

Technical Specifications Distribution Transformer

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1. Introduction:

- 1.1. UGVCL for their requirement of conversion of 11 kV overhead systems to underground system for Bopal and Ghuma area needs to procure 11000/433V; Oil immersed distribution transformers. UGVCL would like to invite offers from qualified suppliers having a strong R & D and state-of-the art production facilities with adequate experience in supplying distribution transformers in India or comparable emerging countries.
- 1.2. It is not the intent to specify completely herein all the details of the design and construction of material. However the product shall conform in all respects to high standards of engineering, design and workmanship and shall be performing in continuous commercial operation in manner acceptable to the purchaser. The offered material shall be complete with all components necessary for their intended purpose. The design and components shall be deemed to be within the scope of vendor's supply irrespective of whether those are specifically brought out in this specification and/or the commercial order or not.

2. Code & Standards:

- 2.1. All equipment and material shall be designed manufactured and tested in accordance with the latest applicable Indian Standard. IEC standard and CBIP manuals except where modified and / or supplemented this specification.
- 2.2. Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted. In such case copies of English version of the standard adopted shall be submitted.
- 2.3. The Transformer offered shall in general comply with the latest issues including amendments of the following Indian standards but not restricted to it.

Title	I.S. Code	IEC standard
Distribution Transformer	IS: 2026	IEC:60076
Method of construction		IEC:60616
Thermal evaluation & Classification of electrical insulation	IS:1271	--
Fittings and accessories for Distribution Transformer	IS:3639	--
Guide for loading of oil immersed transformer	IS:6600	--
Bushing for alternating voltage	IS:2029	--
Dimension of porcelain transformer bushing	IS:2099 / 3347	--
New insulating oil for transformer & switchgear	IS:335	--

3. System Description:

The distribution transformers shall be installed at outdoor/indoor location along 11 kV distribution networks, which consists of both underground and overhead network. The HV winding would be connected to SFU/OCB/VCB of the ring main unit through 11 kV (E) XLPE/PILC cable. LV winding would be connected to switch type Fuse section pillar through 1.1 kV 1c, 400 sq mm XLPE cable.

4. Design Criteria:

- 4.1. The transformers shall be installed in hot, humid tropical atmosphere. All equipment accessories and wiring shall be provided with tropical finish to prevent fungus growth..

- 4.2. The transformers shall be capable of continuous operation of rated output under the operating conditions of voltage and frequency variations as per statutory limits governed by relevant Indian Standard and Electricity Act-2003 and its amendments in force.
- 4.3. The transformer shall conform to best engineering practice.
- 4.4. The design material construction shall be such that to secure reliability, economy, safe and convenient operation and shall include all specified or unspecified incidental items necessary for similar equipment for convenient working in every respect.
- 4.5. The transformers shall be capable of withstanding the short circuit stresses due to terminal fault between phase to phase and phase to ground on one winding with full voltage maintained on the other windings for a minimum period of three seconds.
- 4.6. The transformers shall be free from annoying hum or vibration. The design shall be such as not to cause any undesirable interference with radio or communication circuits.
- 4.7. Atmospheric Condition: The equipment offered shall be suitable for continuous satisfactory operation in following prevailing climatic conditions.

AHMEDABAD

Ambient Air Temperature	Highest 47° C, Average 35 ° C
Relative humidity	95% Maximum
Rainfall	700 mm
Basic wind speed as IS:875	44 m/sec.
Seismic Zone	3

5. Specific Requirement

- 5.1. Requirement: 11000/433 Volt Oil immersed, 250 kVA & 315 kVA, ONAN cooled, double wound, core type suitable for installation on pad or pole.
- 5.2. Voltage Ratio: No load voltage 11000/433 volts within tolerance as stipulated in IS: 2026.
- 5.3. Rating: The transformer shall have a continuous rating as specified at any of the specified tapping position and with the maximum temperature rise specified. The rated KVA shall be the product of the rated voltage in kV, the corresponding rated current and the phase factor 1.73. When the transformer is operated with the rated primary voltage applied to the terminals of the primary winding, the apparent power (kVA) at the terminals of the secondary winding, when carrying the rated secondary current differs from rated kVA by an amount corresponding to the regulation of the transformer and is the product of the actual secondary voltage, the rated secondary current and phase factor 1.73.
- 5.4. System: 11000 volts A.C., 50 Hz supply, having non-effectively earthed neutral (resistively earthed) system on H V side. The 11 kV systems shall have basic insulation level of 36 kV for one minute / 95 kVp impulse and maximum fault level of 26 kA. 433 Volts A.C, 50 Hz supply shall be rated for 1.1 kV grade and basic insulation of 3 kV for one minute and 7.5 kVp impulse. The variations in input and output supply shall be as per statutory variation governed by relevant Indian Standard and Electricity Act-2003 with latest amendments in force. The L.V. neutral shall be earthed solidly at each transformer substation. The transformers will be connected in a system consisting of both overhead and underground mains. Temperature Rise: The maximum temperature rise at the specified maximum continuous output shall not exceed 40°C by thermometer in the hottest portion of the oil or 50°C measured by resistance of winding above ambient temperature of 47°C.

- 5.5. Type of Load: The transformer shall be suitable for carrying load within temperature rise indicated in the Indian Standard specification IS: 6600 'Guide for loading of oil immersed Transformer'.
- 5.6. Overloads: The transformers shall be suitable for carrying overload within temperature rise indicated in IS: 6600 'Guide for Loading of oil immersed Transformer'.
- 5.7. Connections: H.V. Delta and L.V Star connected with neutral brought out on the secondary side for connection to earth; Vector group DYn11 of IS: 2026.

6. Tank :

- 6.1. The transformer tank and cover shall be fabricated from robust M.S. plate steel without pitting and shall have adequate thickness (Top cover 6 mm min., side plates 5 mm min., Bottom plate 6 mm min.) with either external cooling tubes or radiators as per purchaser's requirement. The tank and cover shall be of welded construction. All seams shall be welded and where practicable they shall be double welded. All edges shall be double welded. The tank wall shall be reinforced by stiffener to ensure rigidity, so that it can withstand without any deformation the mechanical shock during transportation.

Detachable radiators shall be provided. The shut off valves for radiators should be supplied if required by purchaser. All removable covers shall be provided with weatherproof, hot oil resistant, resilient gaskets. The design shall be such as to prevent any leakage of water into or oil from the tank.

- 6.2. The tank shall be subjected to a pressure test of 0.35 kg/cm^2 with hot oil for 12 hours when the transformer is complete with all fittings. During the test average oil temperature shall be maintained at 45°C above Ambient temperature throughout test period by circulating suitable current in H.V. winding and short circuiting L.V. winding. There shall be no leakage of oil during or after the test. Also there shall be no deflection at all when the pressure is removed. The purchaser's representative may be present during these tests for which advance intimation shall be given. Otherwise, test Certificate shall be produced in triplicate before dispatching the units.
- 6.3. The top cover of the tank shall be suitably sloped to facilitate water drain off and shall be so designed as to facilitate lifting of the same, in case required, with minimum disconnection of pipe work and accessories. Air release plugs shall be provided on main tank top cover to cover entire area suitably.

7. Cleaning & Painting:

- 7.1. All steel surfaces shall be thoroughly cleaned by Sand blasting or chemical agents, as required to produce a smooth surface free of scales, grease and rust.
- 7.2. The terminal surfaces in contact with insulating oil shall be painted with heat resistant and insulating-Oil resistant paint, which shall not react nor be soluble in the insulating liquid used.
- 7.3. The external surfaces, after cleaning, shall be given two coats of high quality rust resisting primer as per IS: 2074 with latest amendments thereto followed by two coats of weather resisting battleship poly urethane paint specially recommended for transformer use.
- 7.4. The paints shall be carefully selected to withstand tropical heat rain, and other environmental effects. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling.

7.5. Sufficient quantity of touch up paint shall be furnished for application after installation at site.

7.6. Special care shall be taken by the manufacturer to ensure against rusting of nuts, bolts and fittings during operation. All bushings and current carrying parts shall be cleaned properly after final painting.

8. Cable Boxes

The transformer shall be fitted with suitable cable box on 11 kV side to terminate one 11kV/ 3C Aluminum conductor XLPE/PILC cable up to 300 sq. mm. size as per drawing. The Bidder shall ensure the arrangement of H.T. Cable box so as to prevent the ingress of moisture into the box due to rainwater directly falling on the box. The cable box on H.T. side shall be of the split type with faces plain and machined and fitted with Neo-k-Tex or similar quality cork sheet gasket and complete with brass wiping gland to be mounted on separate split type gland plate with nut-bolt arrangement and M.S. earthing clamp. The bushings of the cable box shall be fitted with nuts & stem to take the cable cores without bending them. The stem shall be of copper with copper nuts. The cross section of the connecting rods shall be stated and shall be adequate for carrying the rated currents. On the HV side the terminal rod shall have a diameter of not less than 12mm. The material of connecting rod shall be copper. H. T. Cable support clamp should be provided to avoid tension due to cable weight.

The transformer shall be fitted with suitable LV cable box having non-magnetic material gland plate with appropriate sized single compression brass glands as per the attached drawing on LV side to terminate 1.1 kV /1C XLPE armoured cable as mentioned herein below.

Terminal:

Primary:

12 kV Epoxy bushings as per IS: 2099 for heavily polluted atmosphere having suitable diameter with nuts and check nuts for pad and platform mounted transformer as per drawing. If required by purchaser, 12 kV Porcelain bushing as per IS: 3347 for heavily polluted atmosphere having suitable diameter with nuts and check nuts for pole mounted transformer.

Secondary:

Terminals shall be provided with 1.1 kV Epoxy bushings as per IS: 3347 for heavily polluted atmosphere having fixed palm type connectors with suitable locking arrangements to restrict the rotation of palm assembly. The palm shall be of copper and stud of copper duly brazed at the joint.

A suitable clamping arrangement shall be provided so as to clamp the 1/C x 400mm² XLPE /PVC cables as per the details given here below for different size of the transformers. Each clamp shall be detachable type with nut bolt arrangement for ease in removal/replacement of LV cables. Epoxy bushings Clamp arrangement with copper/brass terminal assembly is required.

250 kVA:

Two holes of 13 mm diameter for long palm double hole lug with 2 nos. of ½ ” zinc passivated bolts with suitable spring washers and hole spacing as per the drawing to connect 1 no. of 400 sq. mm. 1C PVC/XLPE LV cable per phase with AL/CU sockets. If required by purchaser, one hole of 20 mm diameter with 1 no. of ¾“ zinc passivated bolts with suitable spring washers and hole spacing as per the drawing.

315 kVA:

Two holes of 13 mm diameter for long palm double hole lug with 2 nos. of ½ ” zinc passivated bolts with suitable spring washers and hole spacing as per the drawing to connect 1 no. of 400 sq. mm. 1C PVC/XLPE LV cable per phase with AL/CU sockets. If required by purchaser, one hole of 20 mm diameter with 1 no. of ¾“ zinc passivated bolts with suitable spring washers and hole spacing as per the drawing.

15 kV Epoxy bushings as per IS: 2099 for heavily polluted atmosphere having fixed palm type connectors with suitable locking arrangements to restrict the tension on bushing fixing. The palm shall be of copper.

Both H.V. and L.V. bushings of Epoxy cast resin shall have creepage corresponding to heavily polluted atmosphere.

9 Oil :

9.1 The necessary quantity of new transformer oil according to IS: 335 shall be supplied & filled in the transformer tank up to a height above the minimum filling mark of conservator tank. The Supplier shall furnish the relevant technical particulars and test certificates of the oil supplied. An additional 10% of the total quantity of oil required shall be supplied loose along with the transformer.

9.2 Leakage of Oil: Suitable approved type of material such as “Neoprene” of RC 70 C grade which has an oil proof agent, as specified in IS: 1866 shall be provided at all joints to prevent leakage of oil during continued operation or during transportation.

10 Drying-Out:

The transformer winding shall be thoroughly dried out & kept immersed in oil to avoid any further drying out by the purchaser & to facilitate immediate commissioning of the transformer on receipt.

11 Clamping of Leads:

All leads from the coils to the terminals shall be suitably clamped to prevent snagging and fouling with other parts and the tank.

12 Phase Marking:

Phase markings as per IS: 2026 punched on small non-corrosion metallic tags shall be permanently fixed for H.V. just below the cable box or on some suitable removable part of the tank and above L.V. Bushings. Phase markings tags shall be properly fixed with proper alignment.

13 Core and Coil:

13.1 The transformer may be of core type. The core shall be built up with high grade, non-aging, low loss, high permeability, grain oriented, cold-rolled silicon steel laminations especially suitable for core material. The grade of core lamination shall be premium grade M-OH or better quality with appropriate thickness. The transformer shall be so designed as to have minimum humming noise.

- 13.2 The coils shall be manufactured from electrolytic copper conductor and fully insulated for rated voltage. Copper for winding shall be purchased from 'Original Copper Manufacturer'.
- 13.3 Insulating material shall be of proven design. The insulating material shall be class 'A' specified as per IS: 1271 with latest amendments thereto. Coils shall be so insulated that impulse and power frequency voltage stresses are minimum. Due consideration shall also be given to the fact that the transformers will be connected at the end of 11kV and 433V overloaded feeders, in a lightning prevalent area.
- 13.4 Coil assembly shall be suitably supported between adjacent sections by insulating spacers and barriers. Bracing and other insulation used in assembly of the winding shall be arranged to ensure a free circulation of the oil and to reduce the hot spot of the winding.
- 13.5 All leads from the windings to the terminal board and bushings shall be rigidly supported to prevent injury from vibration or short circuit stresses. Guide tube shall be used wherever practicable.
- 13.6 The core and coil assembly shall be securely fixed in position so that no shifting or deformation occurs during movement of transformer. The core and coil assembly shall be capable of withstanding without injury, the thermal and mechanical effects of short circuit at the terminals of any winding as per IS: 2026 with latest amendments thereto.

14 Insulation Level:

The transformer shall be designed to withstand the following.

Voltage	Impulse Voltage (KVP)	Power Frequency Voltage (kV)
11000	95	36
433	7.5	3

15 Losses:

The transformer losses at 75° C and at normal tap without any positive tolerance shall be as under:

Rating	No load losses in watts	Load losses in watts
250 kVA	470	2500
315 kVA	515	2750

NOTE: These are maximum permissible values with no positive tolerance. The maximum losses specified as above will be binding on the supplier and any unit, which exceeds these losses, shall be rejected.

Percentage impedance

The % impedance at 75°c temp. for 250 kVA and 315 kVA transformer shall be 5% .

Regulation:

The regulation at 75° C at full load at unity and 0.8 power factor subject to the usual tolerance as per IS: 2026 shall be specified in the bid

Over fluxing:

The transformer shall be suitable for over fluxing (due to combined effect of voltage and frequency) up to 10% of any tapping without injurious heating at full load conditions.

Maximum efficiency:

The distribution transformer shall be designed so as to ensure that the maximum efficiency of the transformer is at the loading above 60 % and the same shall be verified during routine test failing which the same shall be liable for rejection.

16 C.T.'s with accessories :

The current transformers of rating as specified below shall be provided on LV side of the Transformer. C.T.'s shall be mounted on L.V. Bushing & supported by bakelite sheet of adequate thickness affixed to main tank by nut-bolt arrangement. It shall be possible to replace these C.T.s by removing fixing nuts of bakelite sheets after removal of L.T. cable from bus bar without disturbing L.T. Bushings.

Sr. No.	Particulars	250 kVA & 315 KVA
1	Current Ratio	400/5 Amps
2	Class of Accuracy	0.5
3	Burden	5 VA
4	Type	Resin cast, Ring type Suitable for Outdoor use

The Secondary Terminals of the C.T.'s shall be brought out by using 2.5mm² multicore, flexible copper cable (with colour coding, and ferrules at both ends) in conduit to the sealable junction box which shall be located outside the Transformer enclosure fixed at a suitable height. Similarly, three phase voltages shall be tapped from the L.T bus bar and brought out in the junction box.

17 Fittings & Accessories :

The following accessories conforming to IS: 3639 shall be provided.

- 17.1 Oil conservator with drain plug, oil filling hole with blanking plate and oil level indicator with minimum level marking. Conservator tank shall have capacity of for storing 10% of total oil in main tank. Oil level indicator shall be so designed that it indicates 10% to 90 % oil quantity in conservator tank. Normal level shall be marked at 50% of oil level indicator.
- 17.2 Silica gel breather shall contain minimum 0.5 kg dehydrated silica gel for 250 kVA & 315 kVA size. The Breather shall be connected with conservator with pipe having ¾" diameter.
- 17.3 Pressure relief vent
- 17.4 Earthing terminals- 2 nos.
- 17.5 Lifting lugs
- 17.6 Air release plug
- 17.7 Oil filling hole with plug
- 17.8 Oil drain outlet with sampling facility without valve at the bottom of the main tank with plug or Oil drain outlet with Stainless steel full turn type valve along with valve guard at the bottom of the main tank as per purchaser's requirement.

- 17.9 Oil filter inlet without valve and with plug or with Stainless steel full turn type valve as per purchaser's requirement.
- 17.10 Jacking lugs
- 17.11 Oil Temperature Indicator of Mercury in steel type with Maximum Temperature Indicator, if required by purchaser.
- 17.12 Four nos. of unidirectional flat rollers to facilitate the rolling of transformer in the direction parallel to the side where the terminals have been brought out.
- 17.13 LV cable frames with clamps to hold (as per the submitted drawing)
 - 17.13.1 One or Two nos. of 400 sq. mm, 1 core XLPE cable per phase for 250 kVA & 315 kVA transformer and if required by purchase, 1 no. of 240 sq. mm. 3.5 C PVC cable.
- 17.14 The rating plate shall be as per the sample provided by the purchaser and shall indicate particulars as may be specified including No load and Copper losses, date of manufacture, order no. etc.

18 Tests:

- 18.1 Routine Tests: Following tests shall constitute the routine test.

All transformers or a part of the order quantity as may be desired by the purchaser shall be subjected to routine tests as per IS: 2026. All results obtained during the tests shall be furnished to the purchaser in triplicate for approval/comments.

 - 18.1.1 Measurement of winding resistance.
 - 18.1.2 Ratio, polarity and phase relationship.
 - 18.1.3 Impedance voltage
 - 18.1.4 No load losses and no load current
 - 18.1.5 Load losses
 - 18.1.6 Insulation resistance
 - 18.1.7 Induced over voltage withstand test
 - 18.1.8 Separate source voltage withstand test
 - 18.1.9 Unbalance current test(unbalance current should not be more than 2% of full load current in neutral at full load condition)
- 18.2 Type test
 - 18.2.1 Impulse voltage withstand test
 - 18.2.2 Temperature rise test
 - 18.2.3 Short circuit test
 - 18.2.4 Heat run test
- 18.3 Test certificates:

The equipment offered shall be fully type tested as per the relevant standards. In case the equipment of the type and design offered has already been type tested, the bidder shall furnish the type test reports along with the offer.

19 Contract Drawing:

An outline drawing front (both primary and secondary sides) and End-elevation and plan of the tank and terminal gear, where in the principal dimensions shall be given.

Typical general arrangement drawings of the windings with the details of the insulation at each point and core construction of transformer.

Typical general arrangement drawing showing both primary and secondary sides and End-Elevation and plan of the transformer.

All the above except the typical drawing shall be given by the particular drawing of the transformer to be supplied.

20 Conditions & Requirements :

Bidder must specifically confirm that the following will be complied with

- 20.1 HV and LV bushings shall be on the opposite sides of the transformer main tank. HV bushing shall be mounted at an angle perpendicular to the main tank.
- 20.2 Transformer shall be designed for 11 kV non-effectively earthed system.

21 Inspection:

- 21.1 In respect of raw material such as core stampings, winding conductors, insulating paper and oil, you shall use these materials manufactured/supplied by standard manufacturers and furnish the manufacturers' test certificate as well as the proof of purchase from these manufacturers (excise gate pass) for information of the company. The bidder shall furnish following documents along with their offer in respect to the raw materials.
 - 21.1.1 Invoice of supplier.
 - 21.1.2 Mill's certificate
 - 21.1.3 Packing List
 - 21.1.4 Bill of landing.
 - 21.1.5 Bill of entry certificate by custom.
- 21.2 The successful bidder will give ten days advance intimation to the company to organize stage inspection of the transformer in which the assembling of core and the winding could be inspected.
- 21.3 The company may, at its option, open a transformer supplied to the stores, in your presence at site or at departmental stores. If any of the technical particulars are seen to be at variance than the guaranteed technical particulars, the whole lot of transformer will be rejected and risk purchase resorted to.
- 21.4 In addition to the above, the company may pickup any transformer and decides to get it type tested from competent and authorized body at company's cost. The bidder will have to organize packing of the transformer at company's stores for which they will be paid necessary charges. If the transformer fails to meet the requirement at type tests, the quantity of the transformer ordered on them will be forthwith rejected.
- 21.5 To ascertain the quality of the transformer oil the original manufacturer's test report should be submitted at the time of inspection. Also arrangement should be made for

- testing of transformer oil, after taking out the sample from the manufactured transformer and tested in the presence of company's representative or in an independent laboratory.
- 21.6 If Company intends to have inspection by competent/authorized body at manufacturer's premises during the manufacturing and testing process, the selection of the party will be at sole desecration of the company and manufacture will have to trust & provide all the facilities.
- 21.7 Company can test distribution transformers by using their own testing instruments at manufacturer's premises.
- 21.8 During the witnessing of testing of transformer at the supplier's works Torrent power will also connect company's meters and supplier has to agree for the same.

22 Details in The Data-Sheet :

The bidder shall furnish the details of transformer in the data-sheet as attached herewith. If this data is not filled completely your offer will not be evaluated.

23 Deviations:

The Bidders are not allowed to deviate from the principal requirements of the Specifications. However, the Bidder is required to submit with his bid in the relevant schedule a detailed list of all deviations without any ambiguity. In the absence of a deviation list in the deviation schedules, it is understood that such bid conforms to the Bid Specifications and no post-bid negotiations shall take place in this regard.

24 Schedules

The bidder shall fill in the following schedules, which will be part of the offer. If the schedules are not submitted duly filled in with the offer, the offer shall be liable for rejection.

Schedule-A	:	General Particulars
Schedule-B	:	Guaranteed Technical Particulars
Schedule-C	:	Schedule of Deviations
Schedule-D	:	Deviations from furnishing documents
Schedule-E	:	Bidder's experience

- 24.1 All deviations from the specification shall be brought out in the schedules of deviations (Schedules C & D). The discrepancies, if any, between the specification and the catalogues and / or literatures submitted as part of the offer by the bidders, the same shall not be considered and representations in this regard will not be entertained.
- 24.2 If it is observed that there are deviations in the offer in guaranteed technical particulars other than those specified in the deviation schedules then such deviations shall be treated as deviations.
- 24.3 All the schedules shall be prepared by vendor and to be enclosed with the bid.

25. GUARANTEE FOR THE TRANSFORMERS;

- 25.1 Guarantee period shall be 12 months from the date of commissioning or 18 months from the date of supply whichever is earlier. If any transformer fails during this guarantee period, the supplier shall repair the same at his cost at his works.

- 25.2 The supplier situated outside Gujarat State shall have to establish suitable and adequate arrangement for repairing and testing of failed transformer in Gujarat State at his cost. This arrangement shall have to be continued up to the completion date of guarantee period of supply of last lot.
- 25.3 After intimation of failure of transformer failed within guarantee period, UGVCL will arrange for the dispatch of guarantee period failed transformer to firm's works at the cost of UGVCL. The failed transformer shall be repaired within one month and the repaired unit duly tested shall be dispatched by supplier at his cost to the concerned consignee from where the failed unit was received along with the test report. If the transformer is not repaired and delivered back or dispatched without complete test report within this period, than the cost of GP failed transformer shall be recovered from the supplier's pending / ensuing bill against the order or any other of order. In case, the supplier does not have further order, the cost of GP failed transformers shall be recovered from the Bank Guarantee furnished. Testing of transformer will be done in presence of Board's Engineer to ensure no change in losses as per GTP after repair. Transformer found with higher losses than GTP will not be accepted and cost thereof will be recovered.

Technical Data Sheet			
SR. NO.	PARTICULARS		REQUIRED/OFFERED
	KVA RATING OF TRANSFORMER		315 KVA 250 KVA
1	Name of manufacturer:		
2	Place of Manufacture:		
3	Make:		
4	Reference Standard(s)		
5	Rated : Current HV/ LV in Ampere		
6	Rated : Voltage HV/ LV (Principal Tap)		
7	Weather conditions :		
7.1	Sea level, lightning prone area, 700mm (Ahmedabad) rainfall over a period of 4 months in a year.		
7.2	Seismic zone		
7.3	Humidity (condensing),		
7.4	Humidity During monsoons (July - September)		
8	Taping : (With local indicator)		
8.1	Type of Tap changer		
8.2	If provided with tap changer:		
	Tap. No.	H.V.	L.V. Volts
	1	11825	433
	2	11550	433
	3	11275	433
	(Principal Tap)		
	4	11,000	433
	5	10725	433
	6	10450	433
	7	10175	433
9	Temperature:		
9.1	Reference Ambient Temperature		
9.2	Temp rise over Reference ambient		
9.2.1	Top oil by thermometer		
9.2.2	In windings by resistance		

Technical Data Sheet			
SR. NO.	PARTICULARS	REQUIRED/OFFERED	
	KVA RATING OF TRANSFORMER	315 KVA	250 KVA
10	Connections : Vector group reference		
11	Does the overload Rating match with that of the transformer under all conditions?		
12	Guaranteed losses at principal tap, full load & 90 degree C. (without any positive tolerance)		
12.1	No load loss at rated voltage and frequency: kW	0.515	0.470
12.2	Load loss at rated current at 75° C: kW.	2.750	2.500
12.3	TOTAL KW	3.265	2.970
13	Stray losses as percentage of load losses:		
14	No load current at rated voltage and frequency % of Full Load Rated Current		
14.1	H. V.		
14.2	L. V.		
15	Total Harmonic level at No Load in		
15.1	Voltage circuit		
15.2	Current Circuit		
16	Total Harmonic level at full Load in		
16.1	Voltage circuit		
16.2	Current Circuit		
17	At rated current and frequency % at 75° C. at principal Tap.		
17.1	% Impedance	5	5
17.2	Resistance [Ohm]		
18	Regulation and efficiency at full load at 75° C At 115% and 120 % load		
18.1	At unity power factor		
18.2	At 0.8 power factor lag		
18.3	Maximum Efficiency at --- % of full Load		
19	Maximum current density Amps./Sq. cm.		
19.1	H. V. Winding.		
19.2	L. V. Winding.		
20	With stand Time & Current as multiple of full load current without injury for (for HV)		
21	Three phase dead short circuit at terminals with rated voltage maintained on the other side.		
22	Single phase short circuit at terminal with rated voltage maintained on other side.		
23	Are the transformers subject to Hydraulic test?		
24	Details of the Tank: (Ref. Standard)		
24.1	Shape of the main Tank		
24.2	Thickness of sides (=>4mm).		
24.3	Thickness of cove (=>5mm).		
24.4	Thickness of bottom :		
24.5	Width of the fin : mm		
24.6	Is the tank lid sloped?		
24.7	Thickness of radiator fins mm.		
25	Details of the Core: (Ref. Standard)		
25.1	Core material/Grade.		
25.2	Thickness of lamination in mm.		

Technical Data Sheet			
SR. NO.	PARTICULARS	REQUIRED/OFFERED	
	KVA RATING OF TRANSFORMER	315 KVA	250 KVA
25.3	Insulation of lamination:		
25.4	No of steps of core:		
25.5	Diameter of the core:		
25.6	Equivalent cross section Area (approx) mm. sq.		
25.7	Iron Loss per Kg. at 1.6 Tesla: Watts		
25.8	Dimension of the core clamping MS channel:		
26	Type of coil		
26.1	H. V.		
26.2	L. V.		
27	Gauge/ area C/S of conductor (approx) Sq. mm.		
27.1	H.V.		
27.2	L.V.		
28	Insulating Material (Ref. Standard)		
28.1	H. V. Turn		
28.2	L. V. Turn		
28.3	L. V. Core		
28.4	H. V. - L. V.		
29	Insulating Material thickness		
29.1	H. V. Turn in mm		
29.2	L. V. Turn in mm		
29.3	L. V. Core in mm		
29.4	H. V. - L. V. in mm		
29.5	Thickness of locking spacers between HV coils: in mm		
29.6	No of axial wedges between LV and HV windings. Nos.		
30	Minimum design clearance mm (Ref. Standard)		
30.1	H. V. to earth in Air		
30.2	H. V. to earth in Oil		
30.3	L. V. to earth in Air		
30.4	L. V. to earth in Oil		
30.5	Radial clearance of LV coil to core:		
30.6	Between H. V. & L.V. in Oil		
30.7	Top winding and yoke		
30.8	Bottom winding and yoke		
30.9	Top cover and yoke/live tap changer (oil cover over stamping/Tap changer)		
30.10	Between inner tank surface and outer most winding surface/ Bus bar flats.		
31	Transformer impulse level kV peak.		
31.1	H.V. winding		
31.2	L.V. winding		
32	Insulating Oil (Ref. Standard)		
32.1	Approximate quantity of Oil in liters.		
33	H.V. Bushing (Ref. Standard)		
33.1	Make		
33.2	Type		
33.3	Creepage distance factor MM/KV		

Technical Data Sheet			
SR. NO.	PARTICULARS	REQUIRED/OFFERED	
	KVA RATING OF TRANSFORMER	315 KVA	250 KVA
33.4	Stud Size (not less than 12 mm)		
33.5	Material of stud		
33.6	Is the bushing capable of handling 350 MVA Fault Level?		
33.7	Free space required for bushing removal		
34	L.V. Bushing (Ref. Standard)		
34.1	Make		
34.2	Type		
34.3	Creepage distance MM/KV		
34.4	Distance of live part to earthed part		
34.4.1	Is the conducting part in one piece?		
35	Terminal clearance(Live part to live part) (Terminations will have Right Angle boots)		
35.1	H.V. Between Ph.- Ph. mm		
35.2	H.V. Between Ph.- E mm		
35.3	L.V. Between Ph. - Ph. mm		
35.4	L.V. Between Ph. - E		
36	If weatherproof, Is it suitable for outdoor duty (without any shade)?		
37	Tentative overall dimensions : (Indicative) Length mm Breath mm Height mm		
38	Noise level at a distance of 1 meter from transformer.		
39	Weight data (Approx.) in Kg.		
39.1	Core & frame		
39.2	Core & winding		
39.3	Tank(incl. Lid)		
39.4	Oil		
39.5	Radiators		
39.6	Empty conservator tank		
39.7	Total Weight		
40	Pressure release device		
40.1	Minimum pressure the device is set to rupture KG/ CM SQ.		
41	Terminal Arrangement		
41.1	High Voltage		
41.2	Low Voltage		
42	Tests:		
42.1	Core bolt withstand voltage for 1 minute		
42.2	Type Test :		
43	Flux density: [Tesla]		
43.1	Approximate maximum flux density at rated Voltage and frequency.		
43.2	At 110% Voltage 75 ° C.		
44	Warranty (Years)		
45	Accessories :		
45.1	Oil filling holes and cap (on the conservator tank).		

Technical Data Sheet			
SR. NO.	PARTICULARS	REQUIRED/OFFERED	
	KVA RATING OF TRANSFORMER	315 KVA	250 KVA
45.2	Oil level indicator detachable type with minimum marking (on the conservator tank).The back ground color of indicator will be light gray		
45.3	Conservator tank with drain plug and pipe work for breather. The conservator tank shall be mounted independently of the main cover so that it can be easily detached without disturbing the cover gasket and vice a versa.		
45.4	Silica gel breather of oil sealed type with replaceable silica gel cartridges, mounted so as to avoid use of joints and hands.		
45.5	Drain valve with plug on cover plate.		
45.6	Drain valves with plug at bottom and suitably protected against vandalism.		
45.7	Air release device to be provided on the tank cover.		
45.8	Explosion Vent with two diaphragms, one at the top and other at the bottom.		
45.9	Two earthing terminals with lugs.		
45.10	Lifting lugs with sufficient space for fixing sling wire and D-shackle.		
45.11	Thermometer pockets with 100 mm. dial type thermometer temperature indicator and max. Recorder. The dial shall and fitting shall be impervious to the		
45.12	Four plain rollers fitted such that the transformer can be rolled in a direction parallel to the side where the terminals have been brought out.		
45.13	Terminal marking / Name plate will be of durable non corroding metal.		
45.14	The actual/Guaranteed losses will be mentioned on the Name plate.		
NOTE:			
1	All valves if supplied shall be of the best quality and individually tested for leakage of oil under pressure. Tight leak proof plugs shall be fitted at the open end of the valve		
2	All gaskets on radiator pipes, H.V. cable boxes, oil pipes connecting conservator tank shall be without joints and will have hoods over them so as to prevent their direct contact with rain water.		
3	Not more than three-thread open of the bolt used for fixing HV bushings.		
4	Avoid sharp edge of the nut used at end of HV bushing.		
5	Three nuts should be provided on each HV Bushing.		
6	Re-venting on HV cable box at equal distance of 3 inch instead of welding.		
7	Spares to be quoted along with bid.		