

WEST BENGAL STATE ELECTRICITY DISTRIBUTION COMPANY LTD.
TECHNICAL SPECIFICATION OF 16 , 25, 63 & 100 KVA : 11/0.433 KV : 3 PHASE
POLE MOUNTED OUTDOOR TYPE STACK CORE TYPE ONAN COOLED
DISTRIBUTION TRANSFORMER

1.00 SCOPE:-

1.01 This specification covers design, manufacture, assembly, testing at manufacturer's works, supply & delivery of three phase 50 HZ, 11/ 0.433 KV, Delta/Star, Vector Group Dyn11, two winding, outdoor type, oil immersed naturally Oil & Air cooled, Stack Core Type Distribution Transformer as per details furnished hereafter.

2.00 APPLICABLE STANDARD :

01. Transformers covered by this specification shall, unless otherwise specified be built to conform to the latest Indian Electricity Rules, wherever applicable and the requirements of latest issue of ISS:1180 (Part-1) of 2014 and ISS 2026, CBIP Standards and other ISS (all as per latest issues)
02. In the event of a conflict between the above standard and the specification, the latter shall govern.

3.00 CLIMATIC CONDITION :

3.01 For the purpose of design following climatic conditions shall be considered:-

- | | |
|--|---------------------|
| 1. Elevation at mean sea level | : 1000 M |
| 2. Maximum ambient Air temperature (°C) | : 50 |
| 3. Maximum daily average ambient (°C) | : 40 |
| 4. Minimum Ambient air temperature (°C) | : (-) 5 Deg. C |
| 5. Relative humidity | : 100% |
| 6. Pollution level | : Heavily polluted. |
| 7. Maximum Wind Pressure | : 250 kg/sq. mtr. |
| 8. Annual average rain fall | : 3000mm |
| 9. Average No. of thunder storm day per annum: | 100 |

3.01 APPLICATION :

The equipment shall be installed on double pole structure or plinth at outdoor location any where in West Bengal in the Distribution system of WBSEDCL to effect power supply to the consumer.

4.00 PRINCIPAL PARAMETERS :

- 4.01 The transformers shall be suitable for outdoor installation with three phase, 50 Hz, 11 KV system in which the neutral is effectively earthed and they should be suitable for service with fluctuations in supply voltage upto plus 12.5% to minus 12.5%.
- 4.02 The Transformer shall conform to the following specific parameters

| | | |
|-----|---------------------|---|
| 1. | System Voltage | 12 KV |
| 2. | Rated Voltage HV | 11 KV |
| 3. | Rated Voltage LV | 0.433 KV for 16, 25, 63 & 100 KVA |
| 4. | Phase | 3 phase |
| 5. | Frequency | 50 HZ subject to fluctuation of \pm 5% |
| 6. | Connection HV | Delta |
| 7a. | Connection LV | Star (Neutral brought out) |
| 7b. | LV Neutral Earthing | The Neutral point of the secondary (LV) winding shall be brought out in a separate insulated terminal and shall be solidly earthed. |
| 8. | Vector Group | Dyn11 |
| 9. | Type of Core | CRGO material |

| | | |
|-----|--|--|
| 10. | Winding | HV winding shall be wound from Super Enamel Covered / Double paper Covered aluminium conductor for 16, 25 & 63 KVA and for 100 KVA HV winding shall be wound from Double paper Covered aluminium conductor and the LV winding shall be wound from Double paper Covered aluminium for 16,25,63 & 100KVA . Foil winding will not be acceptable |
| 11. | Rating | 16, 25 , 63 & 100KVA |
| 12. | Type of Cooling | ONAN |
| 13. | Percentage Impedance at 75°C | 4.5% ± IS tolerance |
| 14. | Maximum Temperature Rise over ambient | i) Top oil temp. rise measured by thermometer - 35°C |
| | | ii) Winding temp. rise measured by resistance method - 40 °C |
| | | Bids not meeting the above limits of temperature rise will be treated as non responsive. |
| 15. | Rated Short Circuit Level | 13.1 KA for 3 seconds at 11 KV |
| 16. | Taps | No tapping shall be provided for transformers upto 160 KVA rating, until and unless specified. |
| 17. | Audible sound levels in decibel at rated voltage & frequency | i) Upto 50 KVA 48db ii) 51 – 100 KVA – 51db |

5.00 **Losses:**

Standard Losses at 75°C will be as follows :

The bidder shall guarantee individually the NO Load Loss and Load Loss at 75 ° C within the Maximum allowable value as specified below, but the Total Loss at 50 % & 100% loading at rated voltage and frequency at 75 ° C shall not exceed the value as mentioned below. Capitalization of Transformer losses shall be evaluated as per CEA / REC guideline with the guaranteed value of declared losses of a particular type transformer.

NO POSITIVE TOLERANCE SHALL BE ALLOWED ON THE MAXIMUM ALLOWABLE NO LOAD LOSSES, LOAD LOSSES AT 75 °C, TOTAL LOSSES AT 50 % & 100% LOADING at column (4) , (5), (6) & (7) mentioned below.

| Sl. No. (1) | Voltage Ratio (2) | Rating in KVA (3) | Max ^m Total Loss (NLL + LL) at 75 °C | | Maximum Allowable No load losses (6) | Maximum Allowable Full Load losses at 75 °C (7) |
|----------------|----------------------|----------------------|--|----------------------|---|--|
| | | | 50 % Loading (4) | 100 % Loading (5) | | |
| 2. | 11000 / 433 V | 16 | 150 Watts | 480 Watts | 80 Watts | 475 Watts |
| 2. | 11000 / 433 V | 25 | 210 Watts | 695 Watts | 100 Watts | 685 Watts |
| 3. | 11000 / 433 V | 63 | 380 Watts | 1250 Watts | 180 Watts | 1235 Watts |
| 4. | 11000 / 433 V | 100 | 520 Watts | 1800 Watts | 260 Watts | 1760 Watts |

CAPITALISED COST OF NO LOAD LOSS AND FULL LOAD LOSS PER KILOWATT HAVE BEEN MENTIONED AGAINST CLAUSE - NO. 29 .00 O F THIS SPECIFICATION.

6.00 **TERMINALS :**

Transformer shall be provided with outdoor type bushing insulators on both H.V. & L.V. Sides. HV & LV bushings shall be located on opposite side of the transformer, not on the Top Cover. The Height of the top of the Bushing should be below the minimum oil level marking of the oil level gauge in case of transformer with conservator (i.e 63 & 100 KVA). The inner end of H.V bushing i.e insulated portion of H.V. stud should be below min^m oil level marking in case of 25 KVA DTR. **L.V bushing location should be well above the top yoke.**

The electrical characteristic of bushings insulators shall be in accordance with the latest version of IS 2099. Dimensions & type of bushing shall conform to IS: 3347 & shall be as follows :

H.V. Bushing (11 KV Side) : 17.5 KV class

LV bushing (0. 433 KV side) : 1100 V Class

Neutral bushing at L.V. Side : Neutral of L.V. Winding shall be brought out through porcelain bushing similar to LV bushing for connection with earth terminal.

6.01 **INSULATION LEVEL :**

The Transformer shall be capable to withstand test voltage as specified below :

| Nominal voltage | Highest System voltage | Rated Lightning impulse withstand voltage (In KV peak) | Rated short duration power frequency withstand voltage in KV (r.m.s) |
|-----------------|------------------------|--|--|
| 11 KV | 12 KV | 95 | 28 |
| 433/415 V | - | - | 3 |

7.00 **Cores:**

- 7.01 The cores shall be of stack type only for all the 16, 25, 63 & 100 KVA DTR, , constructed from low loss Silicon Steel cold rolled grain oriented with inter lamination resistance & rust inhibiting property having Magnate/ Carlite as Inter lamination insulation.
- 7.02 The maximum flux density in any part of the core & Yoke at rated frequencies shall not exceed 1.6 Tesla at normal voltage & 1.9 Tesla under over voltage condition i.e. 12.5% over voltage. The magnetizing current at rated voltage at rated frequency should not exceed 3% of F.L.C. while at 112.5% of rated voltage & frequency it should not exceed 6% of F.L.C. as per cl. No. 6.9.2 of IS 1180 (Part-1) of 2014.
- 7.03 The assembled core shall be securely clamped with uniform pressure to minimize noise.
- 7.04 The M.S. Core clamping frame shall be provided with lifting holes for Tanking & detanking and the core is to be electrically connected by tinned copper strip of adequate section to the core frame for earthing through the tank at two different points to drain off electrostatic potential that may build up.
- 7.05 The supporting framework of the core shall be so designed , so as to avoid the presence of pocket which would prevent complete emptying of tank or cause trapping of air during filling.
- 7.06 Adequate provision shall be made to prevent movement of core and winding relative to the tank during transport and installation or while in service.
- 7.07 The core shall conform to: IS : 3024 - 1965, Electrical sheet steel & IS : 649 -1983 , Method of test steel sheet . Successful bidder will offer for core for inspection and / or approval by the purchaser during the manufacturing stage.
- 7.08 The manufacturers call notice in this regard should be accompanied with the following documents as proof towards the use of prime core material.
1) In voice of the supplier 2) Mill's test certificate 3) Packing list 4) Bill of Landing 5) Bill of entry certificate to customs .
Core material shall be procured either from core manufacturer or through their accredited marketing organization of repute.
- 7.09 Transformer Sl. No. shall have to be punched on the top core - yoke frame.

8.00 Winding:

- 8.01 The Transformer shall be provided with requisite number of windings and shall be so designed to withstand the electro mechanical stress exerted under short circuit conditions as per ISS : 2026 -1977
- 8.02 The winding shall be so designed to reduce to a minimum out of balance forces in the transformer.
- 8.03 The winding shall be so designed that all coil assemblies of identical voltage & KVA rating shall be Interchangeable. Foil winding will not be acceptable.
- 8.04 The winding shall be assembled on the core centrally for magnetic balance & symmetrically for electrical balance. Ducts shall be provided for oil circulation and lowering hot spot temperature in the winding.
- 8.05 All insulating materials to be used in the transformer shall be of **Class A** insulation as specified in Indian Standards. The paper insulation shall be dry and free from puncture and other defects. Solid insulation shall be of best quality. Wooden support, if used, shall be well seasoned and compatible with hot transformer oil. The test certificate of the raw materials shall be made available by the Transformer manufacturer on request during Inspection & Testing.
- 8.06 The insulation of Transformer winding & connections shall be free from Insulating materials liable to soften, ooze out , shrink or collapse and shall be non catalytic & chemically inactive to transformer oil during service.
- 8.07 The details of Insulation covering for LV conductors shall be DPC (Double Paper Cover) for 16, 25, 63 & 100 KVA and for H.V winding it may be either of DPC / SE (Super Enamel) for rating up to 63 KVA DTR and the H.V winding insulation shall be of DPC i.r.o. DTR above 100 KVA rating.
- 8.08 The number of HV coils per phase per limb for stack core shall be minimum 4(four) nos. up to 63 KVA DTR , 6(Six) nos. for 100 DTR .
- 8.09 The Inter-leaved Insulating paper between the layers of the winding , shall be Kraft Paper as per IS 9335.
- 8.10 The clearance between the coils shall be adequate and well co - coordinated.
- 8.11 The stacks of windings shall receive adequate pre shrinkage treatment before assembly. No tapping are to be provided on the winding.
- 8.12 HV / LV lead termination to the stud should be made either by method of brazing / soldering or the free end of The lead wire having considerable length should be bent to form a ring & the ring should be fixed to the bushing stud with suitable nut , bolt and washer.

8.13 WINDING AND CLEARANCE INSIDE THE TANK(For Stack type core) C O N S T R U C T I O N:

The winding shall be assembled on the core co-axially for magnetic balance and symmetrically for electrical balance. Liberal ducts shall be provided for oil circulation and lowering hot spot temperature in the winding. Spacers, wedges shall be robust & hard insulations are so fitted in the winding 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, without causing mechanical injury to any insulation in the windings.

- i) The transformer shall have separate H.V. and L.V. windings made of electrical grade Aluminium Wires as specified conforming to relevant I.S.S i.e., IS 191, IS 1897, IS 7404, IS 12444, IS 13730 & IS 6162 of latest edition.
- ii) No. of HV coils per phase/limb shall not be less than 4 nos. for DTR of rating 16,25,63 KVA and for 100 KVA transformer the No. of HV coils per phase /limb shall be minimum 6 nos.
- iii) Minimum clearance between H.V. Coils and/or sections should be 6.4mm and at top/bottom, the minimum clearance should be 12mm including 1.5mm insulating ring.
- iv) Minimum inter phase clearance (HV to HV) with 3mm phase barriers should

- be 10mm up to voltage class of 12 KV.
- v) The minimum end clearance (HV to earth) should be 20mm up to voltage grade 12KV.
 - vi) End insulation at both ends shall include up to 36 KV grade:-
 - a) 3 mm thick yoke insulation over windings of the phases
 - b) 6 mm ducts at the top and bottom for circulation of oil in the LV and HV windings.
 - viii) The minimum radial clearance in the windings will be as follows:-
 - a) Between core and L.V. winding 3mm.
 - b) Between L.V. winding and H.V. winding 10mm including 2.0mm thick Press Board conforming IS 1576 cylinder, where L.V. windings is 1100 V grade and H.V. winding 12 KV grade.
 - xi) L.V. cylinder preferably be made of corrugated insulating press board. Oil ducts need to be provided between core and L.V. winding.
 - x) Minimum clearance between tank wall and H.V. windings/live parts, where the H.V. winding is 12KV grade, clearance: 25mm. No. additional insulating barrier shall be used in between. The dimension in respect of ducts and clearance in windings shall hold for the assembled windings and core prior to application of pressure for permanent shrinkage of coils. The changes in dimensions in finished condition shall remain within 15% (Fifteen percent).
 - xi) The stacks of windings shall receive adequate shrinkage treatment before final assembly. Adjustable devices shall be provided for taking up any possible shrinkage of coils in service. The coil clamping arrangement and the finished dimensions of any oil duct shall be such as will not impede free-circulation of oil through the ducts.
 - xii) All spacers, Axial wedges/runners used in windings shall be made of pre-compressed pressboard –solid, conforming to B 3.1 of IEC 641-3-2. In case crossover coil winding of H.V. all spacers shall be properly sheared and dovetail punched to ensure proper locking. All axial wedges/runners shall be properly milled to dovetail shape so that they pass through the desired spacers freely. Insulation shearing, cutting, milling and punching operations shall be carried out in such a way, that there should not be any burr and climational variations.

8.14 BRACING OF WINDINGS:

- i) 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.
- ii) Coil clamping rings, if provided, shall be of steel or of suitable insulating material. Axially laminated material other than bakelite paper shall not be used.

9.00 TANK :

- 9.01 Conventional plain tank shall be constructed. The Transformer tank and cover shall be fabricated from good commercial grade low Carbon Steel suitable for welding & of adequate thickness. The tank wall should be of thickness **3.15 mm. Top and bottom plate should be of 5.0 mm thickness.** Tolerance as per IS : 1852 shall be applicable.
- 9.02 Tank design shall be such that core & winding assembly can be tanked or detanked easily.
- 9.03 The main tank body shall be capable of withstanding vacuum gauge pressure 250 mm of HG.
- 9.04 The under carriage of the tank shall be made of channel of suitable size & design.
- 9.05 The base of each tank shall be so designed that it shall be possible to move the complete transformer unit by skidding in any direction without injury when using plates or rails.
- 9.06 The radiator should be fitted below the lowermost point of the bushing Gasket so that oil level of the transformers under any circumstances do not go below the topmost point of radiator headers due to oil leakage from the bushing gasket.

9.06 Tank shall be designed to prevent retention of water. Tank cover shall be of adequate strength. It shall be bolted on to flanged rim of the tank with weather proof hot oil resistant Synthetic rubber or synthetic rubberized cork resistant to hot transformer oil conforming to Type III as per IS 11149/Type C as per IS 4253(Part2) of 5 mm thickness and shall be provided with water tight compound between the tank flange and the gasket.

Tank cover should have 90° downward bent edges on all sides to protect the gasket under the top cover from direct exposure to weather. The tank cover should have slightly slanted towards H.V. side so that rain water could not accumulate on the tank top cover

The rating, Sl. No., P.O No., year & month of manufacture, guaranteed for five years, property of WBSEDCL etc. Asset Codification no. & Loss Figures shall be engraved / Embossed distinctly on the tank body in addition to those provided in the name & rating plate. Adequate care shall be taken so that tank does not get damaged during such engraving. Alternatively a M.S Sheet of adequate thickness containing those data being engraved in the sheet may be welded at a suitable location of the tank body. Adequate care must be taken so that the main tank/Hot resistant paint inside the tank/Transformer oil do not suffer any damage during the process of welding.

Nuts & Bolts and washers are to be provided for outside use on tank cover & accessories shall be as follows:

- a) Size 12 mm or below – Stainless Steel
- b) Above 12 mm. – Steel with suitable finish like Electro galvanised with passivation or hot dip galvanized.

9.07 Inside wall of the tank and the M.S.Channel shall be painted with varnish or with hot oil resistance paint.

Stiffener shall be continuously welded on the tank wall.

9.08 All the welding of the tank & accessories must be double welded and all welding operations must be done by qualified welders.

9.09 Nuts, bolts, flat washers, spring washers as specified shall be used and suitably space to press the tank cover.

Following minimum clearance between top yoke and tank cover are to be maintained.

9.10 a) 16 & 25 KVA Transformer

Oil level from top cover shall not be less than 25 mm and height of oil level from top yoke or top of core shall not be less than 50 mm (at cold condition).

b) 63/100 KVA (without tap changer) : Transformer (the clearance between top yoke or top of core and tank cover) shall not be less than 125 mm.

9.11 Silica gel breathers are to be provided on transformers of all ratings. A suitable metallic cover should be provided on the pipe on which breather is provided at a location just above the breather so that it can protect rain water from falling directly onto the breather. Conservators are to be provided on transformers of ratings 63, 100. The pipe for connecting the breather should be provided with a metallic plate suitably shaped in the form of a canopy and at a point of the pipe beneath which the breather is connected so that rain water does not fall onto the breather directly. The moisture absorption shall be indicated by a change in the colour of silica gel crystals which should be visible from a distance. Volume of the breather shall be suitable for 500 gm. of silica gel conforming to IS 3401 for transformers upto 100 KVA. The conservator shall be liberally dimensioned such that with the lowest ambient temperature and no load on the transformer, the oil level shall not recede too low with the highest ambient temperature & permissible overload on the transformer, the oil will not spill into the breather pipe or to the exterior to waste. The conservator shall be provided with oil level indicator of prismatic type with Min^m Normal & Max^m temperature Markings. The inside diameter of the pipe connecting the conservator to the main tank shall be within 20 to 50 mm and it should be projected into the conservator in such a way that its end is approximately 20 mm above the bottom of the conservator.

Conservators shall not be provided with drain plug for transformer of 63 & 100 KVA ratings. Filling hole with cover shall be provided as usual. Conservator pipe for 63 KVA & 100 KVA transformers shall be welded on the top cover. The conservator pipe hole fitted to the tank cover should be provided with a suitable slanted plate, if required so that while pouring oil into the transformer through the conservator, oil does not fall directly on the winding. Care should be taken so that free oil flow is not impeded. Explosion vents for 100 KVA transformers shall also be welded on the cover. Air release plug should be provided on the top of the explosion vent, and in tank cover to release any entrapped air.

9.12 **PRESSURE TEST :**

The tank shall be fixed with a dummy cover with all fittings including bushings in position and shall be subject to air pressure of 80 Kpa above atmosphere for 30 minutes and vacuum of 250 mm. of mercury upto 200KVA & 500 mm. of mercury for rating above 200 KVA for 30 minutes. The permanent deflection of flat plate after pressure has been released shall not exceed the values given below :-

| | |
|-----------------|------------------------------------|
| Length of plate | Deflection for rating upto 200 KVA |
| Upto 750 m | 5 mm |
| 751 to 1250 mm | 6.5mm |

If required, the manufacturers should submit pressure test certificate for the transformers tanks at least for one tank for each batch either conducted by their fabricators or themselves. Transformer tanks should be double welded electrically as per the specification.

9.14 The manufacturers should submit pressure test certificate for the transformers tanks at least for each batch either conducted by them or by their fabricators, for which order is placed with them and the edges (both inside and outside) of the transformer tanks should be double welded electrically and scrupulously as per the specification.

9.15 **Bushings**

| | | |
|---|--|---|
| <p>Bushing: The bushings shall conform to IS: 2000-1968(latest): Bushing for Alternating voltage above 1000 Volts and IS 7421-1974(latest) for bushing upto and including voltage up to 1000 volts.</p> <p>The dimensions of bushings of the following voltage classes shall conform to Indian Standard mentioned against them.</p> | | |
| Voltage Class | Indian Standards | |
| Upto 1KV Bushings | For porcelain parts IS: 3347/Part-I | For Metal Part IS: 3347/Part-I(Sec-2)(1979) |
| 12/17.5KV bushings | IS:3347/Part-III (Sec-I)(1972) | IS:3347/Part-III (Sec-2)(1982) |

The Height of the HV bushings relative to the oil level gauge should be such that the top of the HV bushings are immersed in the oil when the oil level of the oil level gauge is at minimum position.

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

| Nominal System | Test Voltage | Clearances | | |
|-------------------|--------------|--------------------------------------|--------------------|--|
| | | Phase to Phase (mm) | Phase to Earth(mm) | Arcing Horn gap(mm) |
| <u>Voltage KV</u> | Impulse KVP | | | |
| 0.433 | - | 85 for 63 & 100 KVA 75 for 25 KVA | 40 | - |
| 11 | 95 | 255 | 140 | 86/85 Refer Fig-26 in IS: 3347(Part-III/Sec- |

10.00 **PAINTINGS :**

10.01 Before painting or filling with oil, all un-galvanized parts shall be completely cleaned & free from rust, scale & grease and all external surface on castings shall be filled by metal deposition.

10.02 The interior of all transformer tank & Internal structural steel work shall be thoroughly cleaned of all scale & rust by sand blasting or other approved method. This surface shall be painted with hot oil resisting varnish or paint.

10.03 Except for nuts, bolts and washers, all external surfaces shall receive adequate nos. of coating of weather resisting paint.

All steel surfaces exposed to weather, shall be given a primary coat of Zinc chromate and at least two coat of final paint i.e. dark admiral gray paints. (IS 104 & IS: 2932) **OR Powder** Coating Painting as specified by **CEA**.

All nuts & bolts used in the transformer for external fittings shall be painted with body paints.

11.00 **EARTHING TERMINALS :**

Two earthing terminals capable of carrying the full amount of lower voltage , short circuit current of transformer continuously for a period of 5 Sec. shall be provided.

12.00 **RATING & DIAGRAM PLATE :**

12.01 A rating plate bearing the data specified in the relevant clauses of IS : 2026 including connection diagram , Vector Group, Voltages LV & HV, LV & HV current , Percentage Impedance , loss figure, makers name , serial no. Etc. are to be provided along with the transformer.

12.02 The weight of core & winding is to be mentioned.

12.03 Guaranteed maximum Temp rise in oil & winding should be mentioned.

12.04 Guaranteed No - load loss at rated frequency & load loss at rated load (at 75°C) is to be mentioned. Guaranteed Total loss at 50% and 100% load at 75 ° C are also to be mentioned

13.00 **DUTY UNDER FAULT CONDITION :**

13.01 It is to be assumed that abnormal voltage will be maintained on one side of the transformer when there is a short circuit between phases or to earth on the other side.

13.02 The transformer may be directly connected to an underground or overhead line and may be switched into and out of service together with or without its associated incoming / outgoing line.

13.03 The thermal ability to withstand short circuit shall be three seconds without injury for 3 phase dead short circuit at the terminals. The related calculation is to be submitted.

13.04 **Over Load Capacity:**

Each transformer shall be capable of carrying sustained overload as stated in ISS.

14.00 **FITTINGS:-**

14.01 The following fittings shall be provided with the Transformers.

- i) Name , rating & terminal marking plates
- ii) Two nos. earthing terminals.
- iii) Two nos. lifting Lugs at two diagonally opposite corners of the tank top cover.
- iv) Pole / plinth mounting arrangement.
- v) Silica gel breather.
- vi) H.V. Bushing with arcing horn.
- vii) L.V. Bushing for phases & neutrals.
- Viii) Two nos. oil filling hole with cover on the tank top cover for only 16 KVA but for other rating one no. oil filling hole with cover on the tank top cover.
- ix) One no. oil level gauge of prismatic type with Min^m, Normal & Max^m Temperature Markings.
- x) Conservator is to be provided only for 63 & 100 KVA.
- xi) Drain Valve (for 25 , 63 & 100 KVA) [REC type with 3/4" plug]
- xii) Filter Valve (for 63 & 100 KVA) [Wheel valve -- 3/4" size]
- xiii) Explosion Vent with Air release plug is to be provided only for 100 KVA .
- xiv) Air release plug on the tank top cover for 63 & 100 KVA DTR and thermometer pocket as per specification on tank top cover located right above the centre of top yoke.

15.00 **Lifting and Haulage facilities :**

15.01 Each transformer tank shall be provided with lifting lugs suitable for lifting of transformer complete with oil. Suitable holes shall be provided in the base channel of the transformer tank for fixing in the D. P. Structure above ground level of height 4.5 meter approx.

16.00 **Insulating Oil :**

16.01 The transformer shall be supplied filled with oil maintaining the minimum oil level as mentioned in clause 9.10. The insulating oil shall conform to the requirement of IS: 335.

17.00 **Use of re-cycled oil is not acceptable.**

17.01 The specific resistance of the oil shall not be less than 2.5×10^{12} ohm - cm at 27 °C when tested at IS 6103.

17.02 Oil shall be filtered and tested for BDV and moisture content before filling. The Oil shall be filled under Vacuum.

17.03 The design and all materials and processes used in the manufacture of the transformer, shall be such as to reduce a minimum the risk of the development of acidity in the oil.

18.00 **Internal Earthing Arrangement:-**

18.01 All metal parts of the transformer with the exception of the individual core lamination, core bolts and associated clamping plates shall be maintained at same fixed potential & core should be earthed at two points.

ROUTINE & TYPE TEST AND OTHER COMMON DETAILS FOR 16-100 KVA DISTRIBUTION TRANSFORMER

19.00 **Testing & Inspection: -**

19.01

Routine Test :

All transformers shall be subjected to routine tests at the manufactures works. The following tests are to be carried out :

- a) Measurement of winding resistance.
- b) Ratio, polarity and phase relationship
- c) Impedances voltage
- d) Load losses at 75°C
- e) No load loss at 50 Hz and no load current at rated voltage & 112.5% voltage.
- f) Load loss at 50% & 100% loading at 75°C
- f) Insulation resistance.
- g) Induced over voltage withstand.
- h) Separate source voltage withstand
- i) Characteristic requirement of oil sample will be as per IS: 1866 -1983 amended upto 1987.
- j) Unbalance current : The maximum value of unbalance current in transformer shall not exceed 2% of full load current as per CBIP for transformer.
- k) Magnetising current at rated voltage & frequency & 112.5 % of rated voltage & frequency should not exceed the limit as per IS: 1180 (Part – I) Cl . 22.6 .
- j) Pressure Test: As per Clause no. 21.5.1.3 of IS 1180 (Part-1) 2014
- k) Oil leakage Test: As per Clause no. 21.5.1.2 of IS 1180 (Part-1) 2014

19 . 02 **Type Tests & Special test :-**

In addition to the routine tests, the following type tests & Special test are to be made by the manufacturer, after necessary Rotine & Temperature rise test by WBSEDCL Engineers as per terms of the tender:

- a) Dynamic short circuit withstand test to be conducted as per IS 21.3(c) of IS 1180 (Part1): 2014
- b) Lightning Impulse voltage withstand test to be conducted as per IS 21.3(a) of IS 1180(Part1): 2014
- c) Temperature rise test – To be conducted as per IS 21.3(b) of IS 1180 (Part1): 2014. Moreover, this test is also to be conducted on one transformer for every lot offered for inspection as per test procedure described in cl. No. IS 21.3(b) of IS 1180 (Part1): 2014
- d) Pressure Test as per test procedure described in Clause no. 21.3(d) of IS 1180 (Part-1): 2014.

Note : 1) To facilitate testing , arrangement should be made for carrying out Heat run test of two Transformers simultaneously.

2) The date of issuance of the Provisional Reports meant for successful type test by the iussuing authority conducting the test may be treated as the date of actual date of completion of Type test. However the Final Type Test Reports are to submitted to Procurement & contracts Department before completion of supply.

- e) Pressure test - Pressure test on tank as mentioned in the clause at 9.12 of this specification , if required , WBSEDCL's testing wing may witness the said test at the shop .

19.03 The manufacture will have to submit thermal calculation of short circuit withstand ability for 2 seconds and 3 seconds.

19.04 Performance under external short Circuit condition and limit of temperature rise.

19.05 All transformers shall be capable of withstanding , without damage the thermal and mechanical effects of a short circuit at the terminals of any of windings for 2secs. The temperature in the windings after 2secs. of over current must not exceed 200°C for Al and 250 °C for Cu windings.

19.06 After the above tests, the transformer shall be subjected to all or a part of the routine test. The criteria for evaluation of test results shall be the same as that for the test to determine the dynamic ability to withstand short circuit in accordance with ISS 2026.19.07 WBSED CL may also make a testing arrangement for carrying out short circuit tests with duration not exceeding 2secs. For distribution transformer upto 100 kVA in a NABL/Govt. approved Laboratory. The transformer subjected to such test shall be examined for temperature rise within specified limit for any damage or displacement of any parts within the transformer.

19.08 **Variation % reactance :**

The transformer so tested shall not exhibit more than 2 percent variation in percentage reactance for stack core and 4% for wound core after the short circuit test from the original measured value before testing according to clause 16.11.5.4 of IS 2026 (Part-I), 1977.

19.09 The selection of transformer for such test shall be carried out at the discretion of the Company from any lot of transformers of same capacities offered for inspection and testing before delivery.

19.10 However, if it is found that the bidder has submitted Tests Report of identical rating but not conducted on identical design of equipment / material as per specification of WBSEDCL, may be accepted for technical qualification, but **after placement of order**, they have to arrange for Dynamic Short Circuit & Lightning Impulse tests at CPRI, NABL accredited laboratory of third party / Govt. approved Laboratories on a sample chosen at random during routine test by our representative, as per WBSEDCL's design in presence of the Engineers of WBSEDCL before mass production is undertaken and as per terms of the order.

However routine test and temperature rise test shall be done on a sample / samples chosen at random during routine test of transformer in presence of Engineers of WBSEDCL will have to be carried out at the premises of the manufacturer / supplier before aforesaid Type test.

The transformer thus type tested should be carefully preserved at the works of the manufacturer under the sealing of WBSEDCL as are made time to time for comparison with the transformers to be offered in future until the order is complete.

All charges for carrying out such tests, have to be borne by the manufacturer.

20.00 **Inspection & Testing : -**

20.01 Inspection & Testing of the equipment / materials shall be subjected to routine & other acceptance test as per provisions in the relevant I.S.

20.02 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.

20.03 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.

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

20.05 The transformer may be staged inspection 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 the purchaser to carry out **stage inspection** & final inspection and testing of the finished transformers.

20.06 **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 the programme of stage inspection of the Purchaser

20.07 **While offer for final inspection the following point should invariably be taken care of.**

i) Name plates should be welded on the tanks of the transformer.

ii) The bolts connecting the top cover of the transformer with the tank at the two opposite corners are to be provided with holes at their lower portions which would go beyond nuts so that the transformers **may be sealed by inserting sealing wire in these holes.**

iii) The transformers should be offered along with factory routine test certificate as per I . S .

21.00 **Test Certificates:-**

21.01 Seven Copies of Test Certificates i.r.o offered transformers are to be furnished to WBSEDCL for acceptance before issuance of instruction for dispatch of the equipment.

22.00 **Drawings & Manuals :-**

22.01 The following drawings and manuals shall be furnished in triplicate **along with tender**.

i) General Arrangement outline drawing with plan , elevation and end view showing various dimension of transformer and its vital equipment including height of the bottom most portion of bushing from the bottom of base channel and also indicating thereon physical center line & position of center of gravity.

ii) Cross sectional drawing showing various parts, including Core - coil assembly.

iii) Drawing for rating & diagram plate , complete list of fittings , Net weight of core , winding , tank , oil , total weight , fixing arrangement of transformer in structures.

22.02 The following drawings in four sets shall be submitted **for approval** within 10 (ten) days from the date of placement of L.O.I. / Order.

1. As stated in clause 21.01 above.

2. Cross sectional details with Plan, Elevation, End view showing all internal clearance.

3. Property plate drawing.

23.00 **Guaranteed Technical Particulars:-**

23.01 Tenders shall be furnished with guaranteed technical particulars of equipment offered as per Schedule .

Performance guarantee shall be based on guaranteed technical particulars.

24.00 **Performance Certificate as pre-requisites :-**

24.01 Copies of performance certificates of similar equipment supplied to various organization shall have to be furnished in triplicate along with the tender.

25.00 **Credentials as pre-requisites:-**

25.01 Tenderer shall furnish document along with bid , in support of supply, delivery at consignee stores (e.g copy of P.O. , SRV , Challan etc) of identical type & rating transformer and also higher capacity with same voltage Ratio and type, to the Govt. & Power Utility, indicating thereon names of the Organization, quantity ordered, quantity supplied along with the tender. Credentials for Purchase orders shall be within last 3(three) financial years from the

date of opening of bid (If opening date extended, the 1st mentioned date for opening , shall be considered for submission of credential).

26.00 **Type Test & special test Report as pre-requisites :-**

26.01 i) The bidder should submit **Test Report** of Short circuit Test and Lightning Impulse voltage test **on same Sl. No.** transformer along with drawing from **CPRI, NABL accredited laboratory of third party** /Govt. approved laboratories carried out **within Five years** along with their offer having identical rating and type as that of the tendered item as **pre-requisites mentioned in GCC**, failing which their offer may not be technically accepted.

ii) In addition to the routine tests , Type Test & special test are to be arranged by the manufacturer , who does WBSEDCL Spec for 16,25,63 &100 KVA DTR. 13 of 21

not have said tests report from CPRI, NABL accredited laboratory of third party / Govt. approved laboratories witnessed by WBSEDCL and also proto type sample of identically designed transformers.

27.00 **Deviations :-**

27.01 All deviations from the specification , shall be recorded in the ` Deviation Sheet ` with reference to respective clauses of the specification by drawing specification for the same. Unless deviations are recorded in the deviation sheet and submitted with the offer, it will be taken for granted that the offer is made in conformity with specification.

28.00 **Validity Period :-**

28.01 Validity period of the offer shall be reckoned from the next date of opening of tender provided it is technically & commercially complete one . Otherwise , it will be counted from the date of receipt of complete information.

28.02 Anything not covering by this specification , will be as per relevant CEA / REC specification & ISS / CBIP manual.

29.00 **Capitalisation of Losses :-**

29.01 Bidder shall state the transformer losses viz. a) Iron loss b) Copper loss separately. Transformer losses will be taken into account during bid evaluation . The losses at rated load , rated voltage & frequency shall be guaranteed.

i) Capitalised value of iron loss (No load loss) per KW= Rs. 5,64,908 /-

ii) Capitalised value of copper loss (Load loss) per KW=Rs. 1,69,470 /-

If any losses after Routine Tests are found beyond guaranteed value declared in the bid offered , penalty will 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. The result of routine test on the sample selected from a lot would be applied to the specific lot.

No changes in guaranteed figures will be allowed after bid opening.

30..00 **Store Testing** :-

Store testing of supplied DTR at WBSEDCL/vendor store may be done at the discretion of WBSEDCL

31.00 **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 , 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. Guaranteed for 5(Five) years

9. 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 min^m 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.

32.00 **Testing Equipments** :-

i) KV Meter (0 - 30 KV) for 11 KV system .

ii) Volt Meter (0 - 1000 V).

iii) Milli ammeter for leakage current (0 - 100 ma).

iii) Power Analyzer of reputed make (should display 3 - phase current , voltage , watt and $\Sigma 3 - \emptyset$ Power

v) Megger - 2.5 KV

vi) Thermometer (preferably Digital) 0 - 100^o C

vii) TTR Meter

viii) Winding Resistance measurement (Preferably ELTEL or reputed make)

ix) Digital Multimeter

x) Clamp on ammeter (0 - 300 A)

ALL THE ABOVE TESTING EQUIPMENTS SHALL BE AVAILABLE IN THE TESTING LAB AND SHOULD BE

CALIBRATED FROM NABL ACCRIDATED LABORATORY.

COPY OF CALIBRATED CERTIFICATES AS PER GCC CLAUSE NO. 8 SHALL BE AVAILABLE WITH THE BIDDER AS AND WHEN REQUIRED .

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WEST BENGAL STATE ELECTRICITY DISTRIBUTION CO. LTD**SCHEDULE OF GUARANTEED TECHNICAL PARTICULARS****SCHEDULE-A**

(To be furnished and signed by the tenderer for each category of Transformer)

| Sl. No. | PARTICULARS | | GTP TO BE FILLED BY THE BIDDER FOR EACH OFFERED RATING |
|----------------|--|----|---|
| 1 | Name of the manufacturer & Factory address | :: | |
| 2 | Country of origin | :: | |
| 3 | Applicable standard | :: | |
| 4 | Maximum continuous rating in KVA | :: | |
| 5 | No load voltage ratio (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 | (i) Temperature also under normal operating condition above ambient temperature | :: | |
| | (a) Top oil (in ° C.) | :: | |
| | (b) Winding (in ° C) | :: | |
| | (ii) Maximum hot spot temperature of winding (in ° C) | :: | |
| 12 | Magnetizing current referred to H.V. at rated frequency | :: | |
| | (a) At 90% rated voltage (in Amps) | :: | |
| | (b) At 100% rated voltage (in Amps) | :: | |
| | (c) At 112.5% rated voltage (in Amps) | :: | |
| 13 | Power factor of magnetizing current at 100% rated voltage & frequency | :: | |
| 14 | No load current at rated voltage and rated frequency (in Amps) | :: | |
| 15 | Max^m No load loss in watt at rated frequency & voltage | :: | |
| 16 | Max^m Load loss in Watt at 75 °C. at rated output and frequency | :: | |
| 17 | Max^m Total Loss (including NLL & FLL) at 50 % loading at 75 °C | :: | |
| 18 | Max^m Total Loss (including NLL & FLL) at 100 % loading at 75 °C | :: | |

| Sl. No. | PARTICULARS | | GTP TO BE FILLED BY THE BIDDER FOR EACH OFFERED RATING |
|---------|---|----|--|
| 19 | Percentage Regulation at full load at 75 °C | :: | |
| | (a) At unity power factor | :: | |
| | (b) At 0.8 power factor lagging | :: | |
| 20 | Efficiencies at 75 ° C (in percentage) | :: | |
| (a) | At full load | :: | |
| | (i) At unity power factor | :: | |
| (b) | At ¾ full load | :: | |
| | (i) At unity power factor | :: | |
| | (ii) At 0.8 power factor lagging | :: | |
| (c) | At ½ full load | | |
| | (i) At Unity power factor | | |
| | (ii) At 0.8 Power factor lagging | | |
| 21 | Impedance voltage on rated kVA base at rated current and frequency at 75 ° C (in percentage) | :: | |
| 22 | (a) Resistance voltage at rated current and frequency at 75 °C (in percentage) | :: | |
| | (b) Reactance voltage at rated current and frequency at 75 °C (in percentage) | :: | |
| 23 | Resistance at H.V. base at 75 ° C a) HV (between lines) (ohms) b) LV (between lines) (ohms) | :: | |
| 24 | Reactance at H.V. base at 50 c/s | :: | |
| 25 | Withstand time without injury for three phase dead short circuit at terminal (in seconds): | :: | |
| 26 | 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) | :: | |
| 27 | Permissible over loading with time at max amb temp a) 125% load after running with 50% load with steady temp rise. (hrs.) b) 120% load after running with 100% load with steady temp rise. (hrs.) | :: | |
| 28 | Core : | | |
| (i) | Material Type : | | |
| (ii) | Whether stack core / wound core type : | | |

| Sl. No. | PARTICULARS | | GTP TO BE FILLED BY THE BIDDER FOR EACH OFFERED RATING |
|---------|--|----|--|
| (iii) | Flux density of Core and yoke : | :: | |
| | (a) At rated voltage at 50 HZ (in line/sq cm) | | |
| | (b) At 112.5% rated voltage at 50 HZ (in line/sq cm) | | |
| (iv) | Thickness of Stampings (in mm) | :: | |
| (v) | Type of Insulation between core lamination | :: | |
| (vi) | Approximate area of Cross Section of Core and yoke (in sq.mm) | :: | |
| (vii) | Material of Core clamping plate | :: | |
| (vii) | Thickness of Core clamping plate (in mm) | :: | |
| (viii) | Insulation of Core clamping plate | :: | |
| (ix) | Describe location/Method of Core grounding | :: | |
| (x) | Please specify the use of primary core material in the offered transformer | | |
| (xi) | Whether the proof of use of prime core material is enclosed. | | |
| 29 | Terminal Arrangement : | :: | |
| | (i) high voltage | :: | |
| | (ii) low Voltage | :: | |
| 30 | Positive Sequence Impedance between HV & LV winding on rated KVA base at rated current and frequency at 75 °C. Winding temperature (in percent). | :: | |
| 31 | Zero Sequence Impedance at reference temperature of 75 °C (in percent) | :: | |
| 32 | Details of windings : | :: | |
| | (i) Type of Winding : | :: | |
| | (ii) Joints in the windings soldering / brazing but in any case crimping is not allowed | | |
| | a) High Voltage ; | :: | |
| | b) Low Voltage | :: | |
| | (ii) Material of the winding conductor | :: | |
| | (a) High Voltage : | :: | |
| | (b) Low Voltage : | :: | |
| | (iii) Conductor Area | :: | |
| | (a) High voltage (in sq.mm) | :: | |
| | (b) Low Voltage (in sq.mm) | :: | |
| | (iv) Current density of winding at rated KVA | :: | |

| SI. No. | PARTICULARS | | GTP TO BE FILLED BY THE BIDDER FOR EACH OFFERED RATING |
|---------|--|----|--|
| | (a) High Voltage (Amp per sq.cm) | :: | |
| | (b) Low voltage (Amps per Sq.cm) | :: | |
| | (v) Insulating material used for | :: | |
| | (a) High Voltage Winding | :: | |
| | (b)) Low Voltage Winding | :: | |
| | (vi) Insulating material used between | :: | |
| | (a) High voltage and low voltage winding | :: | |
| | (b) Low Voltage winding and Core | :: | |
| 33 | Insulation withstand Test Voltages | :: | |
| | (i) Lightning Impulse withstand test voltage (KV Peak) | :: | |
| | (ii) Power frequency withstand test voltage (in KV rms for 1 mtn) | :: | |
| | (iii) Induced over voltage withstand test voltage (in KV rms) | :: | |
| 34 | Current in the winding at rated KVA | :: | |
| | (I) Low voltage (in Amps) | :: | |
| | (ii) High Voltage (in Amps) | :: | |
| 35 | Voltage per turn (KV per turn) | :: | |
| 36 | Ampere turn | :: | |
| 37 | Number of turns | :: | |
| | (i) Low Voltage | :: | |
| | (ii) High Voltage | :: | |
| 38 | Bushing | :: | High Voltage Low Voltage |
| | (i) Make | :: | |
| | (ii) Type | :: | |
| | (iii) Applicable standard | :: | |
| | (iv) Insulation withstand test voltage | :: | |
| | (a) Lightning Impulse withstand test voltage (1.2 x 50 micro seconds (in KV Peak) | :: | |
| | (b) Power frequency withstand test voltage (in KV for 1 min) | :: | |
| | i) Dry | :: | |
| | ii) Wet | :: | |
| | (v) Creepage distance in air | :: | |

| SI. No. | PARTICULARS | | GTP TO BE FILLED BY THE BIDDER FOR EACH OFFERED RATING | | | |
|---------|--|----|--|-----------------|----------------|-----------------|
| | (i) Total (in mm) | :: | | | | |
| | (ii) Protected (in mm) | :: | | | | |
| | (vi) Minimum height of the bushing | | | | | |
| 39 | Minimum clearance (in mm) | :: | | | | |
| | Between live conductive parts and live conductive parts to earthed structure | | <u>In Oil</u> | | <u>In Air</u> | |
| | | | Between Phases | Phase to Ground | Between Phases | Phase to Ground |
| | (i) H.V. | :: | | | | |
| | (ii) L.V. | :: | | | | |
| 40 | Approximate weight of Transformer (in Kgs) | :: | | | | |
| | (i) Core with clamping | :: | | | | |
| | (ii) Coil with Insulation | :: | | | | |
| | (iii) Core and winding | :: | | | | |
| | (iv) Tank and fitting with accessories | :: | | | | |
| | (v) Untanking weight | :: | | | | |
| | (vi) Oil required for the transformer | :: | | | | |
| | (vii) Total weight with Core, Winding, oil and fittings | :: | | | | |
| 41 | Details of Tank | :: | | | | |
| | (i) Type of tank | :: | | | | |
| | (ii) Approximate thickness of Sheet (in mm) | :: | | | | |
| | (a) Sides | :: | | | | |
| | (b) Bottom | :: | | | | |
| | (c) Cover | :: | | | | |
| | (iii) Vacuum withstand capacity | :: | | | | |
| | (iv) Dimension of base channel (in mm x mm) | :: | | | | |
| 42 | Oil quality | :: | | | | |
| | (i) Applicable standard | :: | | | | |
| | (ii) Total quantity of oil (in litres) | :: | | | | |
| 43 | Approximate overall Dimensions (in mm) | :: | | | | |
| | (a) Length | :: | | | | |
| | (b) Breadth | :: | | | | |
| | (c) Height | :: | | | | |

| Sl. No. | PARTICULARS | | GTP TO BE FILLED BY THE BIDDER FOR EACH OFFERED RATING |
|---------|---|----|--|
| | (d) Minimum height of bottom most portion bushing from bottom of base channel | :: | |
| 44 | Minimum clearance height for lifting tank cover (in mm) | :: | |
| 45 | Whether Type Test Report, Credential, Performance Certificate submitted as Pre-requisites as mentioned in respective clauses . | | |
| 46 | Marking : whether agreeable to a) Punching of transformer Sl. No. on the Top yoke. b) Transformer Rating and Diagram plate along with Asset codification number shall be welded on the tr. Body. | | |
| 47 | Painting: Type of Painting of all steel surface. | | |
| 48 | List of testing equipments available in the testing lab. of manufacturer in line with Cl. No. 31 . 00 | | |

Signature :

Name :

Designation :

Company Seal :

