TECHNICAL SPECIFICATION OF 1000 KVA, 11/ 0.415 KV DRY TYPE (CAST RESINE TYPE) OUTDOOR/ INDOOR TRANSFORMERS

1.0 Scope:

This specification covers design, manufacture, testing and supply of 1000 KVA, 11/0.415 KV, CAST RESINE Type Distribution Transformers as per details furnished.

2.0 Location:

The Transformers may be installed Outdoor/Indoor anywhere in West Bengal. The elevations of the system mean sea level shall not exceed 1000 meters.

3.0 System Details:

Both the 11 KV & 415 V systems are solidly earthed at the neutral points of the star.

4.0 Weather Conditions:

4.1. The area is also subject to heavy monsoon rains, 80 to 90% of the annual precipitation being in the June to October.

Maximum temperature of air in shade	50ºC
Minimum temperature of air	4ºC
Maximum temperature of air in sun	60ºC
Maximum Relative Humidity/Minimum Relative Humidity	100% / 50%
Average number of thunderstorm day per annum	100
Number of months of tropical monsoon rainy Condition Per annum (June to October)	4.5
Average rainfall per annum	200 cm
Maximum wind pressure	150 kg/m^2
Maximum Wind Speed	50 m/Sec
Maximum Height above sea level	1000 mtr.
Basic Horizontal Seismic Co-efficient	0.04

4.2. For the purpose of this specification, the maximum daily average ambient temperature shall be 40ºC over 24 hours period.

5.0 Standards:

5.1. Transformers covered by this specification shall, unless otherwise specified by built to conform Indian Electricity Rules, wherever applicable and other ISS as mentioned below

IS 2026(Part I to V) amended up to date	Distribution Transformers
IS 11171	Dry Type Transformers
IS 12063	Degree Of Protection Provided by Enclosures
IS 3347	Porcelain Transformer Bushing
IS 5. IS 104 & IS 2932	Colour shade and Colours for ready mixed paint and enamels
IEE C57.12.01-1988	Dry Type Transformers
IEC 60076	Dry Type Transformers
IEC 60726	Power Transformers – Insulation levels, dielectric tests and external clearances in air

IEC 60905	Loading Guide for dry type transformers
BS 171	Power transformers Specification for insulation
CBIP standard	levels and dielectric tests

5.2. In the event of a conflict between the above standard and the specification, the latter shall govern.

6.0 Rating and Central Data for Dry type Distribution Transformer:

6.1. Core type three phase Dry type step down two winding distribution Transformers for installation with weather condition as stated above.

6.2. Rating : 1000 KVA.

6.3. Number of phase : Three

6.4. Frequency : Transformer shall be suitable for continuous Operation with a frequency variation of ±3% from normal 50 c/s without exceeding the specified temperature rise.

6.5. Type of cooling : ANAN

6.6. Voltage Ratio : 11/0.415 KV

6.7. Vector Group Reference : Dyn11

6.8. Category : Dry, Air cooled, Fully encapsulated, Cast Resin Type

7.0 Connections :

The primary (HV) winding shall be connected in delta and the secondary (LV) winding in star with vector group Dyn11. The neutral of the secondary (LV) winding shall be brought out to a separate insulated Bushing.

The size (cross section) of the neutral connection conductors and jumpers must be of same size as that of phase connecting conductors and jumpers which shall be properly supported and insulated.

8.0 Temperature Rise :

i) Average winding temp rise by resistance method above 50ºC max. ambient shall not exceed 140ºC(With or without Enclosures) with a maxm. permissible hot-spot temp. of 30ºC over and above specified temperature rise limit for that particular class of insulation.

ii) Core, metallic parts solid insulation and associated materials shall in no case reach a value that may damage these materials or reduce their life expectancies.

9.0 Short Circuit Impedance: As per Annexure - ‘ B ’

10.0Terminal Arrangement:

i) HT side cable Box.

The H.V. cable end box with 3P-1G air filled **non-magnetic** gland **plate** should be suitable for termination of 3 core 185 sq. mm 12KV grade XLPE cable. The cable holding clamp is to be provided. Necessary drawing is to be provided. Necessary drawing is to be furnished in this regard.

ii) LT side cable box.

The L.T cable end box with 4P-2G air filled gland should be suitable for termination of 3 sets of 4 core 400 sq. mm XLPE cable for 1000 KVA Transformer. The cable holding clamp is to be provided. Necessary drawing is to be furnished in this connection. Size of L.T. cable end box with **non-magnetic** gland **plate** suitable for termination of 1000 KVA Transformer shall have to be furnished by the manufacturer during submission of drawing. Bus Duct of Aluminium/copper of adequate cross section of suitably mounted and insulated may also be provided, if termination arrangement requires bus duct.

iii) All flexible of H.T. & L.T. sides should be connected with pressure plates of area equal to the end of the flexible, flat & spring washers, pressure plates with suitable fasteners, flat washers and spring washers should be provided with HV terminal clamps (inside the cable boxes) and pressure plates 16 mm fasteners with plain and spring washers should be provided with LV terminals.

iv) The cable gland should be of brass and provided with cable armour holding clamps.

v) Solid copper dropper shall be provided for termination of 3 sets of LV cables, if provided.

vi) HT terminal for cable connections shall be brought out through sidewall mounted Bushing to a cable end box.

vii) Cable end box shall be self-supporting, weatherproof, air filled type with sufficient space inside for termination and connection of cable.

viii) Cable end box shall be furnished complete with removal gland plate, double compression brass gland.

viii) In general, the arrangement shall be such as to permit removal of core & coil assembly without dismantling the cable installation.

a) Suitable arrangement for HV side box and LV side box shall be provided. The LV cable box shall be suitable for terminating the cable, if provided, which will approach the boxes vertically from the bottom. The cable box shall be suitable for being detached from the main body with suitable mounting arrangement. The HV and LV cable box shall be fixed on the opposite sides and the portion of those boxes other than the minimum area required for specific termination of the H.V. and L.V. terminals shall be kept projected from the main tank enclosures so that natural air circulation does get hindered to a minimum due to placement of the Cable End Box.

b) The HT & LT cable box shall be fixed on the opposite sides.

ix) Cable gland suitable for HT/LT cable box shall be provided as follows:

Cable Size for HT	Cable Size for LT
3 Core X 185 sq. mm. XLPE cable of 12 KV grade	3 sets of 4 Core X 400sq. mm XLPE cable of 1.1 KV Grade

11.0 Leads:

All leads of the windings, connection of the windings or their wires to one another to terminal bushing properly insulated and covered with insulation sleeves. The Brazing materials shall have higher melting temperature above 300 ^{0}C and preferably above 400 ^{0}C for better thermal endurance and mechanical strength. The tenderer shall specifically mention the method and materials to be used by them for lead connection.

12.0 Conductors: Copper as indicated in Annexure - 'C'.

13.0 Tap Changing Arrangement:

Link Type Off Circuit Tap Changing Arrangement should be provided in the Transformer. **Link type Taps** ranging from + 5% to -7.5% in steps of 2.5% on H.V winding for H.V. variation. The Tap link shall be located in a convenient position so that it can operated/changed from ground level. The link connection should be properly marked. The link connection diagram in separate metal sheet shall have to be provided nearby. The same should also be mentioned in Rating & Diagram plate.

14.0 Enclosure & fitments

14.1. The enclosure & fitments shall be of CRCA pressed and shaped sheet steel having low loss and good grain properties, coated with insulation, bolted together to the frames firmly to prevent vibration or noise. The purpose of having the enclosure is to provide safety from live parts , protect and prevent ingress of foreign particles rain water , vermin , rodent, outside dust & against ingress of splashing of water etc. as per IP 54 for outdoor use and IP 53 for Indoor use. The enclosure shall have structural steel frame work with lockable hinged door on HV and LV terminal sides. The gasketted doors shall facilitate the inspection of transformer.

14.2. The CRCA sheet steel thickness shall be not less than 3.0 mm for structural members and 3.0 mm for all doors/covers etc. If corrugated sheet is used then the sheet thickness shall not be less than 1.2mm.

14.3. The complete structure shall be rigid, self – supporting. To remove heat from transformer, its metallic enclosure shall have sufficient heat dissipation capability without any additional cooling arrangement. G.I or S.S. wire mesh shall be provided in the gap in between enclosure and ventilation hood to prevent entry of birds etc. Powder / enamel paint coated 3.0 mm thick CRCA sheet steel shall be provided for enclosing the bottom side.

14.4. The enclosure shall not have degree of protection less than IP 54 as per IS:2147 amended up to date for outdoor installations and IP 53 for Indoor installations.

The fitments shall comprise the following;

i) Cowl type inspection cover is to be provided on a raised boss on the top plate at a suitable position for getting access to HV & LV risers as well as HV tapping links inside the tank.

ii) Two drain plugs should be fitted at the bottom of the transformer enclosure to drain out water, accumulated due to humid deposition or seepage.

iii) Ports should be provided in core & winding for inserting temperature measuring transducers.

iv) Lifting hooks on top cover of the main tank.

v) Diagram and rating plate, **Danger Plate**.

vi) 4(Four) nos. Lifting lugs.

vii) Two earthing terminals

viii) Skid channels with rounded corners to be provided along the width of the transformer with hole centers at 457mm (18φ) at the centre of gravity of the whole transformer. Open side of the channels should be outwards.

ix) Property Plate along with Asset Codification No.:

Asset codification no. for the ordered quantity shall be communicated to the supplier after placement of order. Necessary Engrave/Embossing (cold punch) shall be done on the main tank with 28 no font size and DTR name and diagram plate with font size not less than that used for marking KVA rating of the DTR.

If cold punch on the tank is not possible then separate property plate (details marking of the plate shall be submitted with the transformer drawing for approval) shall be welded to the tank with the following details:-

1. Ratings :
2. Manufacturer's Sl. No. :
3. Manufacturer's Name :
4. P.O. No. :
5. Year of Manufacturing :
6. Property of : WBSEDCL
7. Asset Code Number : (10 digit alpha numeric numbers as allotted by the purchaser)

Again the following points shall have to be noted

a. Front Size of letter shall be 28 i.e. 7 mm x 5.5 mm
b. Letters shall be distinctly engraved by cold Punch
c. Plate size shall be minm 125mm X 170mm and shall be electrical run Welded be throughout its perimeter
d. Material of Plate shall be Mild Steel and not less than 3mm thick.
e. Plate shall be welded on the transformer tank at visible position and height.

x) Explosion Vent-Two nos. explosion vents should be provided on main tank top copper to be shown in the General Arrangement Drawing. The area of each vent shall be 75 mm x 50 mm approx.

xi) The sheet thickness of different parts of the transformer are tabulated below :

LV cable Box	LV Door Leaf	HV cable Box	HV Door Leaf
3.15 mm	3.15 mm	3.15 mm	3.15 mm

15.0 Core

15.1. The magnetic core shall be built of very low loss Silicon steel, cold rolled grain oriented steel. Core should be of stack core type.

15.2. The materials used for insulating the sheets, shall have high interlamination resistance and rust inhibiting property. It shall not be deteriorated by ageing from hottest operating temperature and clamped pressure of the core disintegrated due to mechanical modes of core vibration. It shall not have the least tendency to absorb moisture, or to react with the moisture present in the air thus accelerating deterioration of insulation.

15.3. The assembled core shall be securely clamped in the lines and in the uniform pressure so as to minimize the noise from the core.

15.4. Core Clamping-The core-clamping frame shall be provided with lifting eyes for the purpose of lifting/shifting. The whole core shall be electrically connected by copper strip of adequate section to the core frame at two separate points for being eventually earthed through the tank to drain off electrostatic potential that may be built up.

Core base and top and bottom of yoke shall be supported with M.S. channel of proper size and properly bolted together for stack type core.

15.5. Flux density- Flux density in any part of the core and yoke at rated voltage & frequency shall be 1.69Tesla.

The maximum flux density in any part of the core and yoke shall not exceed 1.9 Tesla.

15.6. All core clamping bolts shall be effectively insulated.

15.7. Adequate provision shall be made to prevent movement of the core and winding relative to the enclosure during transport and installation or while in service.

15.8. The core shall conform to : IS: 3024-1965

Electrical Sheet Steel & IS: 649 – 1983 method of test and steel sheet.

15.9. Core insulation- Class 'C' grade insulation paper of thickness 20 mils (0.5mm) shall be used and make should be clearly stated in the offer along with test certificates.

16.0 Windings:

16.1 Transformer shall be provided with the requisite number of windings (as detailed hereunder in cl.16.2) and shall be designed to withstand the electromechanical stress exerted under short circuit conditions as per ISS: 2026 -1977. Class 'C' Insulation shall be used. The winding of Dry Type transformer will be encapsulated.

16.2 Construction details :

HV & LV Coils

i) Active Material – Electrolytic copper conductor

ii) H.V. Winding – Nomex insulated round conductor.

iii) HV --- Multiple rectangular copper strip with Nomex inter – layer insulation to achieve best short circuit withstand capability. LV -= Copper strip/foil of spiral type.

iv) Coil Insulation-Insulated with Nomex and glass tape

v) Coil spacers & supports-High temp. Epoxy fiber glass.

16.3 The insulation level of the Windings shall be as follows as per IS:11171 –1985 or CEA guideline.

Voltage	Impulse Voltage	Short duration Power frequency Voltage
415 V	-	**3 KV**
11000 V	**75 KV**	**28 KV**

16.4 The winding shall be so designed to reduce to a minimum the out of balance forces in the Transformer (at all voltage ratios).

16.5 Bracing of Windings:

(1) The windings and connections of all transformers shall be braced to withstand shocks which may occur during transport or due to switching short circuit and other transient conditions during service.

(2) Coil clamping rings, if provided, shall be of steel or of suitable insulating material.

(3) The winding shall be assembled on the core co-axially for magnetic balance and symmetrically for electrical balance. Spacers, wedges shall be robust, hard insulations are so fitted in the winding so that they will neither move nor permit any relative movement of any part of the winding during normal service and under a terminal short circuit, not mechanically injure any insulation in the windings.

17.0 Overloads:

Dry type AN cooled transformers, can be overloaded according to IEC 60905 Loading guide for dry type transformers.

18.0 Bushing:

18.1 For 11 KV, 12 KV Bushing will be used and for 415 volts, 1.1 KV Bushing shall be used. Bushing of same voltage class shall be interchangeable.

18.2 Standard practices for Bushing as per IS 347 amended up to date shall be mounted on the side of the enclosure and not on the top cover.

Voltage Class	Indian Standards	
	For Porcelain Parts	For Metal parts
Up-to 11 KV Bushing	IS: 3347 / Part – I (Sec – I) (1979)	IS: 3347 / Part-I(Sec-2) (1979)
36 KV Bushings	IS: 3347 / Part - III (Sec - I) (1972)	IS:3347 / Part-III(Sec-2) (1982)

18.03 The clearances in air between live and conductive parts and live conductive part to earthed structures shall be as follows in cable end box:

Nominal System Voltage (KV RMS)	Test Voltage Impulse (KVP)	Phase to Phase (MM)	Phase of Earth (MM)
0.415	NIL	45 mm. additional clearance after fitment of socket suitable for 3 sets of 400 Sq. mm. LT Power cable	**20** mm. additional clearance after fitment of socket suitable for 3 sets of 400 Sq. mm. LT Power cable
11	75	**130** mm. additional clearance after fitment of socket suitable for 1 set of 185 Sq. mm. HT Power cable of 12 KV grade	**80** mm. additional clearance after fitment of socket suitable for 1 set of 185 Sq. mm. HT Power cabl of 1.1 KV grade.

**** In LT side Copper/Aluminum Bus Bar on suitable fixture and of suitable size (150 mm x 8 mm) to be provided.**

19.0 Cooling Arrangement:

19.1 The transformer shall be suitable for loading of 100% continuous maximum rating with 'ANAN' cooling without exceeding the thermal limit.

19.2 Painting:

19.3 The surface to be painted shall be completely cleaned & made free from all rust, scale or foreign adhering matter of grease.

19.4 After thorough metal treatment enclosure surface shall be given a **primary coat of Zinc chromate** and two coats of **dark admiral gray (IS 104 & IS 2932) enamel / powder paint.** Double coat of corrosion resistant primer shall be applied before painting. The inside of the enclosure shall have semi glossy paint finish. All metal parts not accessible for painting shall be made of corrosion resistant material. All steel surface exposed to weather, shall be given a primary coat of Zinc chromate and two coats of dark admiral gray paints.(IS 104 & IS 2932)//

19.5 All paints shall be carefully selected to withstand tropical heat and extremities of weather. The paint shall not scale off or winkle or be removed by abrasion due to normal handling.

19.6 All nuts and bolts used in the Transformer for external fittings shall be galvanized or zinc passivated and painted with body paint.

20.0 <u>Test & Inspection (As per I.S.S):</u>

20.1. **Routine Test:** All Transformers shall be subject to routine tests at the manufacturers Works. The following tests are to be carried out.

(a) Measurement of winding resistance.
(b) Ratio, polarity and Vector Group test.
(c) % Impedance voltage at Principal Tap position at 50 Hz & 75°C.
(d) No load loss at 50 Hz.
(e) Load Loss at 75°C at 50% loading.
(f) Load Loss at 75°C at 100% loading
(g) Insulation resistance.
(h) Induced over voltage withstand.
(i) Separate source voltage withstand
(j) Unbalance current: The maximum value of unbalance current in Transformer shall not exceed 2% of full load current as per CBIP manual for Transformer.
(k) Magnetizing current at rated voltage & frequency and 110% of rated voltage & frequency.
(l) Temperature rise test will be conducted on one transformer against every Order for inspection. The temperature rise test will be performed on lowest tap at appropriate current related to the said tapping with total losses fed corresponding to minm. Voltage tapping as per IS 2026 (Part-2) 1977, amendment no.2, 1984.

20.2. <u>TYPE & SPECIAL TESTS:</u>

Bidder should submit Lightning Impulse withstand test, Temperature Rise Test, Dynamic Short Circuit withstand test and Measurement of acoustic sound level test report from CPRI/NABL Accredited laboratory (third party)/Govt. approved Laboratories **along with their offer having identical rating and voltage ratio and type as that of the tendered item**, carried out within five years, as per pre-requisites of this tender, failing which their offer may not be technically accepted.

The transformer during Dynamic Short Circuit Test shall not exhibit more than 2 percent variation in percentage reactance.

Temperature rise Test shall have to be conducted on one transformer for every offered lot against the order design in presence of the Engineers of WBSEDCL.

21.0 INSPECTION

The Transformer may be stage inspected at the factory of the manufacturer. The manufacturer shall intimate in advance, in writing, to the purchaser about the stages of manufacturer & subsequent readiness of the transformers, to enable the purchaser to carry out stage inspection & final inspection and testing of the finished transformers.

The stage inspection will be carried out at the discretion of the purchaser during the process of manufacturing of the Transformers. The manufacturer need not stop the process of production because of programme of stage inspection of the Purchaser.

While offering for final inspection, the following point should invariably be taken care of:

i) Name Plates should be welded / riveted on the enclosure of the Transformer.
ii) Proper door locking and transformer sealing arrangement should be provided to ensure unwanted access to the transformer.

22.0 Contract Drawings:

22.1. The General outline drawing giving detail of dimensions and fittings should be submitted for each type of Transformer.
22.2. Name & Rating Plate drawing.
22.3. Internal assembly drawing.
22.4. Terminal arrangement drawing.
22.5. H.V. & L.V. cable box drawing
22.6. Schematic diagram for W.T. Scanner.

23.0 Over Load Capacity:

Each Transformer shall be capable of carrying sustained over load as stated in ISS.

24.0 Over Fluxing:

Over fluxing in the core shall be limited to 12.5% so that the flux density in the core does not exceed (19000 lines/sq.cm.)

The maximum flux density in any part of the core under such condition shall not exceed 19000 lines/sq.cm on the basis of M4,M5 & M6 grades as per BS 601: Part-2:1973(Specification for sheet and for magnetic core of electrical apparatus oriented Steel).

25.0 Internal Earthing Arrangement :

All metal parts of the Transformer with the exception of the individual core laminations, core associated damping plates shall be maintained at some fixed potential and core should be earthed at two positions.

26.0 Inspection & Testing:-

26.1. Inspection & Testing as already mentioned the equipment shall be subjected to routine & other acceptance test as per provisions in the relevant I.S.

26.2. WBSEDCL reserves the right to send its Engineers if so, desires to witness manufacturing process and to reject either raw materials or finished products

found to be not complying with requirement of the specification and also shall have the right to select any/all equipment from the lot offered for tests.

26.3. The manufacturer shall give at least fifteen (15) days advance notice regarding readiness of such Inspection and testing and shall submit the sets of work test certificates of the materials/ equipment offered for Inspection and testing indicating probable date of Inspection and testing.

26.4. The supplier shall arrange all possible facilities for such Inspection and testing at any time during the course of manufacturing, free of cost.

26.5. The transformer may be stage inspected at the factory of the manufacturer. The manufacturer shall intimate in advance in writing to the purchaser about the stages of manufacture & subsequent readiness of the transformers to enable him to carry out stage inspection & final inspection and testing of the finished transformers.

26.6. The stage inspection may be carried out at the discretion of the purchaser during the process of manufacturing of the transformers. The purchaser shall intimate at least 15(Fifteen) days in advance about the different stages of manufacturing. The manufacturer need not stop the process of production because of the program for stage inspection of the Purchaser or for non conduction of stage inspection on part of the purchaser.

26.7. While offer for final inspection the following points should invariably be taken care of:

I. Name plates should be welded on the tanks of the transformer.

II. Suitable provisions should be there to seal the transformer with seals having wires so that inside of the transformers cannot be accessed without removing the seals.

27.0 <u>Test Certificates:-</u>

Seven Copies of Test Certificates as mentioned above are to be furnished to WBSEDCL for acceptance before issuance of instruction for dispatch of the equipment.
Anything not covered by this specification will be as per relevant ISS or other standard Specification.

28.0 Capitalisation of losses:

No Bidder shall specify any tolerance in respect of those losses..

The evaluation of 1000 KVA; **11/0.415 KV DTR will be based upon loss capitalization on the basis of the quoted No Load Loss in KW at frequency 50 Hz and load loss in KW at 75˚C. However the quoted No Load Loss at frequency 50 Hz, Load loss at75˚C temperature, the Total Loss Figures at 50 Hz frequency & 75˚C temperature at 50% and at 100% loading shall not exceed the figures as noted in Annexture-B of the specification.**

The capitalized cost of No load loss (Iron loss) at frequency of 50 Hz and Load loss (copper loss) per KW at 75˚C temperature at rated load, voltage and will be as follows :

i) Capitalised value of Iron loss / KW = Rs.5,64,908/-

ii) Capitalised value of load loss / KW = Rs.1,69,470/-

In the G.T.P. your quoted/ guaranteed transformer NO load loss at frequency 50 Hz & Load Loss at principal Tap position at75˚C temperature are to be specified.

If NO load loss at frequency 50 Hz & Load Loss at principal Tap position at75˚C temperature after Routine Tests in each transformer is found beyond guaranteed values of declared in the bid offered, penalty shall be imposed for the excess loss over the corresponding guaranteed value by applying the above stated values. For fraction of a KW, penalty shall be applied pro-rata, but no bonus will be applied on vice-versa. In case above losses are found beyond the value as stipulated in our specification in Annexure-B, the said transformer will be rejected. In addition if the the Total Loss Figures observed at 50 Hz frequency & 75˚C temperature at 50% and at 100% loading during Routine/Acceptance tests, if exceed the respective values noted in Annexture-B of the specification, the transformer will also be rejected.

No bidder shall specify any tolerance in respect of the quoted figures of the above losses.

Accessories:

Transformer capacity in KVA (upto 11 kV Voltage class)

Sl. No.	Item	1000 KVA
1.	Terminal marking Plate Nos.	1
2.	Property & Danger Plate	1 each
3.	Earthing Terminal-Nos.	2
4.	Lifting Lugs-Nos.(for trans. Assembly)	2
5.	Platform mounting arrangement	Should be provided as per requirement of the Customer
6.	H.V. Bushings	3
7.	L.V. bushings for phases & Neutral	4
8.	Thermometers embedded in windings	1 set in 3 phase LV winding & core only
9	Diagram Plate	1
10	Explosion Vent (for O/D Type only)	2

ANNEXURE-B

Rating of Transformer	No Load (Iron) Loss at 50 Hz frequency (Watts)	Load (Copper) loss at 75ºC temperature on normal Tap position (Watts)	Maximum Total Loss (NLL + LL) at 100% loading at 50 Hz & at 75ºC on normal Tap position (Watts)	Maximum Total Loss (NLL + LL) at 50% loading at 50 Hz & at 75ºC on normal Tap position (Watts)	Percentage Impedance on Normal tap at 50 Hz frequency and 75ºC temperature at rated KVA
1000 KVA; 11/0.415KV	2000	10000	12000	4500	5.0 with IS Tolerance

ANNEXURE-C

1. Bushing Clearance: This should be as per clause No. 18.03 of Specification.
2. Enclosure as Clause No. 2.23 & 2.22 of IS:11171, 1985 for I/D & O/D Type respectively.
3. Winding Materials: Electrolytic Copper
4. Similar materials for both L.V. & H.V. windings should be chosen.
5. Limits of average winding temperature rise above
6. 50ºC maxm. ambient : 120ºC
7. Tap position for Off Load Tap Changer : +5% to – 7.5% in steps of 2.5%

ANNEXURE –A

SCHEDULE OF GUARANTEED PERFORMANCE TECHNICAL AND OTHER PARTICULARS FOR 1000 KVA 11/0.415 KV, DRY(VPI) TYPE, DISTRIBUTION TRANSFORMERS

The Tenderers shall have to submit details applicable to the equipments offered in the forms given below

GUARANTEED TECHNICAL PARTICULARS					
Sl.No.	Particulars				
1.	Name and address of the manufacturer		:		
2.	Country of origin		:		
3.	a) Applicable standard		:		
	b) Service		:		
	c)Type of Dry Type Transformer		:	Cast Resin	
4.	Maximum continuous rating (in KVA)		:		
5.	No load voltage ratio at Principal (Nominal) tap (in KV/KV)		:		
6.	Rated frequency (in Hz)		:		
7.	Number of phases		:		
8.	Type of Cooling		:		
9.	Connections		:		
	(i) H.V. Winding		:		
	(ii) L.V. Winding		:		
10.	Vector Symbol		:		
11.	Tapings		:		
	(a) Range		:		
	(b) Number of steps				
	(c) Variation of voltage in each step (in KV)				
	(d) No load voltage ratio in each tap (in KV/KV) for 1000 KVA 11/0.415 KV Transformer.				
	Tap Number	Voltage ratio		Tap Number	Voltage ratio in

GUARANTEED TECHNICAL PARTICULARS					
		in KV/KV			KV/KV
	1.			4.	
	2.			5.	
	3.			6.	

12.	(i) Temperature rise under normal operating condition above ambient temperature		:		
	(a) Windings (in Degree C)		:		
	(b) Maximum hot spot temperature of Copper windings (in Degree C)		:		
13.	Magnetizing current referred to H.V. at rated frequency		:		
	(a) at 90% rated voltage : (in Amps)		:		
	(b) at 100% rated voltage : (in Amps)		:		
	© at 110% rated voltage (in Amps)		:		
14.	Power factor of magnetizing current at 100% rated voltage & frequency		:		
15.	No load current at rated voltage and Rated frequency (in Arms)		:		
16.	No load loss in KW at rated frequency and voltage		:		
	(a) at Lowest tap		:		
	(b) at principal tap		:		
	© at highest tap		:		
17.	Load loss in KW at 75 Deg. C. at Rated output and frequency		:		
	(a) at Lowest tap		:		
	(b) at principal tap		:		
	© at highest tap		:		
18.	Total loss in KW at 50 Hz & 75˚C **at 50% Load**				
19	Total loss in KW at 50 Hz & 75˚C **at 100% Load**				
20.	Percentage Regulation at full load at 75 Deg.C		:		
	(a) at unity power factor		:		
	(b) at 0.8 power factor lagging		:		

GUARANTEED TECHNICAL PARTICULARS			
21.	Efficiencies at 75 Deg.C (in percentage)	:	
	a) at full load (i) at unity power factor	:	
	(ii) at 0.8 power factor lagging	:	
	(b) at ¾ full load (i) at unity power factor	:	
	(ii) at 0.8 power factor lagging	:	
	(c) at 1/2 full load (i) at unity power factor	:	
	(ii) at 0.8 power factor lagging	:	
22.	Impedance voltage on rated KVA base at rated current and frequency for the Principal tapping 75^0C. (in percentage)	:	
23.	a) Reactance voltage at rated current and frequency for the principal tapping at 75^0C. (in percentage) b) Resistance voltage at rated current and frequency for the principal tapping at 75^0C. (in percentage)	: :	
24.	Resistance at H.V. base at 75^0C		
	(a) at Lowest tap	:	
	(b) at principal tap	:	
	(c) at highest tap	:	
25.	Reactance at H.V. base at 75^0C.		
	(a) at Lowest tap	:	
	(b) at principal tap	:	
	(c) at highest tap	:	
26.	Withstand time without injury for three phase dead short circuit at terminal (in seconds)	:	
27.	Short time current rating for short circuit with duration	:	
	a) H.V. winding (in K. Amps)	:	
	b) L.V. winding (in K Amps)	:	
	c) Duration (in seconds)	:	
28.	Permissible overloading with time	:	

GUARANTEED TECHNICAL PARTICULARS			
29.	Core :		
	i) Type	:	
	ii) Flux density of Core and yoke at principal tap	:	
	a) at rated voltage at 50 Hz (in lines/sq.cm	:	
	b) at 112.50% rated voltage at 50 Hz (in lines/sq.cm.)	:	
	iii) Thickness of Stamping (in mm)	:	
	iv) Type of insulation between core laminations	:	
	v) Core bolt withstand Insulation (in KV rms for 1 min)	:	
	vi) Approximate area of Cross Section of Core and yoke (in sq.mm.)	:	
	vii) Material of Core clamping plate	:	
	viii) Thickness of Core clamping plate (in mm)	:	
	ix) Insulation of Core clamping plate	:	
	x) Describe location/Method of Core grounding	:	
30.	Terminal Arrangement	:	
	i) High Voltage	:	
	ii) Low Voltage	:	
31	Positive Sequence Impedance between HV & L.V. winding on rated MVA base at rated Current and frequency at 75 Deg.C. winding temperature	:	
	i) AT principal tapping (in percent)	:	
	ii) At lowest tapping (in percent)	:	
	iii) At highest tapping (in percent)	:	
32	Zero Sequence Impedance at reference temperature of 75^0C at principal tap (in percent)	:	
33	Details of windings	:	
	i) Type of Winding	:	
	(a) High Voltage	:	
	(b) Low Voltage	:	

GUARANTEED TECHNICAL PARTICULARS				
34	Winding conductor	:		
i)	Material of the winding conductor			
	(a) High Voltage	:		
	(b) Low Voltage	:		
ii)	Conductor Area :			
	(a) High Voltage (in sq.cm)	:		
	(b) Low Voltage (in sq.cm)	:		

iii)	Current density of windings at rated KVA	At principal tapping 1	At lowest tapping 2	At highest tapping 3
(a)	High voltage (Amp. per sq.cm)			
(b)	Low voltage (Amp. per sq.mm)			

iv)	Insulating material used for	:	
	(a) High voltage winding	:	
	(b) Low voltage winding	:	
v)	Insulting material used between	:	
	(a) High voltage and low voltage winding	:	
	(b) Low voltage winding and core	:	
vi)	Whether adjustable coil clamps are pro0vided for H.V. & L.V. winding (if yes, details may be given) :		
vii)	Type of Axial Coil Supports	:	
	(a) H.V. winding	:	
	(b) L.V. winding	:	
vii)	Type of Radial Coil Supports	:	
	(a) H.V. winding	:	
	(b) L.V. winding	:	

GUARANTEED TECHNICAL PARTICULARS					
35	Insulation withstand Test voltages	:	H.V.		L.V.
	i) Lightning Impulse withstand test voltage 9kv Peak)	:			
	(ii) Power frequency withstand test voltage (in KV rms for 1 min)	:			
	(iii) Induced over voltage withstand test voltage (in KV rms)	:			
36	Current in the winding at rated KVA	:	At principal tapping	At lowest tapping	AT highest tapping
	(i) Low voltage (in Amps)	:			
	(ii) High voltage (in Amps)	:			
37	Voltage per turn (KV per turn)	:			
38	Ampere turn	:			
39	Number of turns	:	At principal tapping	At lowest tapping	AT highest tapping
	(i) Low Voltage	:			
	(ii) High Voltage	:			
40.	Details of Tap changer	:			
	i) Number of steps	:			
	ii) Number of Plus taps	:			
	iii) Number of minus taps	:			
	iv) Position of taps on HV	:			
	v) Type of tap changing arrangement	:			
41.	Bushing :		High voltage	Low voltage	
i)	Make	:			
ii)	Type	:			
iii)	Applicable standard	:			
iv)	Insulation withstand test Voltage	:			
a)	Lightning Impulse withstand test	:			

GUARANTEED TECHNICAL PARTICULARS				
	voltage (1.2 x 50 micro seconds in KV peak)			
b)	Power frequency withstand test voltage (in KV rms for 1 min)	:		
	1)Dry	:		
	2)Wet	:		
v)	Creepage distance			
	a) Total (in mm)	:		
	b) Protected (in mm)	:		
vi)	Minimum height of the bushing	:		
42.	Minimum clearance (in mm)	:		
			In Air	
			Between Phases	Phase to Ground
	i) H.V.			
	ii) L.V.			
43.	Particulars of Enclosures & Fitment			
	i) CRCA Steel Thickness	:		
	ii) No of Louvers provided in side enclosures	:		
	iii) Covering of Louvers – Fine Steel Mesh	:		
	iv) Proper ventilation is provided	:		
	v) Structure of Enclosure along with Dimension			
	a) Whether the Hinged Door are lockable	:		
	b) The IP of Enclosure	:		
	vi) No of Cowl type inspection Cover provided	:		
	vii) No of Drain Plug Provided	:	:	
	viii) No of Lifting Hooks provided in the main tank	:		
	ix) No of Lifting Lug	:		
	X) No of Earthing terminal Provided	:		
	i) Skid Chanel with Round Corner provided	:		
	ii) No of Explosion Vent provided	:		

GUARANTEED TECHNICAL PARTICULARS			
	iii) The area of Each Vent	:	
	iv) Thickness of LT cable End Box Metal Sheet		
	v) Thickness of LV Door leaf Sheet Metal		
	vi) Thickness of HT cable End Box Metal Sheet		
	Vii) Thickness of HV Door leaf Sheet Metal		
44.	Weight of Transformer, Enclosure and fitting with accessories	:	
	i) Untanking weight	:	
	ii) Total weight with Core, Winding, Fittings.	:	
iv)	Detail of Thermometer embedded in winding	:	
v)	Current rating of each contact of Temp meter	:	
45.	Approximate overall Dimensions (in mm)	:	
	a) Length	:	
	b) Breadth	:	
	c) Height	:	
	d) Minimum height of bottom most portion of bushing from bottom of base channel	:	
46.	Minimum clearance height for lifting Enclosures (in mm)	:	
47.	Whether agreeable to carry out Type Tests, in line with specification at your Cost?	:	
48.	Category	:	
49.	Whether all particulars against sl. No. 1 to 46 furnished?		

SIGNATURE OF THE TENDERER

WITH COMPANY'S SEAL