchaser and will be required to adjust such details at no extra cost to the purchaser over and above the tendered rates and prices.
- 1.5 Tolerances:
Tolerances on all the dimensions shall be in accordance with provisions made in the relevant Indian/IEC standards and in these specifications. Otherwise the same will be governed by good engineering practice in conformity with required quality of the product.

2 System Particulars:-

- | | | | | | |
|-----|--------------------------------------|---|--------------------------------|-------|------|
| 2.1 | Nominal System Voltage | : | 33 kV | 22 kV | 11kV |
| 2.2 | Corresponding Highest System Voltage | : | 36 kV | 24 kV | 12kV |
| 2.3 | Frequency | : | 50 Hz with ± 3 % tolerance | | |
| 2.4 | Number of Phase | : | 3 | | |
| 2.5 | Neutral earthing | : | Solidly earthed | | |

3 SERVICE CONDITIONS:

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

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

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

4 Applicable Standards:-

- 4.1 Unless otherwise modified in this specification the transformers shall comply with the Indian Standard Specification IS: 2026 latest or relevant International Standard such as ANSI, OSA, DIN, IEC etc., acceptable to the purchaser. The specified equipments are of standard industrial type and can be supplied by manufacturers active in the international market.
- 4.2 Equipment meeting with the requirements of other authentic standards, which ensure equal or better quality than the standards mentioned above, shall also be considered. Two copies of such standards, in authentic English translation shall be furnished alongwith the offer.
- 4.3 Equipment offered shall comply with all currently applicable statutory requirements, regulations and safety codes applicable for design, quality of material and construction, manufacture, inspection and performance.
- 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 shall prevail.

5 Specific Technical requirement:

5.1 Standard MVA Ratings:-

The standard ratings shall be 5 & 10 MVA for transformer with OLTC.

5.2 Nominal voltage ratings

- | | | |
|----|-------------------|------------------|
| i | Primary voltage | - 33 kV or 22 kV |
| ii | Secondary voltage | - 22 kV or 11 kV |

5.3 Temperature Rise:

- i The temperature rise for top oil over an ambient temperature of **50 °C** should be **45 °C** maximum (measured by thermometer in accordance with IS 2026 or relevant International Standard).
- ii Temperature rise for winding over an ambient temperature of **50 °C** should be **50 °C** maximum (measured by resistance in accordance with IS 2026 or relevant International Standard).

5.4 No load voltage ratio:-

The no load voltage ratio corresponding to the principal tapping shall be 33,000/11,000 Volts, 33000/22000 Volts or 22,000/11,000 Volts.

5.5 Flux density:-

Flux density should not be more than 1.55 Tesla at the rated voltage and frequency. Transformer core should be designed in such a way that it will not get saturated for any value of V/f (Voltage/frequency) ratio to the extent of 112.5% of rated value of V/f ratio (i.e. 11000/50, 22,000/50, 33000/50). Actual core design alongwith calculations in support of it should be enclosed with the offer.

5.6 Core Lamination:-

The grade of core laminations to be used shall be **M4 or better**.

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

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

5.7 Current Density:

The current density for HV & LV windings should not exceed 2.8 A / mm² for copper conductor at any working tap including extreme tap 17 (-15% voltage).

5.8 Magnetizing Current:-

The magnetizing current at normal voltage & frequency shall be limited to 1% of full load current.

6 General Technical Requirement:-

6.1 On Load Tap Gear:

The transformers with on load taps shall have taps ranging from +5% to -15% in steps of 1.25% each on HV winding for HV variation.

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

6.2 The equipment for local hand, local electrical and remote electrical operation shall be provided.

6.3 The Remote Control Cubicle:-

The remote control cubicle will be complete with:

- 6.3.1 Relays in the control circuit for the operation of the transformers in parallel.
 - 6.3.2 Tap position indicator.
 - 6.3.3 Tap change in progress lamp (white color) with circuit interrupter for blinking.
 - 6.3.4 Lamps (white) showing healthy auxiliary supply from 240/110 Volts Center point earthing transformer.
 - 6.3.5 Time delay contactors 1-5 Seconds with 5 Amps. contacts for tripping when a follower fails to go into steps with the master together with indication.
 - 6.3.6 Oil temperature alarm with suitable cancellation device.
 - 6.3.7 Winding Temperature alarm with suitable cancellation device for 10 MVA Transformer.
 - 6.3.8 Signaling apparatus for out-of-step alarm.
 - 6.3.9 Time delay contactors 1-5 Seconds for tripping due to incorrect coupling in master position (out of step tripping). The desired time delay for tripping will be to 50 Seconds.
 - 6.3.10 Remote Push Button for Lower & Raise Tap.
 - 6.3.11 Alarm cancellation Push Button.
 - 6.3.12 Tap Changer Supply Isolating Switch.
 - 6.3.13 Sequence Selector Switch.
 - 6.3.14 Out of Step Alarm with Cancellation Push Button.
 - 6.3.15 Panel Strip Heater with Switch.
 - 6.3.16 Panel Lamp with Door Switch.
- 6.4 The circuit arrangement shall be flexible to provide for addition of a transformer at a later date. The scheme will be such that a selector switch can be provided so that any one transformer of the group can at a time be selected as 'Master', 'follower' or 'independent'.
- i. An out of step device shall be provided for each transformer which shall be arranged to prevent further tap changing when transformers in a group operating in parallel control are one tap out of step.
- 6.5 Tapping method:
- i The switch position no.1 shall correspond to the maximum plus tap.
 - ii The primary winding shall be connected delta and secondary winding star as per vector group Dyn 11 (IS 2026 latest version.) so as to produce a positive displacement of 30 deg. from the primary to the secondary vector of the same phase (vector rotation assumed counter clockwise).
 - iii The neutral point of the secondary winding shall be solidly earthed and should be brought out to separate insulated terminal through an earthing current transformer for an earth leakage relay to be connected whenever required.
- 7 Impedance Values-**
- The percentage impedance at 75 °C shall be 7.15% for 5000KVA and 8.35% for 10000 KVA power transformers.

The impedance values refer to the principal tapping and are subject to tolerance of $\pm 10\%$. The impedance value measured on any other tapping shall not exceed the value measured on the principal tapping by more than $+ 10\%$.

8 Losses:-

8.1 The No Load & Full Load Losses are specified as below:

KVA	Voltage Ratio (in kV)	NO LOAD (kW)	LOAD LOSSES (kW) at 75 ° C.
5000	33/11	3.6	19.0
	33/22	3.6	19.0
	22/11	3.6	19.0
10000	33/11	5.4	37.0
	33/22	5.4	37.0
	22/11	5.4	37.0

8.2 The above Losses have tolerance as specified in the IS: 2026 amended upto date.

9 Terminal Arrangement:-

9.1 Transformers on HV side, 36kV/24 kV and for LV side, 24kV/12 kV Porcelain Bushing shall be used. Bushings of the same voltage class shall be interchangeable. The bushings shall be located on opposite sides. The HV /LV Bushings assembly shall be as per relevant IS: 3347, amended up to date. Porcelain part of both HV/LV Bushings shall be as per IS: 8603 (part I & III)-1977 (for heavily polluted atmosphere). The rated values, performance requirements & tests for HV/LV Bushings shall be in accordance with IS: 2099-1986. The Clamping arrangement of both HV/LV Porcelain Bushings shall be accordance with IS: 4257 (part I)-1981.

9.2 The electrical characteristic of Porcelain HV/LV Bushings shall be in accordance with IS : 3347 & IS:2099 latest version or relevant International Standard.

9.3 The minimum creepage distance of both HV/LV Bushings shall not be less than 25 mm per kV.

10 Tolerance:

The tolerance of guaranteed performance figures shall be as specified in the latest issue of IS 2026 or relevant International Standard except wherever specified otherwise in this specification.

11 Axles and wheels:

The transformers shall be provided with flanged wheels suitable for use on 1435 mm gauge track for 5 MVA Transformer and 1676 mm gauge for 10 MVA Transformer. These wheels shall be suitable for being turned through an angle of 90 deg. and locked in that position when the tank is jacked up.

12 Fittings:

Unless otherwise specified in the order, the following standard fittings shall be provided. The fittings shall be in accordance with the details to the extent these are specified in latest IS: 2026.

- i Inspection covers.(Thickness of inspection cover shall be same as Top of the tank)
- ii Rating plate to be riveted.
- iii Terminal marking plate.
- iv Two earthing terminals with crimping lugs.
- v Lifting lugs.
- vi Radiators (18 SWG.) The no. of radiators/fins and heat dissipation calculation to justify the no. of radiators shall be submitted along with the offer.
- vii Explosion vent with equalizer pipe
- viii Conservator with drain plug.
- ix Dehydrating breather (Silica gel type) for Transformer & OLTC (approx. 3 kg)
- x Thermometer pocket.
- xi Oil level gauge indicating three positions of oil marked as under
 - a. Minimum (-) 5 ° C
 - b. 30 ° C
 - c. Maximum 98 ° C
- xii Oil filling hole with cap.
- xiii Air release device.
- xiv Pressure relief device.
- xv Gas/Oil actuated relay (Buchholz Relay) with shut off valves on both sides.
- xvi Filter valves (lower valve to be also used as drain valve).
- xvii Flanged wheels.
- xviii Jacking lugs.
- xix Sampling valve.
- xx Marshalling Box:

Vermin proof with required glands, locks, glass door, terminal Board, heater with switch, illumination lamp with switch, terminal connectors etc.
- xxi Oil Temperature Indicator with two contacts for alarm & Trip – 1 No.
- xxii Winding temperature Indicator with two contacts for alarm & Trip –1 No. (Only for 10 MVA Transformer)
- xxiii Surge relay for O.L.T.C. with isolating valve
- xxiv On load tap changer (Make: CTR/OLG/OWN)

13 Transformer Oil

The quantity of transformer oil excluding OLTC shall not be less than 3000 Ltrs for 5 MVA Transformers and 4500 ltrs for 10 MVA Transformers.

Transformer oil to be used in all the power transformers shall comply with the requirements of latest IS 335 or relevant. In addition the oil should conform to 'Ageing Characteristics' specified below for New Oil and Oil in Transformers.

New oil - Ageing characteristics after accelerated ageing (open beaker method with copper catalyst):

- i Specific Resistance (Resistivity)
 - a. at 20 ° C :- 2.5×10^{12} Ohm-Cm (Min)
 - b. at 90 ° C :- 0.2×10^{12} Ohm-Cm (Min)
- ii Dielectric dissipation factor - 0.20 (Max.tan delta) at 90 ° C.
- iii Total acidity mg/KOH/gm - 0.05 (Max)
- iv Total sludge value (%) by weight - 0.05 (Max.)
- v The method of testing these aging characteristics is given in Appendix - C of IS 335.
- vi Oil filled in Transformers:

The important characteristics of the transformer oil after it is filled in the transformer (within 3 months of filling) shall be as follows: -

Sr.No.	Characteristics	Specifications
1.	Electric Strength (Breakdown voltage)	30 kV (Min) at 2.5 mm gap
2.	Dielectric dissipation factor (Tan Delta) at 90 deg.C.)	0.01 (Max)
3.	Specific resistance (Resistivity) at 27 deg. C (ohm-cm)	10×10^{12}
4.	Flash Point, P.M. (closed)	140 ° C (Min)
5.	Inter facial tension at 27 ° C.	0.03N/M (Min)
	Neutralization value (total acidity)	0.05mg.KOH/gm (Max.)
7	Water content PPM	35 (Max)

14 Tank

14.1 The transformer tank and cover shall be fabricated from good, commercial grade, low carbon steel plate of minimum 6 and 8 mm thick for side wall and 8 and 10mm thick for top and bottom cover and suitable for welding for 5 and 10MVA transformers respectively.

14.2 The tank and cover shall be of welded construction. All seams shall be welded and wherever practicable, they shall be double welded. The tank weld shall be reinforced by stiffeners of structural steel for general rigidity. The tank shall have sufficient strength to withstand without permanent distortion under following conditions:

- i Oil filling under vacuum.
- ii Continuous internal gas pressure of 35 KPa with oil at operating level and

iii Normal Mechanical shock during transportation, loading and unloading operations.

- 14.3 The tank cover shall be bolted to the tank and the transformer design shall be such that the tank will not be split between the lower and upper cooler connection for untanking.
- 14.4 The tank of the transformer shall be complete with all accessories and shall be designed so as to allow the complete transformer filled with oil to be lifted by crane or jack transported by road, rail or water way without over straining any joints and without causing subsequent leakage of oil.
- 14.5 The main tank body excluding tap changing compartments, radiators and coolers shall be capable of withstanding following vacuums.

Vacuum gauge pressure (KN/sq.m.)	Mm of Hg
68.0	500

- 14.6 The base of each tank shall be so designed that it shall be possible to move the complete transformer unit by skidding on plates or rails in any direction without injury.
- 14.7 Suitable guides shall be provided for positioning the core.
- 14.8 All Control cabinets and marshaling kiosks being supplied as transformer accessories, except OLTC. Remote control panel shall be preferably mounted on the transformer body. No cabinet or marshaling kiosk shall be mounted on radiators.
- 14.9 Top of the tank cover shall be sloped towards LV side by approximately upto 10° to prevent retention of rainwater.
- 14.10 The thermometer pockets shall be fitted with captive screwed top to prevent the ingress of water.
- 14.11 The thermometer pockets shall be located in the position of maximum oil temperature at continuous Maximum rating and it shall be possible to remove the instrument bulbs without lowering the oil in the tank.
- 14.12 The tank cover and the inspection covers shall be provided with suitable lifting arrangements. Inspection covers shall not weigh more than 25 Kg. each.
- 14.13 Cleaning and Painting.
 - i Before painting or filling with oil, the external surfaces of transformer tank and structural steel work shall be completely cleaned and made free from rust, scale and grease by applying shot blasting or sand blasting. Cavities on castings shall be filled by metal depositions.
 - ii The interior of transformer tank, other oil filled chambers and internal structural steel work shall be cleaned of all the scales and rust by application of standard approved methods. There after these surfaces shall be painted with hot-oil resistant varnish or paint.
 - iii Except for nuts, bolts and washers which may have to be removed for maintenance purposes all external surfaces shall receive minimum of four coats of paint. The total paint thickness shall be in the range of 52 to 60 microns.
 - iv The 1st and 2nd coats of painting shall be of primer and shall be applied immediately after cleaning. The 3rd coat shall be of an oil and weather resisting quality, preferably given a fungicide treatment and of a shade or color easily distinguishable from the primary coats and shall be applied after the primary coats have been touched up where necessary. The

final coats shall be of glossy oil finish and weather resisting non-fading paint of shade no. 220 (Olive Green) of IS 5 or relevant International Standard. Primer paint shall be ready mix Zinc chromates as per IS 104 or relevant International Standard. Intermediate and final coat of paint shall be as per IS 2932 or relevant International Standard.

15 Lifting and Haulage facilities:

- 15.1 Lifting eyes or lugs shall be provided on all parts of the transformer, which require independent handling during loading, unloading, assembly or dismantling. In addition, the transformer tank shall be provided with lifting lugs, bosses and jacking pads properly secured to the sides of the tank for lifting the transformer complete with oil either by crane or by jacks.
- 15.2 The transformer shall also be provided with suitable haulage holes on the four sides with suitably braced, pulling eyes for haulage of the transformer in longitudinal as well as transverse directions.

16 Lifting jacks:-

The bidder shall quote unit rates for a set of 4 (four) nos. suitably rated hydraulic type Lifting Jacks complete with all accessories, for each rating of the transformer. Prices of these jacks shall not be considered for tender evaluation. The purchaser shall decide the quantity to be ordered.

17 Windings:

- 17.1 Insulation of L.V. winding shall be adequate to withstand surge voltages appearing across them as a result of transfer due to an impulse striking on HV terminals.
- 17.2 The stacks of windings shall receive adequate shrinkage treatment before and after final assembly. Adjustable devices if necessary shall be provided for taking up possible shrinkage of coils if any, in service. The provisions made in this respect shall be clearly brought out in the Bid.
- 17.3 The conductor used for the coil shall be electrolytic grade copper conforming to the relevant Indian Standard specification.
- 17.4 The conductors shall be transposed at suitable intervals in order to minimize eddy current and to equalize the distribution of current and temperature alongwith windings.
- 17.5 The winding shall be so designed that all coil assembly of identical voltage rating shall be interchangeable and field repairs to the windings can be made without special equipments.

18 Minimum clearances:

- 18.1 Following minimum clearances in air and oil shall be maintained

Voltage	Phase to phase	Phase to ground Out of Oil.	Phase to ground In Oil.
11 kV	280 mm	140 mm	25 mm
22 kV	350 mm	320 mm	40 mm
33 kV	350 mm	320 mm	40 mm

19 Conservator vessels, Oil Gauges & Breathers:-

- 19.1 A conservator complete with sump and drain valves shall be provided in such a position as not to obstruct the electrical connections to the transformer, having a capacity between the highest and the lowest visible levels to meet the requirement of expansion of the total cold oil volume in the transformer and cooling equipment from the minimum ambient temperature i.e. -5 Deg. C to 98 Deg.C. The minimum indicated oil level shall be with the feed pipe from the main tank covered with not less than 25 mm depth of oil and the indicated range of oil level be from minimum to maximum.
- 19.2 Conservator will have volumetric capacity of at least 10 % of total volume of oil in the tank. Moreover the oil in conservator upto the minimum level mark on the oil level gauge should be at least 3 % of the total volume of oil in the transformer excluding oil in the OLTC. The conservator shall also be provided with oil filling hole, cap, drain valve, 15-mm air release plug and silica gel breather. The size of the drain valve shall be 15 mm for Conservator diameter of 650 mm and below. For higher size of the Conservator, the drain valve shall be of 25 mm size. It shall be possible to completely drain the oil from Conservator when it is installed in its normal position on the transformer.
- 19.3 Equalizer pipe shall be provided.
- 19.4 The oil connection from transformer tank to the Conservator Vessel shall be arranged at a rising angle of 3 to 9° to the horizontal up to the Bucholz Relay and shall consist of 50 mm. inside diameter pipe as per latest IS 3639 or equivalent International Standard.

20 Bushing Insulators and Terminals:-

- 20.1 The transformer shall be fitted with bushing insulators having suitable characteristics. Preference will be given to vertically mounted bushings. The main winding and neutral leads shall be brought out through out-door type of bushings which shall be so located that full flash over strength will be utilized. Wherever neutral current transformers are required, accommodation for the same is required to be provided on the neutral terminal bushing and the bushing shall be so arranged that it can be removed without disturbing the current transformer, secondary terminals and other connections or pipe work.
- 20.2 Each terminal, including the neutral, shall be distinctly marked on both primary and secondary in accordance with the connection diagram fixed upon the transformer which shall conform to latest IS 2026 (Part IV).

21 Gasket Joints:-

For gasket joints wherever used, nitrite betel rubber gasket or Neoprene cork gasket shall be used. The gaskets shall be placed in properly machined grooves with adequate space for accommodating the gaskets under compression. Suitable mechanical stops shall be provided to prevent crushing of gaskets.

22 Over Loading:-

The Power transformer shall be suitable for operating under overload condition as specified in IS 6600. and a separate Over Loading chart should be submitted along with offer.

23 Rating and Diagram Plate & Valve Schedule Plate.

- 23.1 The transformer shall be provided with non-corrosive, legible rating and diagram plate of minimum 18 SWG Brass materials. Rating and diagram plate shall be riveted to the transformer tank at an average height of about 1500 mm above the plinth level. The rating and diagram plate shall bear data as specified in Part-3 of IS 2026 or relevant International Standard. The plate shall also bear Name of purchaser viz. Maharashtra State Electricity Distribution Company Limited in full.

- 23.2 A plate showing the location and function of all valves and air release cocks or plugs shall be provided.
- 23.3 In addition to the above a plan of the transformer giving the correct physical relationship of the terminals shall be clearly indicated on the rating and diagram plate.

24 Test and Inspection:-

24.1 Routine Tests:-

- i All transformers shall be subjected to the following routine tests at the manufacturer's works. The tests are to be carried out in accordance with the details specified in IS 2026 or as agreed upon between the purchaser and the manufacturer.
 - a) Measurement of winding resistance.
 - b) Ratio, polarity and phase relationship.
 - c) Impedance voltage.
 - d) Load losses.
 - e) No-load losses and No-load current.
 - f) Insulation resistance.
 - g) Induced over voltage withstand.
 - h) Separate source voltages withstand.
 - i) Duty cycle of On-load Tap Changer.
 - j) Oil leakage gas collection, oil surge and voltage tests on gas and oil actuated relays.
- ii All the routine tests shall be conducted in the suppliers' laboratory at their cost.
- iii Heat run test shall be arranged free of cost on the unit selected from the 1st lot by our Executive Engineer / Authorized Representative.
- iv The calculations to confirm the thermal ability as per Clause no. 9.1 of latest IS: 2026 Part-I or equivalent International Standard, shall be submitted to our Executive Engineer (IW).

25 Type Tests:-

- 25.1 The transformer offered should have been successfully type tested at NABL laboratories, in line with standard and technical specifications, within the last 5 (five) years from the date of opening of Tender. The tenderer shall furnish the following type tests reports (alongwith General arrangement drawing, Rating and Diagram Plate and Internal Constructional drawing, Core & Core details with flux density calculations) alongwith the offer.
- i. Impulse Voltage withstand Test chopped on the tail on all three LV & HV phases.
 - ii. Temperature Rise Test on Tap No. 17 (i.e. -15% voltage Tap)
 - iii. Short circuit Test
- 25.2 In case of Temperature Rise Test, if NABL laboratories are unable to carry out test at their own laboratory, then bidder may hire services of NABL laboratories and carry out Temperature Rise Test at their works with testing equipment of NABL. Test have to be carried out by testing engineer of NABL and certification of the same have to be given on NABLs letter head.

- 25.3 If above tests are carried out beyond 5 years, then the offer may be considered for placement of order however, successful bidders have to carry out the said type tests before commencement of supply at their own expense.
- 25.4 If above tests are carried out on higher capacity of offered type transformer, then the offer is considered for placement of order. However, successful bidders have to carry out the said type tests on offered type transformers before commencement of supply at their own expense.
- 25.5 The purchaser reserves right to demand repetition of some or all type tests, in the presence of purchaser's representative. For this purpose, the tenderer may quote unit rates for carrying out each type test.
- 25.6 The bidder should not make any changes or alteration in the transformer design / type offered against the subject tender. However, if the bidder desires to make any changes or alteration in the transformer design /type offered against the subject tender, the purchaser reserves right to demand of repetition of the type tests on the transformer to be supplied against subject tender, without any extra cost. The type test reports of the same should got approved from **Chief Engineer (Stores)**.
- 25.7 After getting drawings approval of power transformer to be supplied against subject tender, successful bidders should got approved of type test reports (as per this tech spec.cl. 25.1) from office of the **Chief Engineer (Stores), Ist Floor, Prakashgad, MSEDCL, Bandra**. The original type test reports should be made available for verification.

26 Vacuum Test: -

The tank of a Power Transformer (excluding tap changing compartment, radiators and coolers) shall be able to withstand a vacuum gauge pressure of 68.0 KN/ sq.m. (500 mm. of Hg).

The permanent deflection of the flat plate after subjecting the transformer tank to the above vacuum for one hour shall not exceed the following values, without affecting the performance of the transformer.

Horizontal length of flat plate	Permanent deflection(mm)
Upto and including 750 mm	5.0
751 to 1250	6.5
1251 to 2000	8.5
2001 to 2250	11.0
2251 to 2500	12.5
2501 to 3000	16.0
Above 3000	19.0

27 Transformer oil:-

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

28 Rejection:-

28.1 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 No load loss exceeds the values mentioned in Clause. No.8 above.
- ii Load loss exceeds the specified values mentioned in Clause No. 8 above.
- iii Impedance voltage value exceeds the Guaranteed value plus tolerances as mentioned at Clause No.7 above.
- iv Type test are not carried out as per clause no. 25 of the specification.
- v Drawings are not submitted as per clause no. 31 of the specification.
- vi GTP not submitted as per clause no. 32 of the specification.

29 Stage Inspection:-

29.1 Supplier shall give 10 days' advance intimation to the **CE(Stores)** and S.E. (Store/Distribution) to organize stage inspection in which assembly of core, windings and other core materials etc. would be inspected. In respect of raw materials such as core stamping, winding conductor, oil etc. successful tenderer shall use these materials manufactured/supplied by the standard manufacturers and furnish the manufacturer's test certificates, as well as, proof of purchase from those manufacturers (excise, gate passes), for the information of the department.

29.2 Chief Engineer (Stores) will depute representatives from testing and inspection wing at the time of stage inspection.

29.3 The transformer will be tested for acceptance tests at factory, in the presence of purchaser's representative, before dispatch.

29.4 The inspection may be carried out by the purchaser at any stage of manufacture. The successful tenderer shall grant free access to the purchaser's representatives at a reasonable time when the work is in progress. Inspection and acceptance of any equipment under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specifications and shall not prevent subsequent rejection if the equipment is found to be defective.

30 Quality Assurance

30.1 The tenderer shall invariably furnish following information along with his offer failing which his offer will be rejected.

30.2 Certificates of following materials.

- i Copper conductor
- ii Transformer oil
- iii Core
- iv Insulations.
- v Porcelain Bushings
- vi Steel Plate used for Tank

30.3 Names of the supplier for the raw material, list of standard according to which the raw materials are tested, list of test normally carried out on raw materials in presence of tenders' representatives, copies of type test certificates.

- 30.4 Information and copies of test certificate as in Cl No. 30.2 above respect of bought out accessories including terminal connectors.
- 30.5 List of manufacturing facilities available. In this list the tenderer 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.
- 30.6 Level of automation achieved and list of areas where manual processing still exists.
- 30.7 List of areas in manufacturing process where stage inspection are normally carried out for quality control and details of such tests and inspections.
- 30.8 Special features provided in the equipments to make it maintenance free
- 30.9 The tenderer shall submit the List of testing equipment available with them for testing the transformers for acceptance and routine tests as specified in the relevant standards and the present specification. The successful tenderer shall submit the Routine Test Certificate alongwith central Excise Gate Passes 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.

31 Document & Drawings:-

- 31.1 A. Following documents should be submitted along with offer.
 - 1. Flux Density Calculations
 - 2. Heat Dissipation calculation
 - 3. Type Test Reports
 - a. Impulse Voltage withstand Test on all three LV & HV phases.
 - b. Temperature Rise Test on Tap No. 17 (i.e. -15% voltage Tap)
 - c. Short circuit Test
 - 4. Test Certificates of following bought out materials.
 - a. Copper conductor
 - b. Transformer oil
 - c. Core
 - d. Insulations.
 - e. Porcelain Bushings
 - f. Steel Plate used for Tank
 - g. Terminal Connectors
 - 5. Names of the supplier for the raw material.
 - 6. List of manufacturing facilities available.
 - 7. List of testing equipment available with the tenderer.
- B. A set of following main drawings shall be submitted by the tenderer alongwith the offer:
 - i Rating & Diagram Plate Drawing.
 - ii. General Arrangement Drawing.
 - iii. Internal Construction drawing.

- iv Core & Core Details with flux density calculations
- v HV/LV Bushings with creepage distance.
- vi. Marhalling Box with connection diagram.

C. The tenderer should also furnish the following O.L.T.C. drawings alongwith the offer.

- i OLTC Rating Plate
- ii. Tap changer phase diagram.
- iii. G.A. of Tap changer control panel.
- iv. Wiring diagram of tap changer control panel.
- v. Schematic diagram for group control of tap change gear.
- vi. G.A. of RTCC Panel .
- vii. Breather
- viii. O&M Manual.

- 31.2 The drawings shall be of A-3 (420 x 297 mm) size only. The tenderer should also supply alongwith his offer the pamphlets/literatures etc. for Oil surge relay, Buchholz Relay, Breather etc.
- 31.3 The tenderer should confirm specifically that he will adhere to the design once offered during execution of the order, if placed with him and no changes shall be made without prior approval of the purchaser.
- 31.4 The successful Bidders shall submit complete set of Drawings (as listed in the clause No.31.0 (B & C) & as per indicative drawings attached with this specification of transformer in triplicate indicating dimensions to **CE (Stores)** for approval and get approved it before offering I st stage inspection.

32 Guaranteed & Technical Particulars:

The bidder should fill up all the details in Schedule A and the statement such as “as per drawings enclosed”, “as per MSEDCL requirement” “as per IS” etc. shall be considered as details not furnished and such offers will be rejected.

33 Qualifying Requirement: As per Tender.

34 Final Inspection:

- 34.1 **C.E. (Stores) will depute his representative at the time of final inspection along with CPA’s representative.**

35 Challenge Testing:

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

The challenge testing would cover following tests:

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

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

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

36 Performance Guarantee:

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

37 COST DATA SHEET:-

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

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

FORMAT FOR COST DATA					
ITEM ----- KVA , ----- KV POWER TRANSFORMER					
Sr. No.	PARTICULARS	UNIT	UNIT RATE S Rs.	QTY	AMT (Rs.)
1	CORE (M4 or better)	KG			
2	COPPER FOR HV WINDING	KG			
3	COPPER FOR LV WINDING				
3	INSULATION PAPER	METER			
4	OIL	LTRS			
5	TANK	NO			
6	CHANNELS	KG			

7	INSULATORS/BUSHINGS	KG			
8.	OTHERS	LUMPS UM			
				TOTAL	
	WASTAGE @ %				

38 Schedules

- 38.1 The bidder shall fill in the following schedules which form part of the tender specification and offer. If the schedules are not submitted duly filled in with the offer, the offer shall be rejected.
- Schedule `A' -Guaranteed Technical Particulars
- Schedule `B' -Schedule of Tenderer's Experience.
- 38.2 The discrepancies between the specification and the catalogs, Literatures and indicative drawings which are subject to change, submitted as part of the offer, shall not be considered and representation in this regard will not be entertained.
- 38.3 The Bidder shall submit the list of orders for similar type of equipments, executed of under execution during the last three years, with full details in the schedule of Tenderer's experience (Schedule `B') to enable the purchaser to evaluate the tender.

Schedule A

E- GURANTEED TECHNICAL PARTICULARS

SR.N O.	GTP PARAMETERS	REMARK
1	Name of Manufacturer	TEXT
2	Reference Standard	TEXT
3	Transformer shall be Oil Natural Air Natural (ONAN) type Yes/No	BOOLEAN
4	Transformer shall be suitable for outdoor installation Yes/No	BOOLEAN
5	Transformer shall be oil immersed type Yes/No	BOOLEAN
6	Normal full load capacity shall be 5/10 MVA Yes/No	BOOLEAN
7	Primary Voltage in KV	NUMERIC
8	Secondary Voltage in KV	NUMERIC
9	Method of connection for H.V. Winding shall be Delta : Yes/No.	BOOLEAN
10	Method of connection for L.V. Winding shall be Star : Yes/No	BOOLEAN
11	Connection Symbol shall be Dyn11 Yes/No	BOOLEAN
12	By resistance method Maximum temperature rise of Windings over an Ambient temp. of 50°C in °C	NUMERIC
13	The temperature shall in no case reach a value that will damage the core itself ,other parts or adjacent materials (Yes/No)	BOOLEAN
14	By thermometer Maximum temperature rise of Oil over an Ambient temp. of 50°C is in °C	NUMERIC
15	Estimated maximum hot spot Temperature in deg. centigrade	NUMERIC
16	Whether neutral is solidly earthed (Yes /No)	BOOLEAN
17	Magnetizing current (in amps) at rated voltage and rated frequency & its % with full load current	TEXT
18	Magnetizing current at maximum voltage (112.5% of rated voltage) and rated frequency (in amps) & its % with full load current	TEXT
19	No load losses at normal voltage and frequency in Watts	NUMERIC
20	Resistance of HV winding at 20 ° C in Ohm/phase	TEXT
21	Resistance of LV winding at 20 ° C in Ohm/phase	TEXT
22	Full load losses at rated voltage at 75 deg. Centigrade in Watts	NUMERIC
23	Flux density at normal voltage and frequency in Tesla	TEXT
24	Efficiency at 75 deg. centigrade at unity p.f at 100 % Load	TEXT
25	Efficiency at 75 deg. centigrade temperature at unity p.f at 75 % Load	TEXT
26	Efficiency at 75 deg. centigrade temperature at unity p.f at 50 % Load	TEXT
27	Efficiency at 75 deg. centigrade temperature at unity p.f at 25 % Load	TEXT
28	Efficiency at 75 deg. centigrade temperature at unity p.f at 125 % Load	TEXT
29	Efficiency at 75 deg. centigrade temperature at 0.8 p.f lag at 100 % Load	TEXT
30	Efficiency at 75 deg. centigrade temperature at 0.8 p.f lag at 75 % Load	TEXT
31	Efficiency at 75 deg. centigrade temperature at 0.8 p.f lag at 50 % Load	TEXT
32	Efficiency at 75 deg. centigrade temperature at 0.8 p.f lag at 25 % Load	TEXT
33	Efficiency at 75 deg. centigrade temperature at 0.8 p.f lag at 125 % Load	TEXT
34	Efficiency at 75 deg. centigrade temperature at 0.8 p.f leading at 100 % Load	TEXT
35	Efficiency at 75 deg. centigrade temperature at 0.8 p.f leading at 75 % Load	TEXT

36	Efficiency at 75 deg. centigrade temperature at 0.8 p.f leading at 50 % Load	TEXT
37	Efficiency at 75 deg. centigrade temperature at 0.8 p.f leading at 25 % Load	TEXT
38	Efficiency at 75 deg. centigrade temperature at 0.8 p.f leading at 125 % Load	TEXT
39	Current density of HV winding at any Tap, in Amps/sq. mm.	TEXT
40	Current density of LV winding, in Amps / sq.mm.	TEXT
41	Minimum cross section of Copper used in HV Winding at 17th Tap in sq. mm	TEXT
42	Minimum cross section of Copper used in HV Winding at Normal Tap in sq. mm	TEXT
43	Minimum cross section of Copper used in LV Winding in sq. mm	TEXT
44	% Reactance drop on full load	TEXT
45	% Impedance at 75 °C	TEXT
46	Regulation at 75 deg. C.	TEXT
47	Overload capacity of transformers for 2 hrs.	TEXT
48	Min. clearance between phase to earth of primary winding in oil in mm	TEXT
49	Min. clearance between phase to earth of primary winding out of oil in mm	TEXT
50	Min. clearance between phase to earth of secondary winding in oil in mm	TEXT
51	Min. clearance between phase to earth of secondary winding out of oil in mm	TEXT
52	Min Width of oil duct between LV & HV windings (in mm)	TEXT
53	Impulse strength of HV winding (stating wave form adopted) 170 kVp	TEXT
54	Total radiating surface (Tank + Radiators) in sq. mtrs.	TEXT
55	Radiators size (HXW) , thickness and no of fins	TEXT
56	Name of Radiator manufacturer	TEXT
57	Approximate length of the Transformer in mm	NUMERIC
58	Approximate breadth of the Transformer in mm	NUMERIC
59	Approximate height of the Transformer in mm	NUMERIC
60	Approximate length of the Transformer tank in mm	NUMERIC
61	Approximate breadth of the Transformer tank in mm	NUMERIC
62	Approximate height of the Transformer tank in mm	NUMERIC
63	Minimum thickness of the side of transformer tank plates in mm	NUMERIC
64	Minimum thickness of the bottom of transformer tank plates in mm	NUMERIC
65	Minimum thickness of the cover of transformer tank plates in mm	NUMERIC
66	Minimum thickness of the radiator of transformer in SWG	NUMERIC
67	Approximate Weights of Core Laminations kgs	NUMERIC
68	Approximate Weights of Copper (Windings): kgs	NUMERIC
69	Approximate Weights of Transformer core and windings :kgs	NUMERIC
70	Approximate Weights of Tank & fittings: kgs	NUMERIC
71	Approximate Weights of Transformer complete with oil :kgs	NUMERIC
72	Material of core plates and grade of laminations of CRGO	TEXT
73	Thickness of core lamination in mm	TEXT
74	No. of H.V. disks per limb (1 limb)	TEXT
75	No of HV Turns	NUMERIC
76	No of LV Turns	NUMERIC
77	Minimum quantity of oil required in first filling excluding OLTC in Ltrs	TEXT
78	Oil shall be Conformed to Indian standard : IS:335 Yes/No	BOOLEAN

79	Oil manufacturers name	TEXT
80	Qty of oil absorption in liters	TEXT
81	Whether the transformer will be transported with oil Yes/No	BOOLEAN
82	Make of breather fitted to the transformer	TEXT
83	Capacity of breather fitted to the transformer in kg	TEXT
84	Type of breather	TEXT
85	Is a dial type oil temperature indicator fitted or not? Yes/No	BOOLEAN
86	Manufacturer's name of oil temperature indicator	TEXT
87	Temperature range of oil temperature indicator	TEXT
88	Voltage per turn used in HV/LV winding for design	NUMERIC
89	Whether end insulation is provided to the end turns	BOOLEAN
90	Percentage of voltage of end turns with reinforced insulation	TEXT
91	Type of insulation on HV conductors	TEXT
92	Type of insulation on LV conductors	TEXT
93	Type of insulation on LV to core	TEXT
94	Type of insulation on Core Bolts	TEXT
95	Type of insulation on Core Bolt Washers	TEXT
96	Type of insulation on Core Lamination	TEXT
97	Manufacturer's name of HV Bushings:	TEXT
98	Material of HV Bushings	TEXT
99	1 Minute Power frequency withstand voltage (Dry)at 50 Hz of HV Bushings:: 70 kV	TEXT
100	1 Minute Power frequency withstand voltage (Wet) at 50 Hz of HV Bushings: : less than 70 kV	TEXT
101	Impulse Flash over voltage kV (stating the wave form adopted) of HT Bushings: 170 kVp	TEXT
102	Rating of HV bushing : 36 kV, 630 A	TEXT
103	Minimum Creepage Distance of HV Bushings in mm	TEXT
104	Manufacturer's name of LV Bushings:	TEXT
105	Material of LV Bushings:	TEXT
106	Minimum Creepage Distance of HV Bushings in mm	TEXT
107	1 Minute Power frequency withstand voltage (Dry) over voltage at 50 Hz of LV Bushings: 28 kV	TEXT
108	1 Minute Power frequency withstand voltage (Wet) over voltage at 50 Hz of LV Bushings: 28 kV	TEXT
109	Impulse Flash over voltage kV (stating the wave form adopted) of LV Bushings:: 75 kV	TEXT
110	Rating of LV bushing : 12 kV, 630 A.	TEXT
111	Minimum Creepage Distance of LV Bushings in mm	TEXT
112	Make of on load tap changer	TEXT
113	Type of on load tap changer (linear/coarse fine)	TEXT
114	Rated voltage of on load tap changer: 33 kV	TEXT
115	Rated current of on load tap changer in Amps	TEXT
116	On load tap changer shall have 16 steps : Yes/No	BOOLEAN
117	Auxiliary supply details of on load tap changer	TEXT
118	Voltage control of on load tap changer	TEXT
119	Name of Protective devices of on load tap changer Oil Surge Relay	TEXT

120	Approximate overall weight of on load tap changer in kg	TEXT
121	Approximate overall dimensions L x B x H (mm) of on load tap changer	TEXT
122	Approximate tank dimensions of OLTC L x B x H (mm) of on load tap changer	TEXT
123	Approximate quantity of oil including qty of oil in On load tap changer and OLTC conservator tank	TEXT
124	Colour of transformer	TEXT
125	Core material & grade of laminations used	TEXT
126	Type of Core	TEXT
127	Regulation at 0.8 p.f. lag (in %)	TEXT
128	Regulation at 0.8 p.f. leading (in %)	TEXT
129	Shape of main tank	TEXT
130	Breakdown values of oil at the time of first filling (kV for 2.5 mm gap)	TEXT
131	Name plate provided with all details as per the specifications (Yes/No)	BOOLEAN
132	No of steps used in CRGO Core	NUMERIC
133	Diameter of the core (in mm)	TEXT
134	Effective Core Area (Sq.mm)	TEXT
135	The test certificates of copper conductors, core material, insulation paper, porcelain Bushings, steel plate used for tank of the offered transformer are enclosed with the offer in physical format with soft copy (Yes/No)	BOOLEAN
136	All type test reports of type tests carried out on transformer as per IS:2026 & tech.specifications at NABL laboratory shall be submitted with the offer in physical format & with soft copy (Yes/No)	BOOLEAN
137	Unbalanced current test, Air pressure test & temperature rise test shall be conducted at your works format enclosed with the technical specification & IS:2026 alongwith the offer with soft copy (Yes/NO)	BOOLEAN
138	All drawings of transformers, OLTC, Breather, Marshalling Box etc shall be submitted with the offer Flux Density calculations, heat dissipation calculation, oil absorption calculations, shall be submitted with offer (Yes/No)	BOOLEAN
139	Plant & machinery , list of order executed /under execution shall be furnished separately in physical format & with soft copy alongwith the offer (Yes/No)	BOOLEAN
140	The information required under Quality Assurance shall be submitted with the offer in physical format & soft copy (Yes/No)	BOOLEAN
141	The cost data in prescribed format shall be submitted with the offer in physical format & soft copy (Yes/No)	BOOLEAN
142	The performance Guarantee of the transformers in years	NUMERIC

SCHEDULE - B

SCHEDULE OF TENDERER'S EXPERIENCE

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

Sr. No.	Name of Client & Description. order	Value of order alongwith capacity .of transformer	Period of supply and commissioning may be made	Name & Address to whom reference
---------	-------------------------------------	---	--	----------------------------------

NAME OF FIRM _____

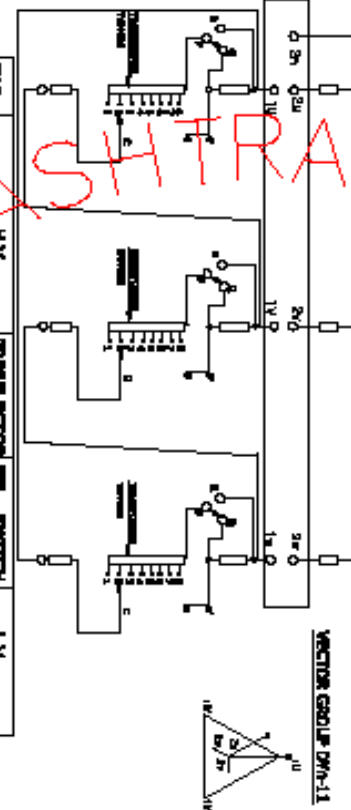
NAME & SIGNATURE OF THE TENDERER_____

DESIGNATION _____

DATE _____

NAME OF MANUFACTURE
ADDRESS _____

VECTOR GROUP 0M-11



VECTOR GROUP 0M-11

NAME OF MANUFACTURE
ADDRESS _____

ELECTRICITY DISTRIBUTION

THIS IS AN INDICATIVE DRAWING

COOLING

WATERS

NO LOAD

VOLTAHGE

PAUL LEAD

CHAMBER

SPACE HEAT

LEAD 200/200

ASSEMBLY TIME

WTR. TEMP. 120°C

WTR. TEMP. 100°C

WTR. TEMP. 80°C

WTR. TEMP. 60°C

WTR. TEMP. 40°C

WTR. TEMP. 20°C

WTR. TEMP. 0°C

WTR. TEMP. -20°C

WTR. TEMP. -40°C

WTR. TEMP. -60°C

WTR. TEMP. -80°C

WTR. TEMP. -100°C

WTR. TEMP. -120°C

WTR. TEMP. -140°C

WTR. TEMP. -160°C

WTR. TEMP. -180°C

WTR. TEMP. -200°C

WTR. TEMP. -220°C

WTR. TEMP. -240°C

WTR. TEMP. -260°C

WTR. TEMP. -280°C

WTR. TEMP. -300°C

WTR. TEMP. -320°C

WTR. TEMP. -340°C

WTR. TEMP. -360°C

WTR. TEMP. -380°C

WTR. TEMP. -400°C

WTR. TEMP. -420°C

WTR. TEMP. -440°C

WTR. TEMP. -460°C

WTR. TEMP. -480°C

WTR. TEMP. -500°C

WTR. TEMP. -520°C

WTR. TEMP. -540°C

WTR. TEMP. -560°C

WTR. TEMP. -580°C

WTR. TEMP. -600°C

WTR. TEMP. -620°C

WTR. TEMP. -640°C

WTR. TEMP. -660°C

WTR. TEMP. -680°C

WTR. TEMP. -700°C

WTR. TEMP. -720°C

WTR. TEMP. -740°C

WTR. TEMP. -760°C

WTR. TEMP. -780°C

WTR. TEMP. -800°C

WTR. TEMP. -820°C

WTR. TEMP. -840°C

WTR. TEMP. -860°C

WTR. TEMP. -880°C

WTR. TEMP. -900°C

WTR. TEMP. -920°C

WTR. TEMP. -940°C

WTR. TEMP. -960°C

WTR. TEMP. -980°C

WTR. TEMP. -1000°C

NO.	H.V. VOLTS	H.V. AMPERES	PHASE CONNECTION O.L.T.C.	REL. SWITCH CONNECTION O.L.T.C.	L.V. VOLTS	L.V. AMPERES
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

MATERIAL OF WINDING : COPPER

PROPERTY OF : M.S. & O.L.T.C.

NOTE:-

1. (P) ACTUAL FIGURES SHALL BE MARKED AT THE TIME OF DESIGNING.

2. HON & THERMISTS OF WINDING FLUX --- X --- AND THE INTERNAL ---

NAME OF MANUFACTURE

RATING & TERMINAL MARKING PLATE

FOR --- KVA, --- KV POWER TRANSFORMER

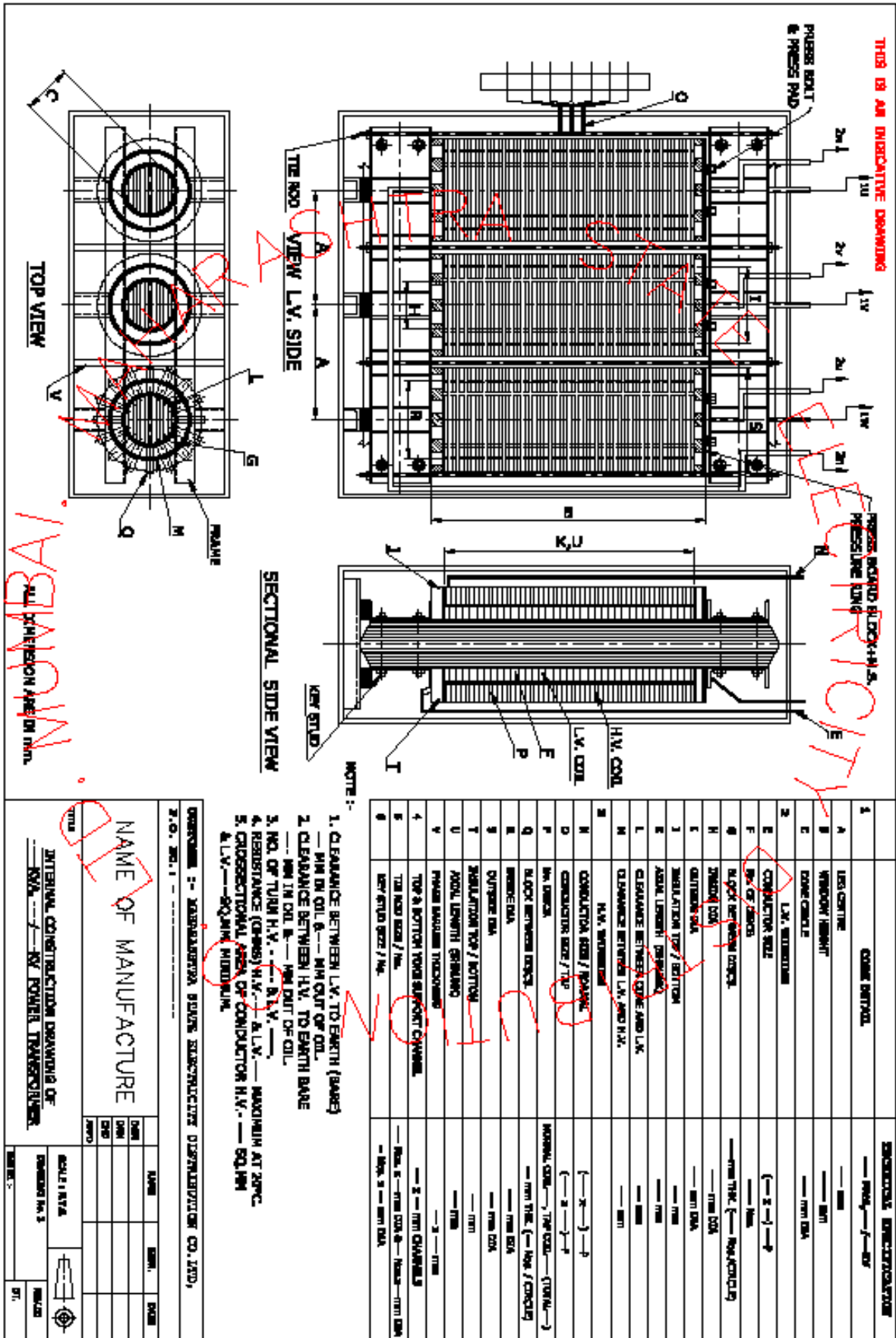
ALL DIMENSIONS ARE IN MM.

NO. _____

DATE _____

DATE _____

NO. _____



MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO.

MUMBAI.

0000

THIS IS AN INDICATIVE DRAWING

TYPE NO.	01	02	03	04	05	06	07	08	09	10	11	12
WIDTH												
STACK												
AREA												
TOTAL CONE SECTION AREA = mm ² _____												
EFFECTIVE CONE AREA = $\pi \times R_1 \times R_2 \times H$ mm ² _____												
FLUR DENSITY CALCULATION = $\frac{11000 \times 10^9}{\sqrt{3} \times 6.6 \times 10^3 \times 2} \times \frac{1}{\pi \times R_1 \times R_2 \times H}$ TURNS												

CONSTRUCTION :- MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.,
 P.O. NO. 1 - _____

NAME OF MANUFACTURE _____

SCALE: A1:X _____

DATE: _____

BY: _____

		AS SPECIFIED	AS OFFERED	ELECTRICITY			
				AS SPECIFIED	AS OFFERED	AS OFFERED EQUIPMENT	
				H.V. OL.	L.V. OL.	H.V.	L.V.
01	PRIMARY VOLTAGE (KV)	AS SPECIFIED	AS OFFERED				
02	SECONDARY VOLTAGE (KV)			NOT SPECIFIED	NOT SPECIFIED		
03	RAATING (KVA)			NOT SPECIFIED	NOT SPECIFIED	—(—)MVA.	—(—)MVA.
04	VECTOR GROUP	DYN11	DYN11			—(—)MVA.	—(—)MVA.
05	CONNECTION TO	DS-2025	DS-2025				
06	PER. VISIBLE VOLTAGE FLUCTUATION %					— sqmm (sqm.)	— sqmm (sqm.)
07	TEMP. OF TOP OIL (MAX. °C)						
08	TEMP. OF WINDING (MAX. °C)						
CORE DETAILS							
09	a) CORE MATERIAL			KRAFT PAPER	KRAFT PAPER		
	b) PRINCIPAL SOURCE OF CORE MATERIAL	NOT SPECIFIED		2 (SQA.K.)	2 (SQA.K.)		
10	c) GAUGE OF LAMINATION			NOT SPECIFIED	NOT SPECIFIED	-	-
	d) FLUX DENSITY	1.55 MAX.		NOT SPECIFIED	NOT SPECIFIED	-	-
	e) NO. OF STIRS	NOT SPECIFIED		NOT SPECIFIED	NOT SPECIFIED	-	-
11	f) % DIFFERENCE	— ± 13 TOL.		NOT SPECIFIED	NOT SPECIFIED	-	-
	g) CORE DIMENSION					- (OHMS)	- (OHMS)
12	WINDING						
	a) MATERIAL						
	b) SPECIFIC CONDUCTIVITY						
	c) conductor size mm/mm (GAUGE)						
	d) conductor cross section mm²						
	e) insulation MATERIAL						
	f) CURRENT DENSITY A/mm²						
	g) NO. OF TURNS						
	h) OUTER DIMENSION mm						
	i) INSIDE DIMENSION mm						
	j) axial length mm (SHIELD)						
	k) NO. OF COILS PER PHASE						
	l) RESISTANCE PER PHASE AT 20°C						
13	NON-LOSSAGE DISTANCE OF RESIDUES			AS SPECIFIED	AS OFFERED		
	a) LOSSES			28 mVA/KVA	28 mVA/KVA		
	b) NO LOAD LOSSES W/m²						
	c) FULL LOAD LOSSES AT 75°C						
14	TANK						
	a) SIDE WALL THICKNESS mm						
	b) TOP & BOTTOM FLANGE THICKNESS mm						
	c) OIL USED						
	d) NAME OF MANUFACTURE	NOT SPECIFIED					
	e) GAUGE	NOT SPECIFIED					
	f) VOLUME (LITERS)						
	g) IN TANK OIL	NOT SPECIFIED					
	h) IN CONSERVATOR	NOT SPECIFIED					
	i) TOTAL						
15	BREATHERS						
	a) NAME	NOT SPECIFIED					
	b) CAPACITY						
16	DETAILED HEAT DISSIPATION CALCULATION			TO BE ENCLOSED			

THIS IS AN INDICATIVE DRAWING

MUMBAI. MAHARASHTRA

CONSUMER :- MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.,
 P.O. NO. :-

NAME OF MANUFACTURE

TECHNICAL DETAILS OF
 KVA, / POWER TRANSFORMER

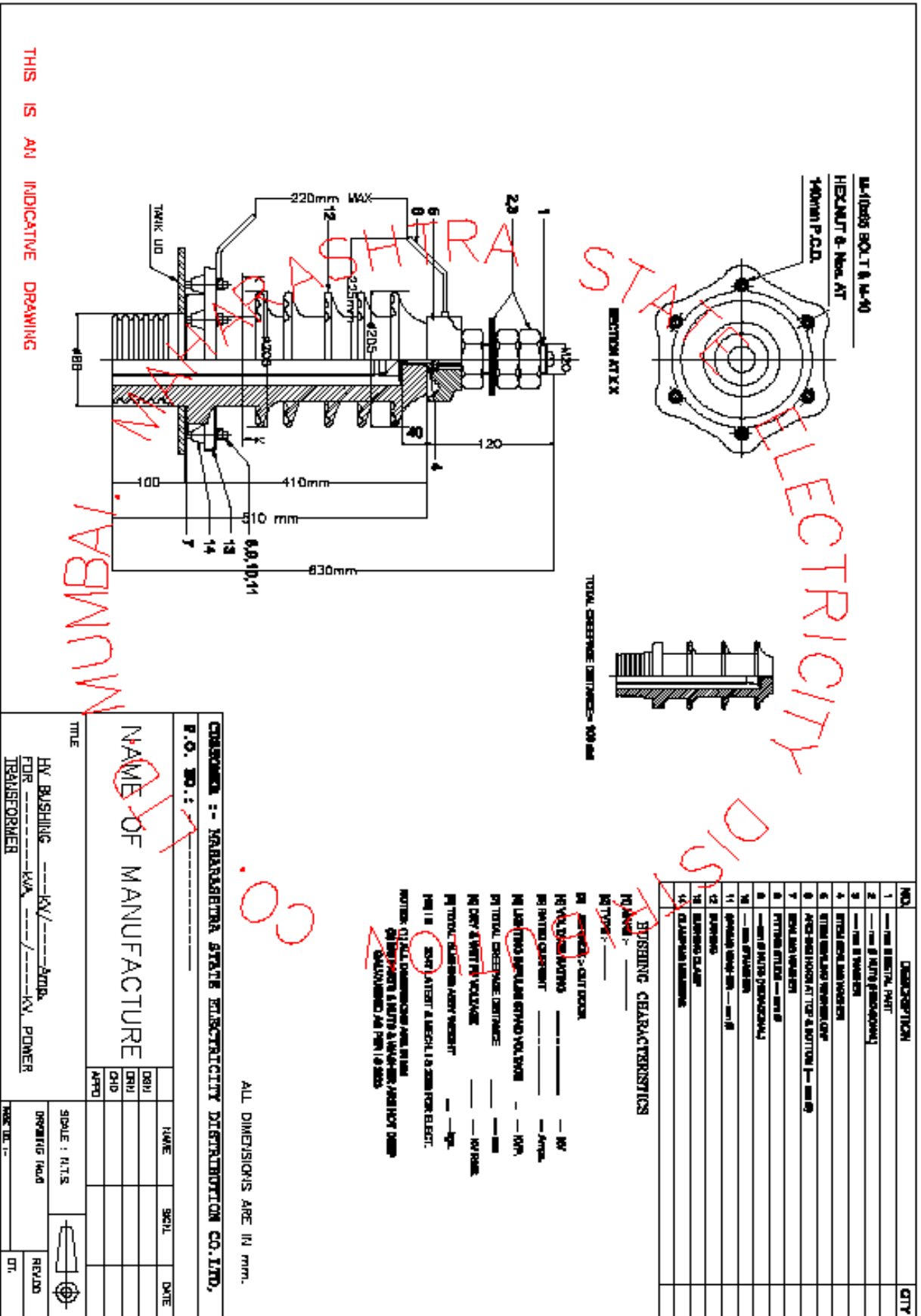
DATE
 DATE
 DATE

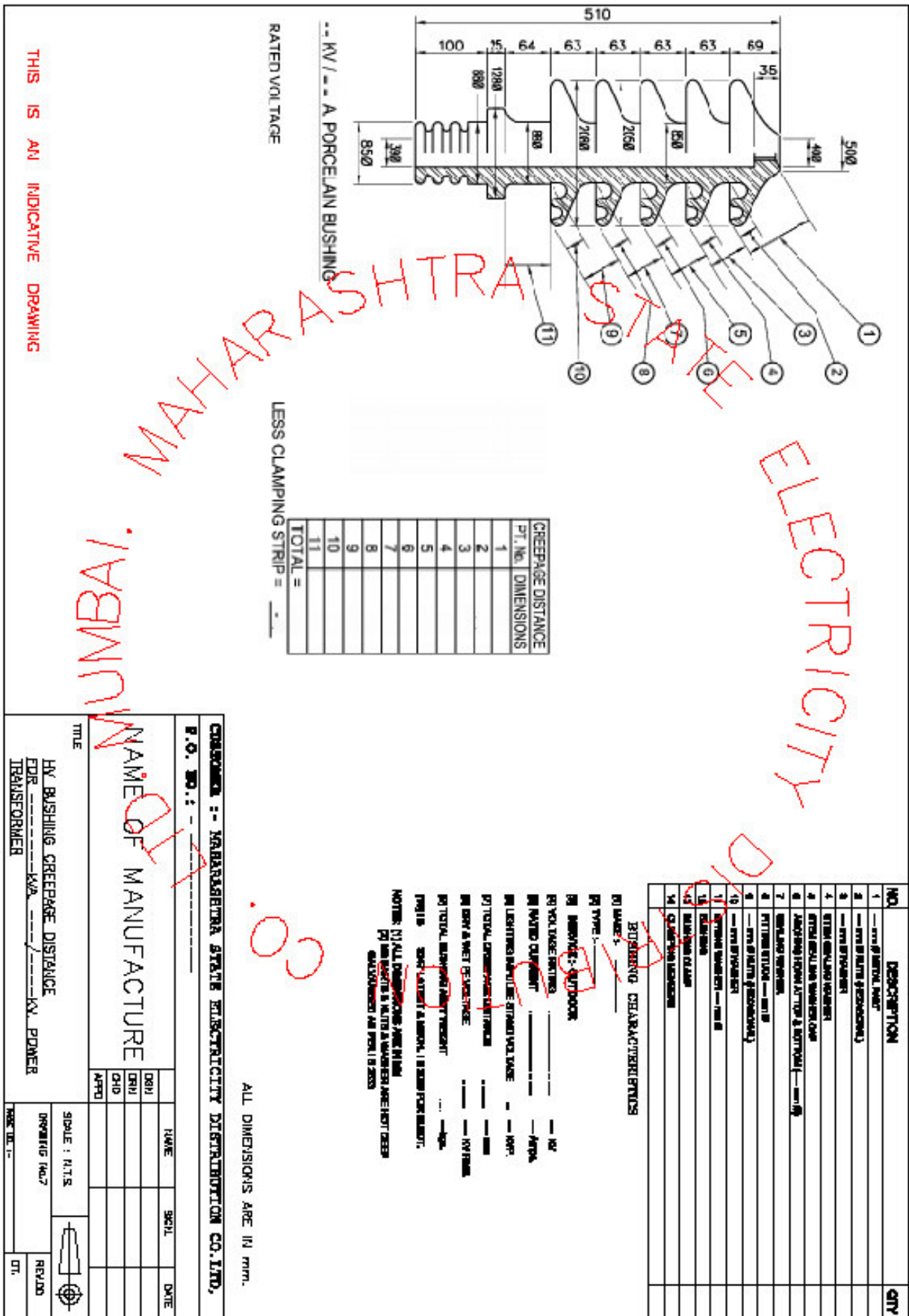
SCALE 1:1750

DRAWING No. 9

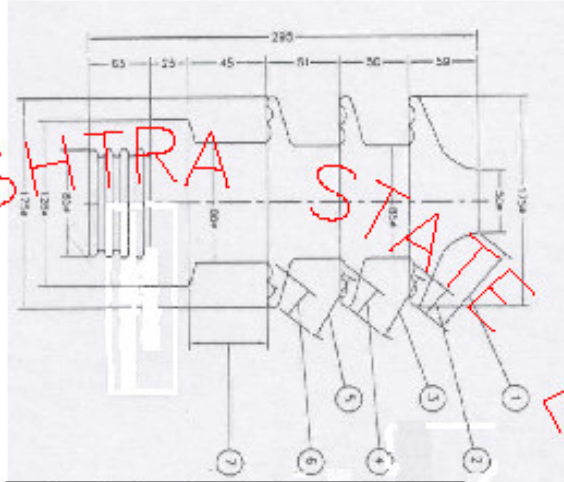
DR.

ALL DIMENSIONS ARE IN MM.





THIS IS AN INDICATIVE DRAWING



PT. NO.	DIMENSIONS	CREEPAGE DISTANCE
1		
2		
3		
4		
5		
6		
7		
TOTAL =		-----

ELECTRICITY

MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.

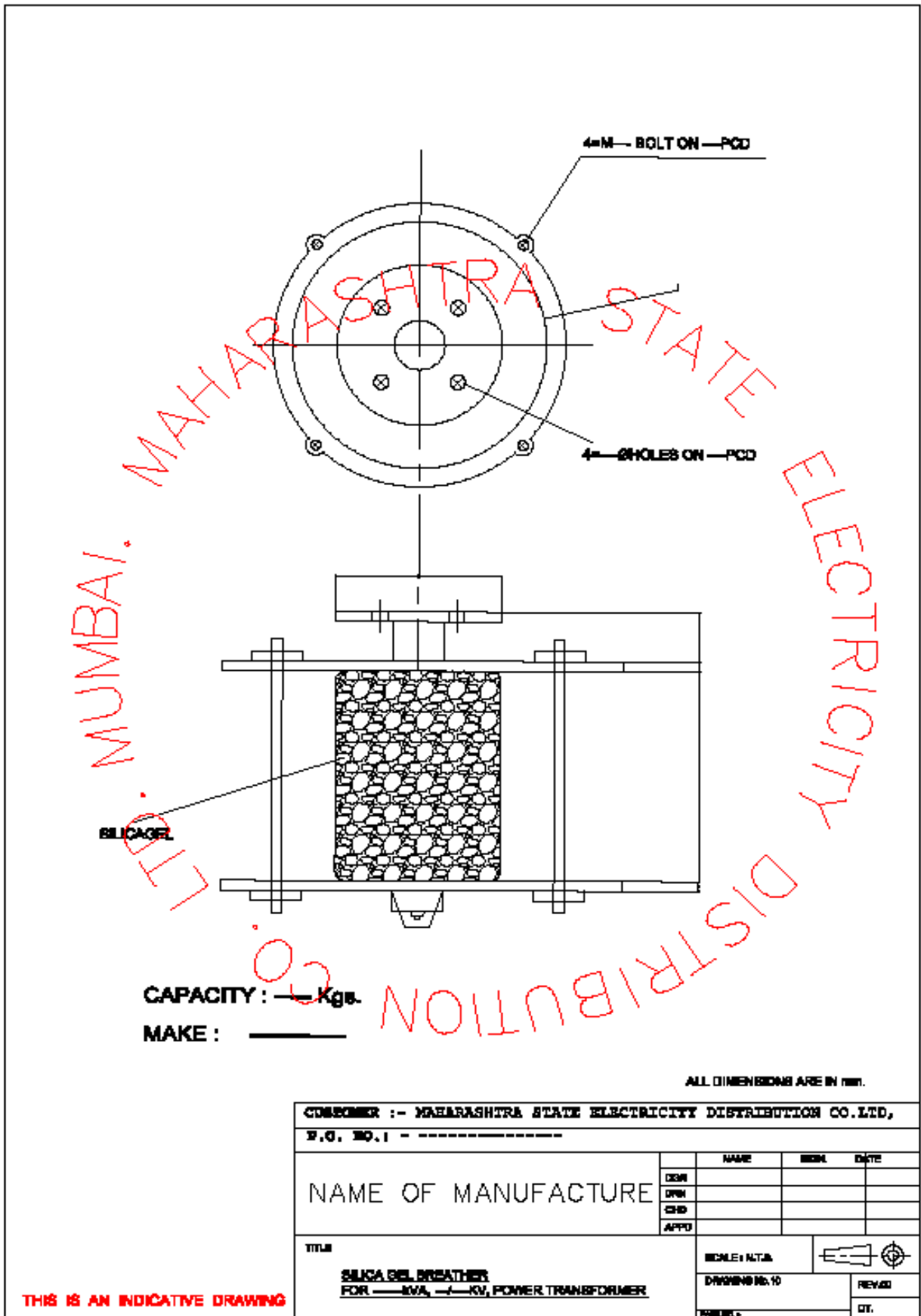
JAMBUNAMBAI

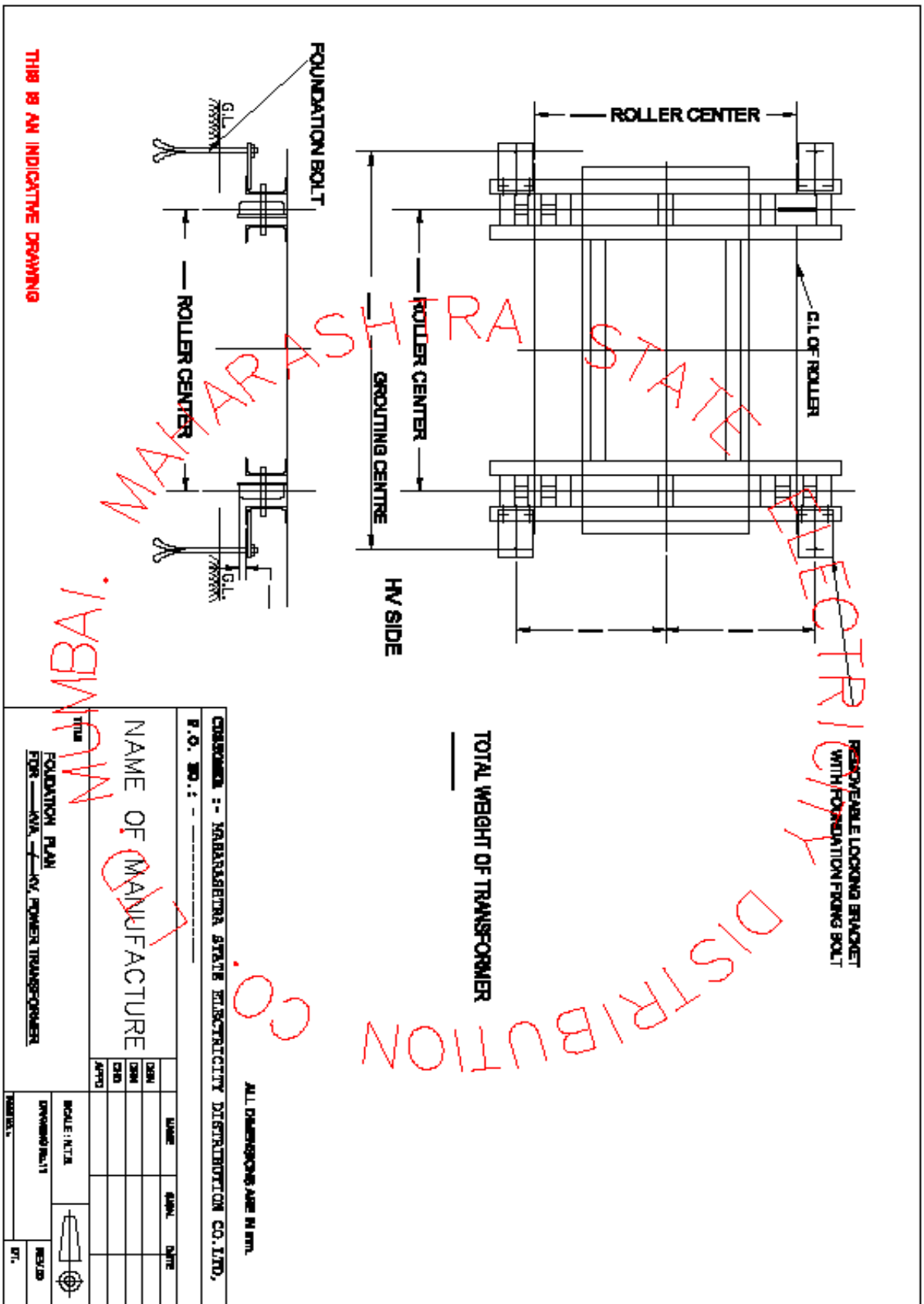
NO.	DESCRIPTION	QTY
1	--- FOR THE TOP OF THE BUSHING	
2	--- FOR THE MIDDLE OF THE BUSHING	
3	--- FOR THE BOTTOM OF THE BUSHING	
4	--- FOR THE BASE OF THE BUSHING	
5	--- FOR THE BASE OF THE BUSHING	
6	--- FOR THE BASE OF THE BUSHING	
7	--- FOR THE BASE OF THE BUSHING	
8	--- FOR THE BASE OF THE BUSHING	
9	--- FOR THE BASE OF THE BUSHING	
10	--- FOR THE BASE OF THE BUSHING	
11	--- FOR THE BASE OF THE BUSHING	
12	--- FOR THE BASE OF THE BUSHING	
13	--- FOR THE BASE OF THE BUSHING	
14	--- FOR THE BASE OF THE BUSHING	

BUSING CHARACTERISTICS
 Material: ---
 PT. NO. 1: ---
 PT. NO. 2: ---
 PT. NO. 3: ---
 PT. NO. 4: ---
 PT. NO. 5: ---
 PT. NO. 6: ---
 PT. NO. 7: ---
 PT. NO. 8: ---
 PT. NO. 9: ---
 PT. NO. 10: ---
 PT. NO. 11: ---
 PT. NO. 12: ---
 PT. NO. 13: ---
 PT. NO. 14: ---

CONSUMER :- KARNATAKA STATE ELECTRICITY DISTRIBUTION CO. LTD.,
 P.O. NO. :-
 NAME OF MANUFACTURE
 TITLE
 L.V. BUSHING CREEPAGE DISTANCE
 FOR --- KVA --- KV. PIONEER
 TRANSFORMER
 SCALE : 1:1.5
 DRAWING No. 08
 REVISED
 DT.

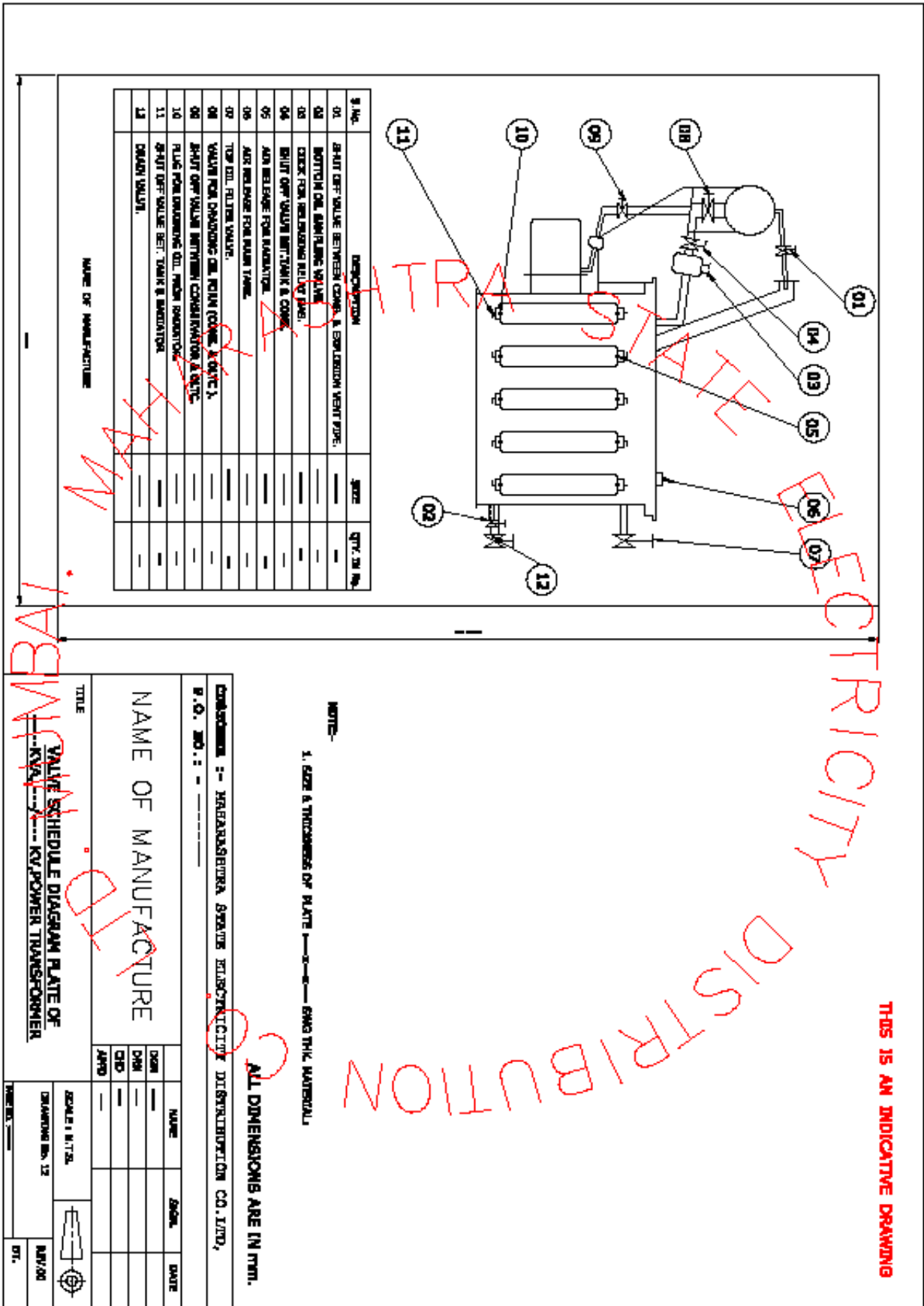
ALL DIMENSIONS ARE IN MM.

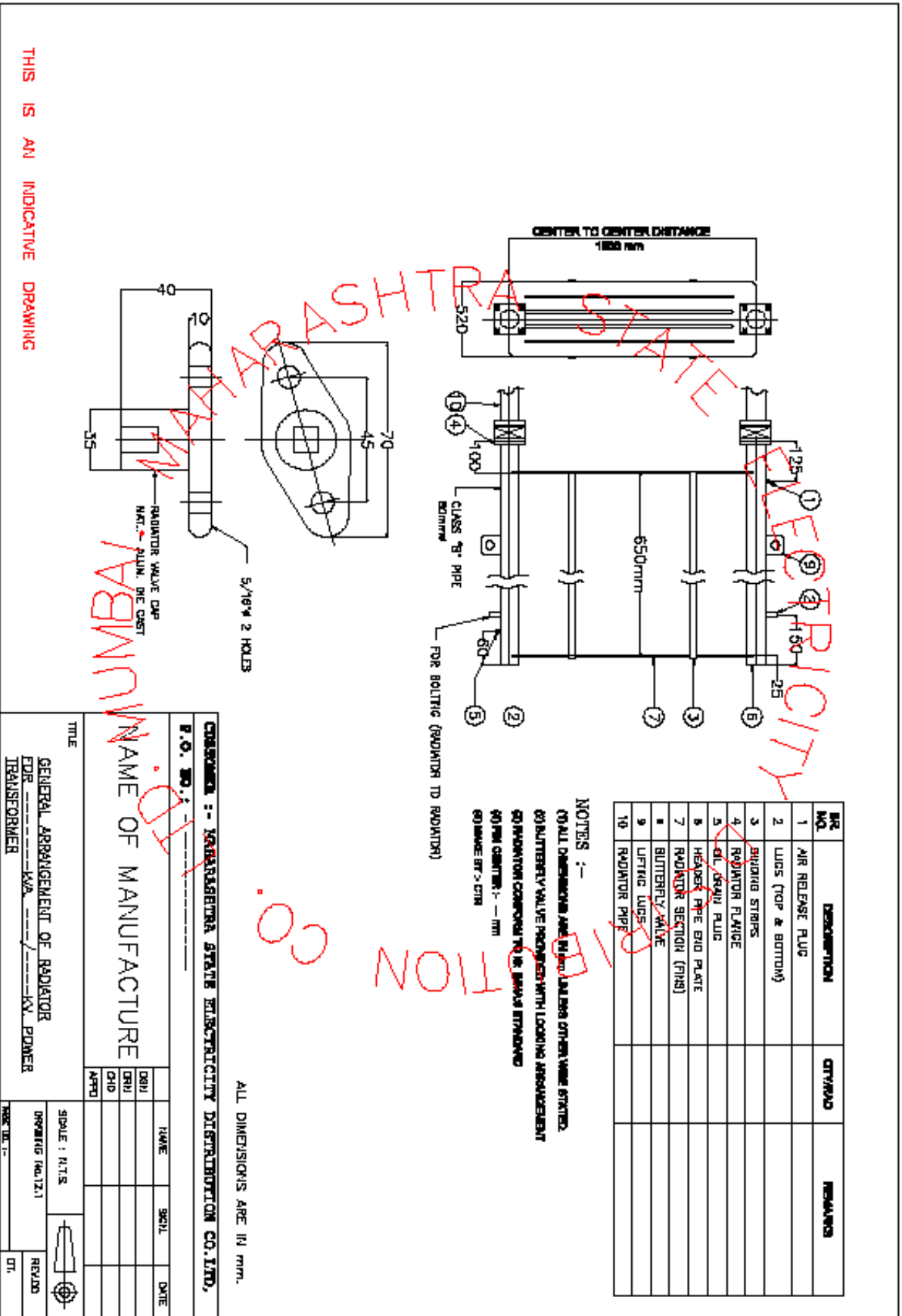




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MUMBAI. MAHARASHTRA STATE ELECTRICITY DISTRIBUTION Co. Ltd.





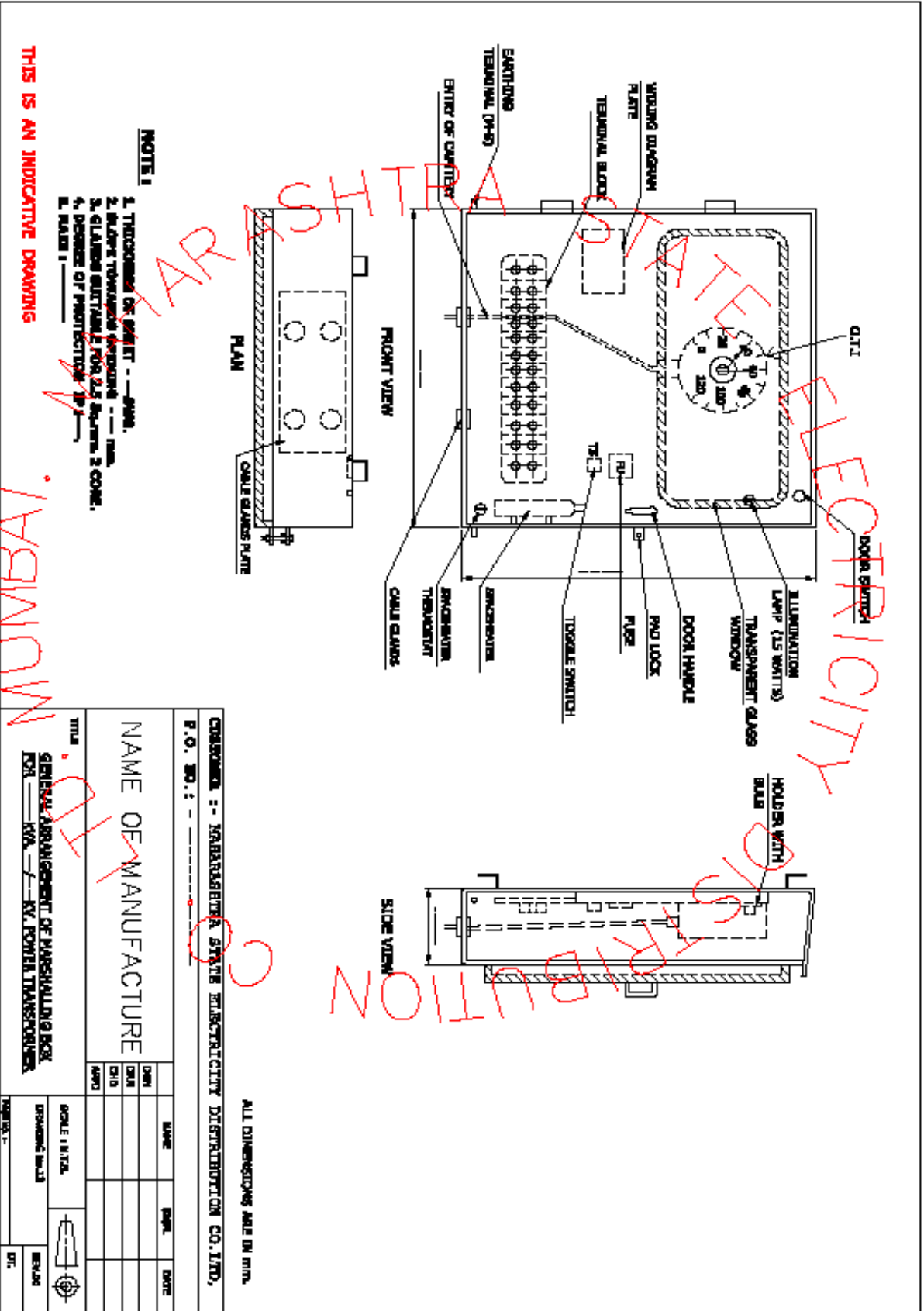
SR NO.	DESCRIPTION	QTY/NO	REMARKS
1	AIR RELEASE FLUG		
2	LUGS (TOP & BOTTOM)		
3	BRIDING STRIPS		
4	RADIATOR FLANGE		
5	OIL SEAL FLUG		
6	HEADER PIPE END PLATE		
7	RADIATOR SECTION (FINN)		
8	BUTTERFLY VALVE		
9	LIFTING LUGS		
10	RADIATOR PIPE		

NOTES :-
 (0) ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
 (0) BUTTERFLY VALVE PROVIDED WITH LOCKING ARRANGEMENT
 (0) RADIATOR CONNECTION TO BE BRASS STANDARD
 (0) FINN CENTER - - - MM
 (0) LUGS BT > 50MM

ALL DIMENSIONS ARE IN MM.

COMPANED :- KARNATAK STATE ELECTRICITY DISTRIBUTION CO. LTD.,
 B.O. NO. _____
 NAME OF MANUFACTURE _____
 TITLE: GENERAL ARRANGEMENT OF RADIATOR
 FOR _____ KV POWER TRANSFORMER
 SCALE: 1:1.5
 DRAWING No. 12.1
 DATE: _____

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THIS IS AN INDICATIVE DRAWING

NOTE :

- 1. THICKNESS OF SHEET - —mm.
- 2. SLANT TOWARDS FORWARD - —mm.
- 3. GLASSE SUITABLE FOR 2.5 AMPERE 2 CORE.
- 4. DEGREE OF PROTECTIVE IP —
- 5. NAAM :- —

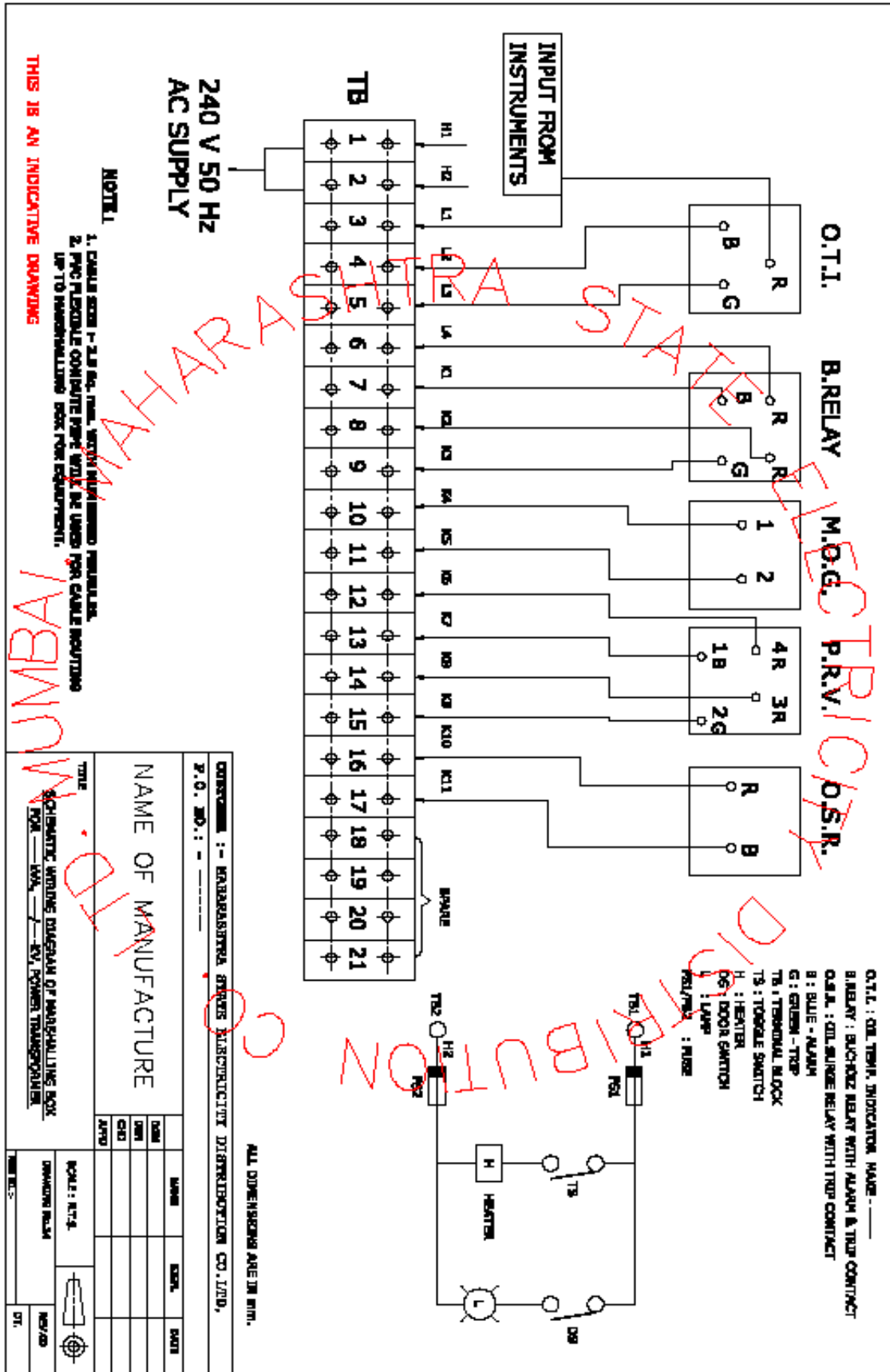
CONSUMER :- VARANASIHATA STATE ELECTRICITY DISTRIBUTION CO. LTD.

F.O. NO. : -

ALL DIMENSIONS ARE IN MM.

NAME OF MANUFACTURE		DATE	DATE

<p style="text-align: center;">TITLE</p> <p style="text-align: center;">GENERAL ARRANGEMENT OF MANUFACTURING BOX FOR KV / KV_A POWER TRANSFORMER</p>	<p style="text-align: center;">SCALE 1:1/10</p> <p style="text-align: center;">DRAWING No. 1.3</p>
<p style="text-align: center;">NO.</p> <p style="text-align: center;">REV.</p>	<p style="text-align: center;">REVISION</p>



CTR

ON LOAD TAPCHANGER

LICENCE: ENGLISH ELECTRIC, ENGLAND.

TYPE S.F.Nr. YEAR

CTR Q.A.Nr. CUSTOMER W.O.Nr.

MOTOR V 50 HZ CONTROL V 50 HZ

SERVICE VOLTAGE KV NORMAL WORKING CURRENT A
MAX. RATED THROUGH CURRENT A

PHASES 3 FREQUENCY 50 HZ STEPS STEP VOLTAGE V

WEIGHTS/VOLUME

TAPCHANGER WITHOUT OIL Kg TOTAL Kg

OIL Kg LITRES

THIS TAPCHANGER IS SUITABLE FOR DIRECTION OF POWERFLOW TO THE EXTENT SHOWN BELOW.

HV TO LV % LV TO HV %

MAKERS: MANUFACTURING INDUSTRIES LIMITED. IS:846B
POONA 411014 INDIA.

DISTRIBUTION

MAHARASHTRA

BOMBAY

CONSUMER :- KANARABETHA STATE ELECTRICITY DISTRIBUTION CO. LTD.,
P.O. NO. :- 7

NAME OF MANUFACTURE

DATE	SCALE	DATE
DRU		
GRU		
GRD		
APRD		

TITLE:

SCALE: 1:1.5

DATE:

REVISION:

DT:

ALL DIMENSIONS ARE IN mm.

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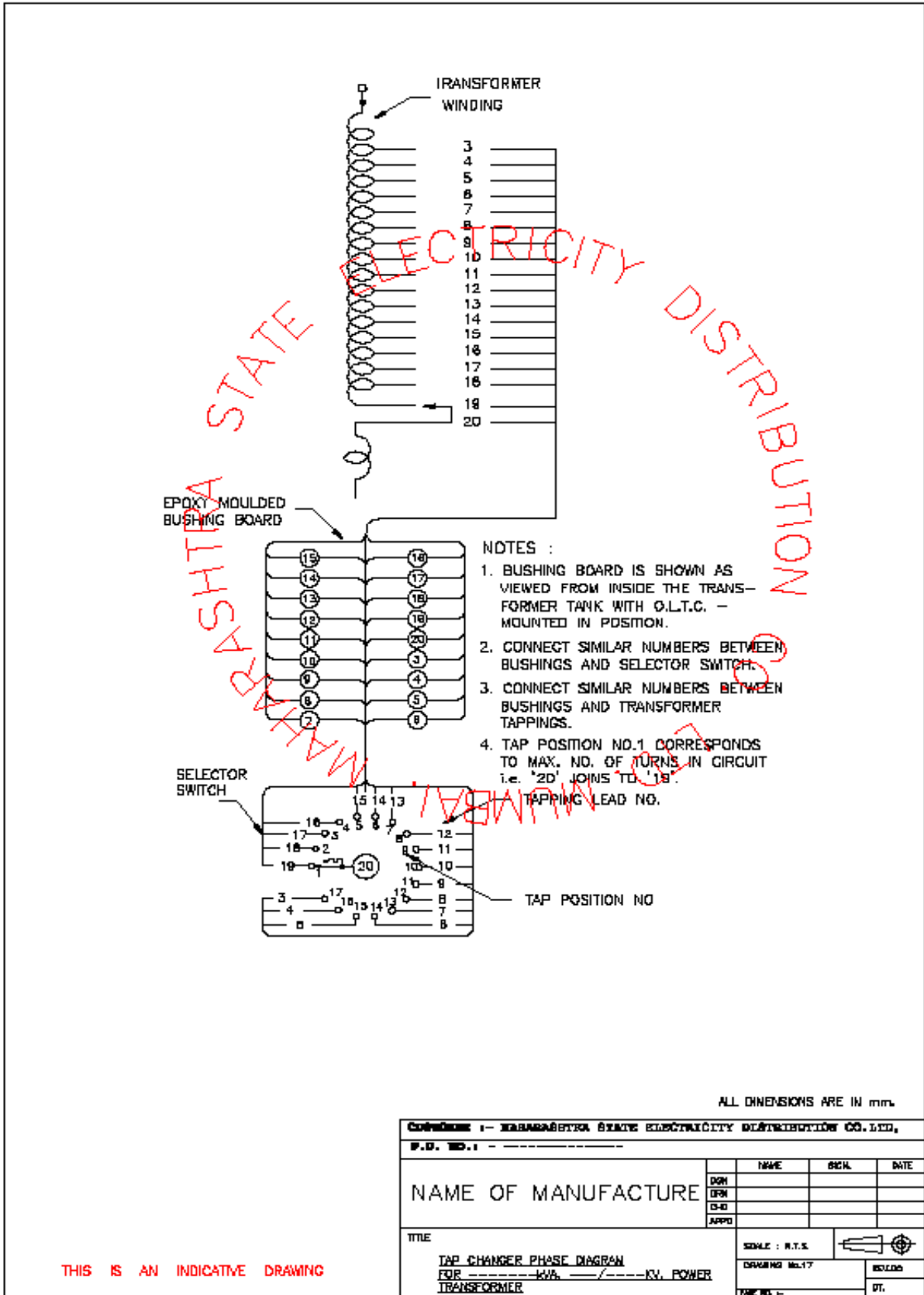
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MAHARASHTRA ELECTRICITY DISTRIBUTION

OIL CONTENT & WEIGHT	NO. (APPROX.)
TOTAL WEIGHT INCLUDING OIL :	
OIL QUANTITY :	LITRE (APPROX.)

ALL DIMENSIONS ARE IN mm.

CONSUMER :- KARNATAKETA STATE ELECTRICITY DISTRIBUTION CO. LTD.			
P.O. NO. :-			
NAME OF MANUFACTURE			
TITLE		DATE	SCALE
GENERAL ARRANGEMENT OF TAP CHANGER FOR 220 KV POWER TRANSFORMER			
DRW	CHKD	DATE	SCALE
APPRO			
SIGNATURE : R.T.S.			
DRAWING NO. 10			
MARK NO. 1-			DT.



THIS IS AN INDICATIVE DRAWING

INDICATES INTER-CONNECTION BETWEEN TWO DIETS & RINGS
 INDICATES INTER-CONNECTION BETWEEN TWO DIETS &

ELECTRICAL

- NOTES**
1. NAME AND LOWER REFER TO TAP NUMBERS.
 2. ALL EQUIPMENT IS IN NORMAL OPERATIONAL TAP CHANGERS EXCEPT OF TAP TR-1 & TR-2 WHICH ARE IN ACTUAL TAP CHANGERS.
 3. THE CHANGES SHOULD BE MADE IN PARALLEL.
 4. CORRECT PHASE SEQUENCE R-Y-B IS ESSENTIAL FOR CONNECTING SUPPLY TERMINALS FROM ALLIED UNIT.
 5. TO ISOLATE RIGID SELECTORS TO TAP POSITION, FOR COMPLETE ISOLATION OF MAINTENANCE EQUIPMENT FROM TAP CHANGERS, THE TAP POSITION SHOULD BE IN 'OFF' POSITION IN ORDER TO ISOLATE ITS TRIPWIRE CIRCUIT FROM OTHER UNIT.
 6. FOR CHECKING LOCAL ELECTRICAL OPERATIONS OF TAP-CHANGERS WHEN TAP IS IN 'OFF' POSITION, THE FOLLOWING WIRING (a) TAP & (b) TAP TR-1 & TAP TR-2 ARE TO BE MADE.
 7. TAP TR-1 & TAP TR-2 ARE USED FOR CONNECTIONS FROM OF TAP CHANGERS TO TAP CHANGERS WHEN BOTH TAP TR-1'S ARE CONNECTED IN PARALLEL.

KEY TO DIAGRAM

NO	LOCATION - T.C. - TAP CHANGER	DESCRIPTION
TR-1	TRIP SWITCH	TRIP SWITCH
TR-2	TRIP SWITCH	TRIP SWITCH
TR-3	TRIP SWITCH	TRIP SWITCH
TR-4	TRIP SWITCH	TRIP SWITCH
TR-5	TRIP SWITCH	TRIP SWITCH
TR-6	TRIP SWITCH	TRIP SWITCH
TR-7	TRIP SWITCH	TRIP SWITCH
TR-8	TRIP SWITCH	TRIP SWITCH
TR-9	TRIP SWITCH	TRIP SWITCH
TR-10	TRIP SWITCH	TRIP SWITCH
TR-11	TRIP SWITCH	TRIP SWITCH
TR-12	TRIP SWITCH	TRIP SWITCH
TR-13	TRIP SWITCH	TRIP SWITCH
TR-14	TRIP SWITCH	TRIP SWITCH
TR-15	TRIP SWITCH	TRIP SWITCH
TR-16	TRIP SWITCH	TRIP SWITCH
TR-17	TRIP SWITCH	TRIP SWITCH
TR-18	TRIP SWITCH	TRIP SWITCH
TR-19	TRIP SWITCH	TRIP SWITCH
TR-20	TRIP SWITCH	TRIP SWITCH
TR-21	TRIP SWITCH	TRIP SWITCH
TR-22	TRIP SWITCH	TRIP SWITCH
TR-23	TRIP SWITCH	TRIP SWITCH
TR-24	TRIP SWITCH	TRIP SWITCH
TR-25	TRIP SWITCH	TRIP SWITCH
TR-26	TRIP SWITCH	TRIP SWITCH
TR-27	TRIP SWITCH	TRIP SWITCH
TR-28	TRIP SWITCH	TRIP SWITCH
TR-29	TRIP SWITCH	TRIP SWITCH
TR-30	TRIP SWITCH	TRIP SWITCH
TR-31	TRIP SWITCH	TRIP SWITCH
TR-32	TRIP SWITCH	TRIP SWITCH
TR-33	TRIP SWITCH	TRIP SWITCH
TR-34	TRIP SWITCH	TRIP SWITCH
TR-35	TRIP SWITCH	TRIP SWITCH
TR-36	TRIP SWITCH	TRIP SWITCH
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TR-38	TRIP SWITCH	TRIP SWITCH
TR-39	TRIP SWITCH	TRIP SWITCH
TR-40	TRIP SWITCH	TRIP SWITCH
TR-41	TRIP SWITCH	TRIP SWITCH
TR-42	TRIP SWITCH	TRIP SWITCH
TR-43	TRIP SWITCH	TRIP SWITCH
TR-44	TRIP SWITCH	TRIP SWITCH
TR-45	TRIP SWITCH	TRIP SWITCH
TR-46	TRIP SWITCH	TRIP SWITCH
TR-47	TRIP SWITCH	TRIP SWITCH
TR-48	TRIP SWITCH	TRIP SWITCH
TR-49	TRIP SWITCH	TRIP SWITCH
TR-50	TRIP SWITCH	TRIP SWITCH
TR-51	TRIP SWITCH	TRIP SWITCH
TR-52	TRIP SWITCH	TRIP SWITCH
TR-53	TRIP SWITCH	TRIP SWITCH
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TR-66	TRIP SWITCH	TRIP SWITCH
TR-67	TRIP SWITCH	TRIP SWITCH
TR-68	TRIP SWITCH	TRIP SWITCH
TR-69	TRIP SWITCH	TRIP SWITCH
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TR-79	TRIP SWITCH	TRIP SWITCH
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TR-90	TRIP SWITCH	TRIP SWITCH
TR-91	TRIP SWITCH	TRIP SWITCH
TR-92	TRIP SWITCH	TRIP SWITCH
TR-93	TRIP SWITCH	TRIP SWITCH
TR-94	TRIP SWITCH	TRIP SWITCH
TR-95	TRIP SWITCH	TRIP SWITCH
TR-96	TRIP SWITCH	TRIP SWITCH
TR-97	TRIP SWITCH	TRIP SWITCH
TR-98	TRIP SWITCH	TRIP SWITCH
TR-99	TRIP SWITCH	TRIP SWITCH
TR-100	TRIP SWITCH	TRIP SWITCH

MAHARASHTRA
 NUNBAI.

ALL DIMENSIONS ARE IN MM.

CONTRACTOR :- MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.,
 P.O. NO. :-

NAME OF MANUFACTURE

NO	NAME	QTY	DATE
DBH			
DRU			
CHD			
APFD			

TITLE

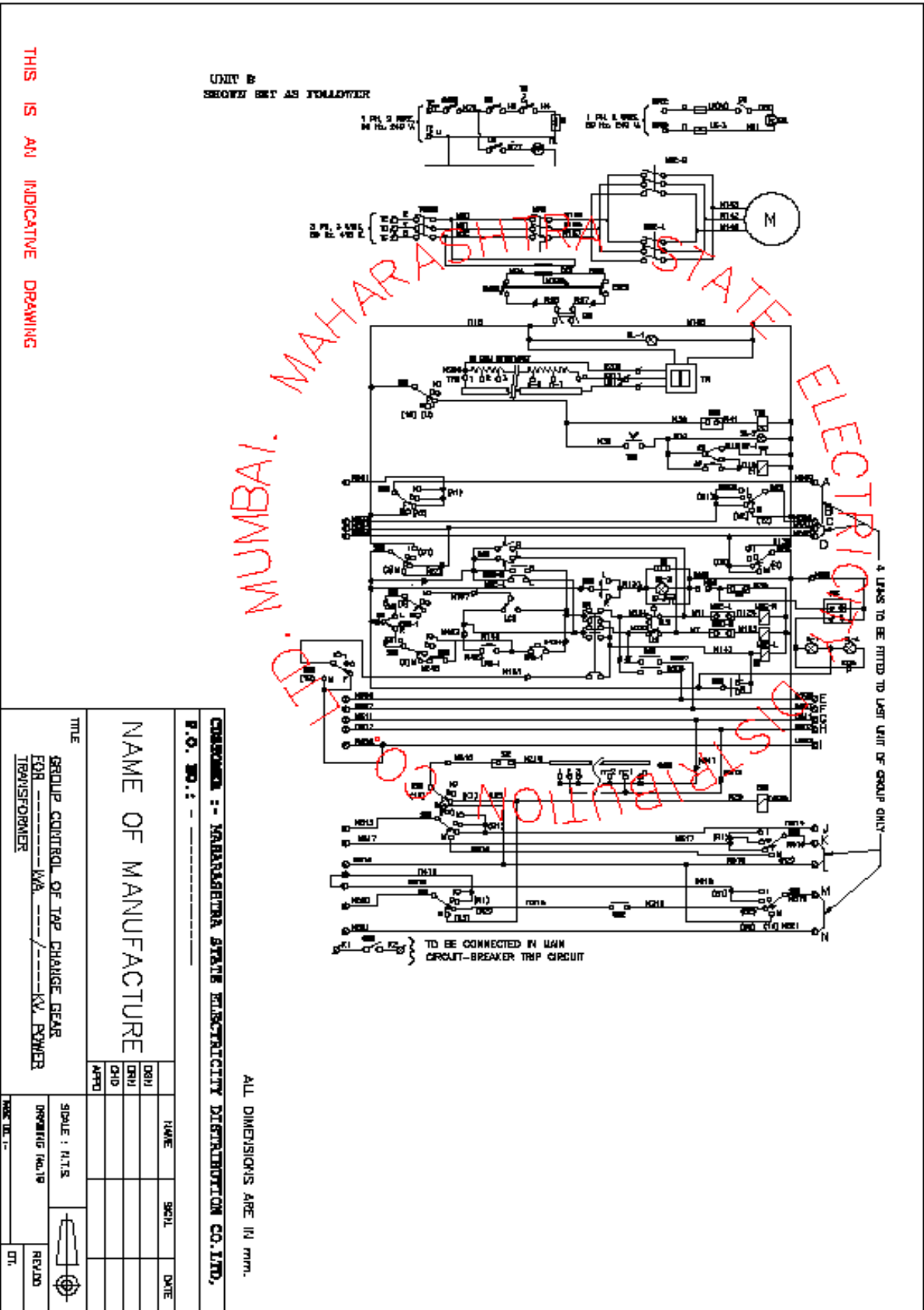
GROUP CONTROL OF TAP CHANGE GEAR
 FOR 11KV POWER TRANSFORMER

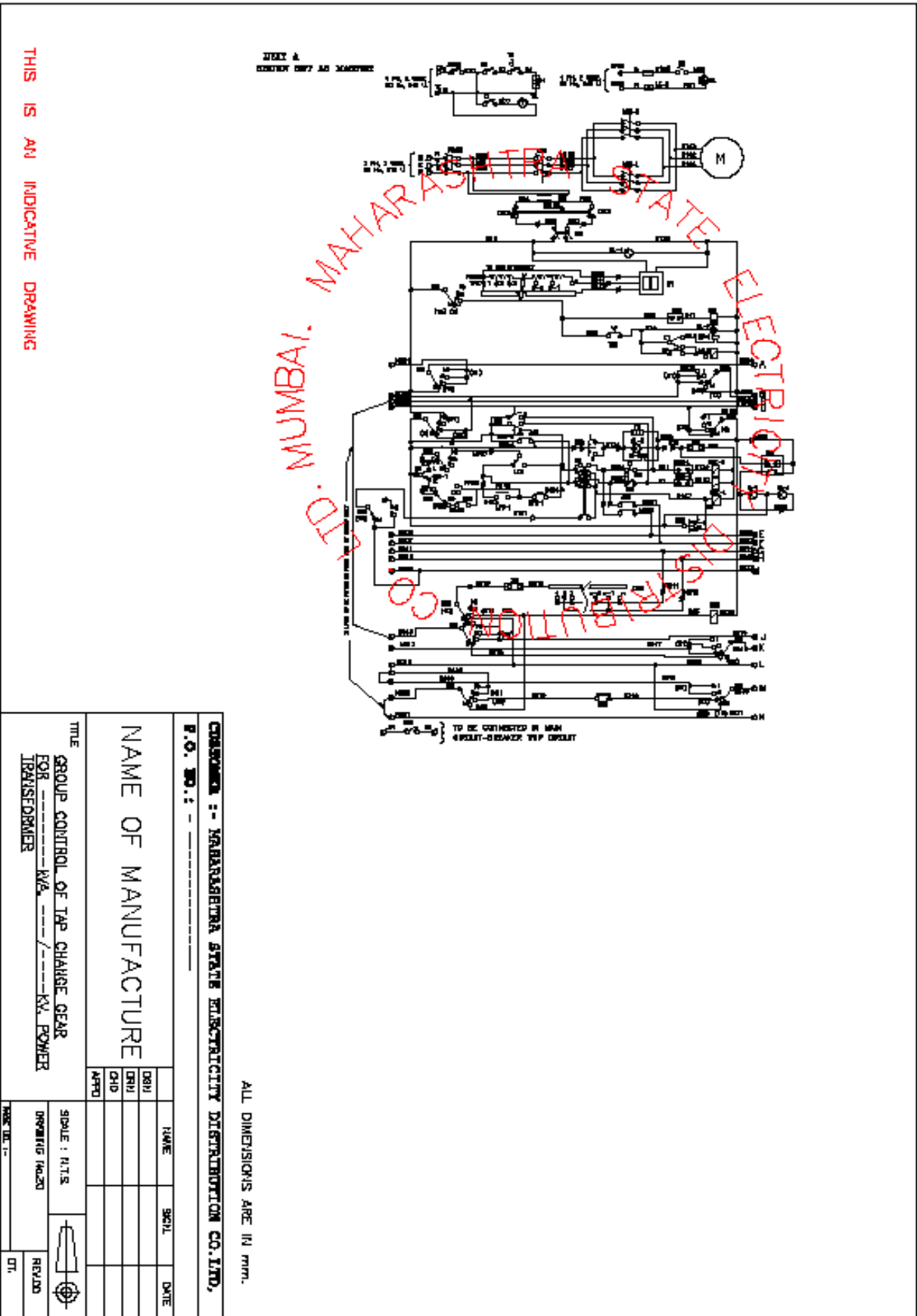
SCALE : 1:1.75

DRAWING NO. 18

REVISED

DATE

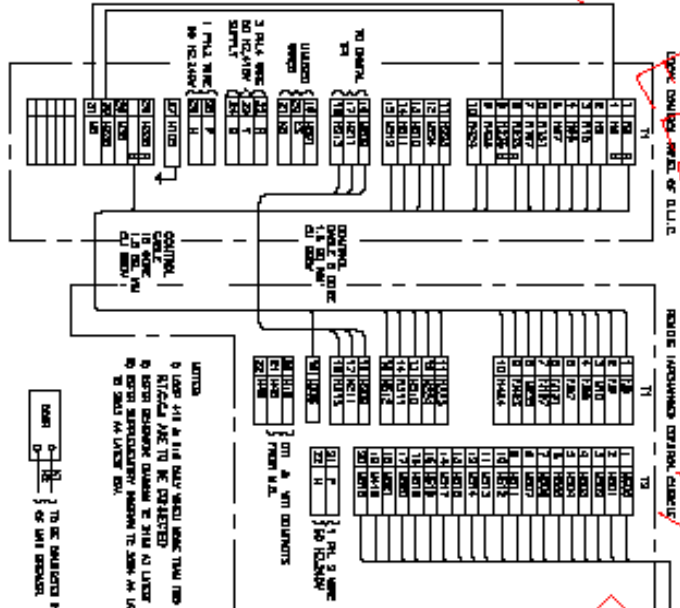




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MAHARASHTRA STATE ELECTRICITY
MUMBAI.



NOTES:
 1. GROUP 1 & 2 ARE TO BE CONNECTED IN THE CIRCUIT
 2. GROUP 3 & 4 ARE TO BE CONNECTED IN THE CIRCUIT

REF. NO.	DESCRIPTION	UNIT
1	GROUP 1	NO.
2	GROUP 2	NO.
3	GROUP 3	NO.
4	GROUP 4	NO.
5	GROUP 5	NO.
6	GROUP 6	NO.
7	GROUP 7	NO.
8	GROUP 8	NO.
9	GROUP 9	NO.
10	GROUP 10	NO.
11	GROUP 11	NO.
12	GROUP 12	NO.
13	GROUP 13	NO.
14	GROUP 14	NO.
15	GROUP 15	NO.
16	GROUP 16	NO.
17	GROUP 17	NO.
18	GROUP 18	NO.
19	GROUP 19	NO.
20	GROUP 20	NO.
21	GROUP 21	NO.
22	GROUP 22	NO.

CONSUMER :- MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.,

P.O. NO. :-

NAME OF MANUFACTURE

GROUP CONTROL OF TAP CHANGER GEAR FOR --KV. BYWIRE TRANSFORMER

DATE	NAME	SCALE	DATE

SCALE : 1:1

DRAWING NO: 21

REV: 0

DT.

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MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.

MUMBAI.

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Sl. No.	DESCRIPTION	Qty
1	INDICATING LAMP - RED	1
2	INDICATING LAMP - GREEN	1
3	INDICATING LAMP - BLUE	1
4	INDICATING LAMP - STOP	1
5	INDICATING LAMP - STOP	1
6	INDICATING LAMP - STOP	1
7	INDICATING LAMP - STOP	1
8	INDICATING LAMP - STOP	1
9	INDICATING LAMP - STOP	1
10	INDICATING LAMP - STOP	1
11	INDICATING LAMP - STOP	1
12	INDICATING LAMP - STOP	1
13	INDICATING LAMP - STOP	1
14	INDICATING LAMP - STOP	1
15	INDICATING LAMP - STOP	1
16	INDICATING LAMP - STOP	1
17	INDICATING LAMP - STOP	1
18	INDICATING LAMP - STOP	1
19	INDICATING LAMP - STOP	1
20	INDICATING LAMP - STOP	1
21	INDICATING LAMP - STOP	1
22	INDICATING LAMP - STOP	1
23	INDICATING LAMP - STOP	1
24	INDICATING LAMP - STOP	1
25	INDICATING LAMP - STOP	1
26	INDICATING LAMP - STOP	1
27	INDICATING LAMP - STOP	1
28	INDICATING LAMP - STOP	1
29	INDICATING LAMP - STOP	1
30	INDICATING LAMP - STOP	1
31	INDICATING LAMP - STOP	1
32	INDICATING LAMP - STOP	1
33	INDICATING LAMP - STOP	1
34	INDICATING LAMP - STOP	1
35	INDICATING LAMP - STOP	1
36	INDICATING LAMP - STOP	1

ALL DIMENSIONS ARE IN MM.

CONSUMER :- MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.	P.O. NO. :-
NAME OF MANUFACTURE	
TITLE GENERAL ARRANGEMENT OF TAP CHANGER CONTROL PANEL FOR _____KV _____KV POWER TRANSFORMER	SCALE : N.T.S. DRAWING NO. ZZ REV. NO DT.
DATE	DATE

MAHARAJA MAHADEVJI BAI. JABIMANNI ELECTRICAL DISTRIBUTION CO.

ALL DIMENSIONS ARE IN MM.

33	PACKET		
32	INSULATION		
31	TRANSFORMER OIL		
30	COPPER		
29	CONE		
28	AIR RELEASE PLUG		
27	OIL LEVEL GAUGE INDICATING 3 POS. OF OIL MARKED		
26	CONSERVATOR DRAIN VALVE		
25	L.V. OUTDOOR BUSHING 12 KV 630A		
24	H.V. OUTDOOR BUSHING 24 KV 630A		
23	PROJECT FOR OIL		
22	DIAL TYPE OIL MTR. A/T CONTACT		
21	WASHING BOX		
20	THERMOMETRIC POCKET		
19	INSPECTION HOLE WITH COVER		
18	PRESSURE RELIEF VALVE		
17	SHUT OFF VALVE BTHV. COHV. & TOP COVER		
16	DOUBLE FLOAT BUSHING RELAY WITH A/T CONTACT		
15	RADIATOR BATH WITH TOP & BOTTOM SHUT OFF VALVE		
14	ON LOAD TAP CHANGING GEAR WITH OIL SURGE RELAY		
13	ERUPTION VENT WITH EQUALIZER PIPE		
12	DEHYDRATING SUCKER BREAKER		
11	OIL CONSERVATOR WITH OIL FILLING HOLE & LIFTING LUGS		
10	COVER LIFTING LUG		
9	JACKING LUG		
8	HULLING EYES		
7	LIFTING LUG		
6	NAME. PLATING & DISCREW PLATE		
5	OIL SOAKING VALVE WITH FLANGE (TOP & BOTTOM)		
4	OIL FILTER VALVE WITH FLANGE (TOP & BOTTOM)		
3	OIL DRAIN VALVE WITH FLANGE		
2	LIFTER BASE CHANGED WITH W-DIG FLANGED ROLLERS		
1	EARTHING TERMINALS WITH DRIMMING LUG		

LIST OF FITTINGS

CONSUMER :- KANARABETNA STATE ELECTRICITY DISTRIBUTION CO. LTD.,		R.O. NO. :-	
NAME OF MANUFACTURE		DATE	APPRO
DATE			
DATE			
DATE			
DATE			

SCALE: 1:10

DRIVING PULLEY

REAR END

DR.

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No.	DESCRIPTION	QTY

MUMBAI. MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.

P.O. NO. 1

CONSUMER :- MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.

NAME OF MANUFACTURE			
DB/1	NAME	SCALE	DATE
DB/2			
DB/3			
DB/4			
APPD			

SCALE : 1:1

PACKING LIST FOR TRANSFORMER KA - 1 KV. PIONEER

DATE

REVISED DT.

ALL DIMENSIONS ARE IN MM.

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